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Stereotactic and Functional Neurosurgery

XXth Congress of the European Society for Stereotactic and Functional Neurosurgery

Cascais/Lisbon, Portugal, September 26–29, 2012

Abstracts

Guest Editors:
António J. Gonçalves Ferreira, Lisbon
Joachim K. Krauss, Hannover
Bart Nuttin, Leuven
Jean Régis, Marseille
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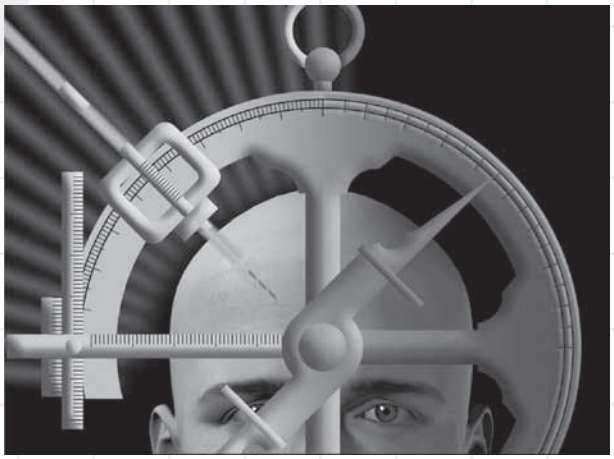
Rick Schuurman, Amsterdam



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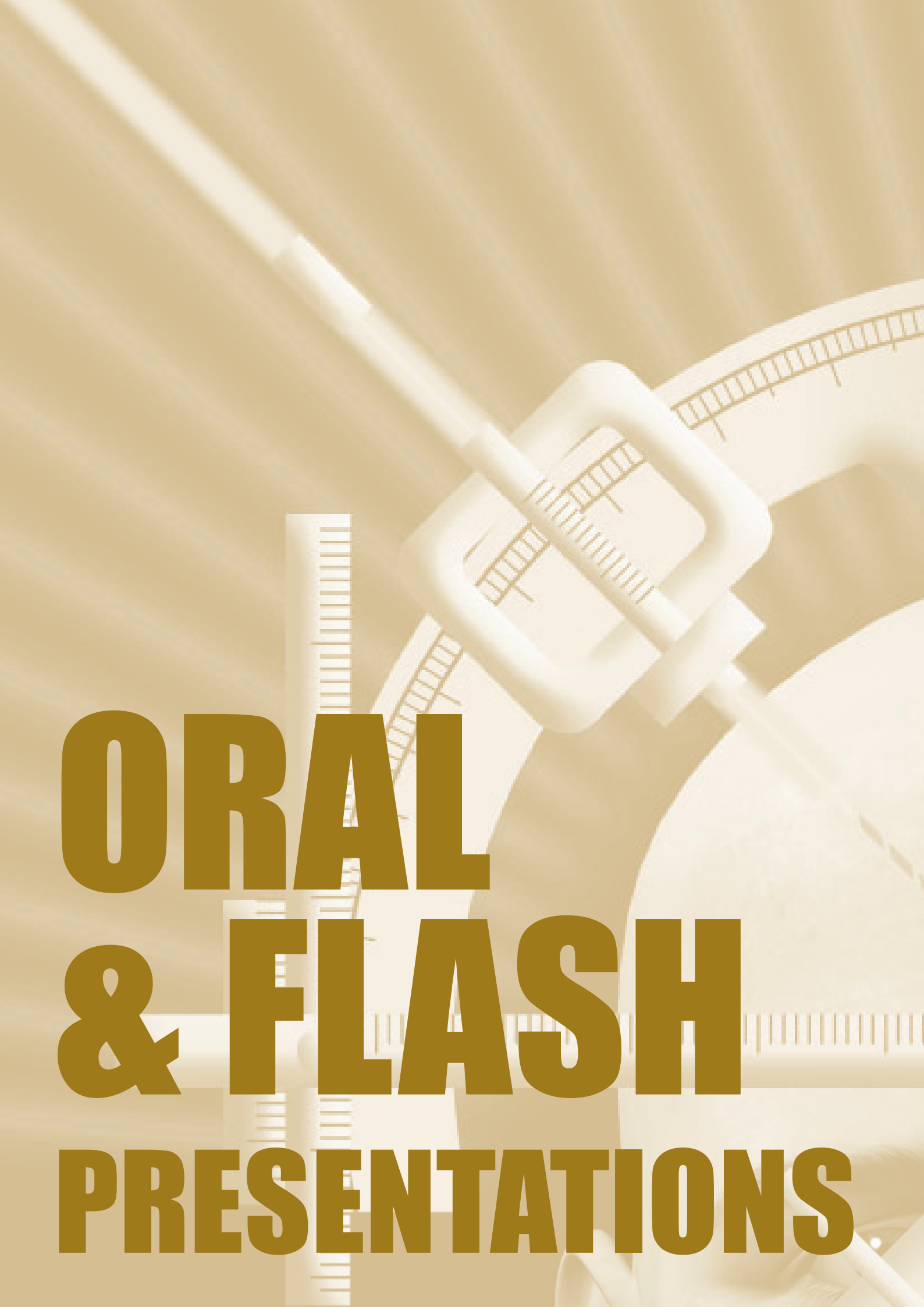

ORAL & FLASH PRESENTATIONS

BASIC SCIENCE, IMAGING AND DEVELOPMENT TECHNIQUES

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TOUCH-LESS MEDICAL IMAGE MANIPULATION

Rainha Campos, A.[1]; Nabais, F.[2]; Tavares, F.[2]; Correia, I.[2]; Cardoso, P.[2]; Gonçalves-Ferreira, A.[3]; Lobo-Antunes, J.[3].

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Introduction: In recent years, hospitals and clinics stopped developing films from MRI and CT scans. Today the standard procedure is to burn a CD with the entire exam in order to present this to the physicians. The CD's have their own DICOM viewer software's that are designed for reviewing purposes with the requisites of radiologists. In this new digital era, DICOM viewers became almost as diverse as clinics that make the exams but lacking the specifications needed in an operating room. They rely on a user interface that depends on mouse and keyboard which aren't practical when surgeons are in a sterile dressing. Besides, they present single images or sequences of images from the same series with standard arrangements, not letting the surgeon choose which images from the different series they want to see. Compared to films that include the entire exam, this paradigm represents a huge downgrade in the way images are available in the operating room.

Methods: We developed a DICOM viewer optimized for Neurosurgeons with a touch-less interface that facilitates the way they interact with the viewer during the surgery. This digital scope was built over the ClearCanvas® DICOM render engine using a depth sensing camera that, together with proprietary computer vision algorithms, allows to track the user movements in the air.

Results and conclusions: This viewer can optimize the way different pictures from different sequences or modalities are organized and, with the help of the gesture based interface, the surgeon can interact changing sequences, zooming, windowing, etc. while performing his surgery and without having to change or scrub again.

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ULTRA-FLEXIBLE, THIN-FILM ELECTRODE ARRAYS FOR CHRONIC NEURAL RECORDING AND STIMULATION OF BRAIN CAVITY WALL

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Introduction: Brain injuries are a major source of difficult-to-treat deficits and human disability. Brain lesion cavities are seen in stroke, brain trauma, congenital brain disorders and after successful resection of brain tumors and abscesses. Brain computer interfaces offer an exciting new approach to address deficits resulting from brain lesions. The idea is to implant mechanically flexible implants that adopt the shape of the lesion cavity wall and that are covered with electrode contacts for recording neuronal signals and electrical stimulation. This should enable us to interact with the residual intact brain tissue and partially restore functionality by interacting with pathological circuits.

Aim: The aim of this research is to design and develop a highly-flexible, biocompatible electrode array that can be used for long-term recording of neuronal signals.

Methods: Using soft lithography, thin-film (7 micron), net-shaped 4 x 4 electrode arrays were produced. Platinum electrode contacts were separately embedded in 0.4 mm wide square islands that were connected by 0.2 mm long spring-like structures. This design guarantees flexibility and optimal adhesion to curved surfaces (cortical gyri and sulci) and lesion cavities. Platinum contacts were 92 micron in diameter and were placed at a pitch of 675 micron. These electrode arrays were implanted on the sensorimotor cortex of healthy rats for histological assessment of biocompatibility (n=3) and for recording evoked potentials (EP, n=4, repeated measurements up to 4 months after implantation). EP recording was performed with peripheral stimulation of fore- and hindlimbs, both ipsi- and contralateral to the electrode array implant.

Results: The electrode arrays adopted the surface of the sensorimotor cortex in rat and chronic implantation induced no overt discomfort. Tissue damage due to the implantation procedure was seen around 300 micron deep, but was comparable to sham implantation procedures. Preliminary data demonstrate that electrophysiological EP responses could be recorded over the 4 month follow-up period.

Conclusion: The design of this electrode array allowed implantation on curved surfaces and can be used for chronic electrophysiological measurements. One of the possible applications is interaction with the lesion cavity wall, in order to restore function.

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STUDY ON TRANSCRANIAL MAGNETIC RESONANCE-GUIDED FOCUSED ULTRASOUND TREATMENT OF NEUROPATHIC PAIN AND MOVEMENT DISORDERS: SAFETY, ACCURACY AND INITIAL CLINICAL OUTCOMES

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4 - Rheumatology - Solothurn, Switzerland

Introduction: Recent technological developments in MR-guided focused ultrasound enable incisionless transcranial therapeutic interventions to the brain. The goal of this study is to establish the safety, targeting accuracy and efficiency of this technique in the treatment of neuropathic pain and movement disorders. We shall present clinical and neurophysiological data on 3 month and 1 year follow-ups of neuropathic pain patients, as well as initial results on parkinsonian and essential tremor patients.

Methods: Medial thalamic (central lateral nucleus) and subthalamic FUS thermocoagulations were performed under real-time MR-imaging and MR-thermometry guidance, applying peak temperatures between 50° and 60°.

Results: The mean absolute targeting accuracy for 30 targets was 0.44 mm for the mediolateral dimension, 0.38 mm for the anteroposterior dimension and 0.66 mm for the dorsoventral dimension. There were no device- or procedure-related complications and no post-treatment neurological deficits. Currently, 12 neurogenic pain patients present at 3-month follow-up a mean pain relief of 51.3%, a mean improvement of their visual analogue scale ratings of 35.7%, and 66.7% of them had a pain relief of or above 50%. A reduction of quantitative EEG spectral overactivities can be observed particularly in the delta and theta frequency bands.

Discussion: This study expands and confirms the already published evidence on MR-guided focused ultrasound in the treatment of neuropathic pain and brings first data on the treatment of movement disorders. This technology avoids the surgical risks related to brain penetration, and the real-time continuous MR-imaging and MR-thermometry allow an optimized lesioning safety and accuracy. Our experience has shown that the immediate effects of thermal lesioning could be used to enable a closed-loop control and optimization of target lesioning based on these two imaging modalities.

Conclusion: MR-guided focused ultrasound offers a safe and precise option for the treatment of neuropathic pain and movement disorders.

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CLINICAL IMPROVEMENT IN NON-RESPONSIVE PATIENTS WITH TRANSCRANIAL DIRECT CURRENT STIMULATION

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Objectives: To assess the therapeutic effects of transcranial direct current stimulation (tDCS) in patients who are in persistent vegetative state (PVS) or minimally conscious state (MCS).

Methods: Ten patients (7 in PVS, 3 in MCS) were submitted to (a) five consecutive daily sessions of sham tDCS, (b) five consecutive daily sessions of 20-minute tDCS at 1 mA, and (c) five consecutive daily sessions of 20-minute tDCS at 2 mA. Behavioural assessment with the JFK Comma Recovery Scale – Revised (CRS-R) was performed before treatment, and at the end of each 5-day period. Follow-up assessments were conducted one week and one year post treatment.

Results: All three patients who were in MCS before treatment showed increased scores in the CRS-R at the end of 2 mA tDCS, or at one week follow-up. One patient who was in PVS for 5 years, showed increased score in the CRS-R at one-year follow up, and a change of status to MCS. Improvement in the CRS-R was due to reproducible localization of noxious stimulation, visual pursuit, and motor response to verbal command.

Conclusions: Multi-session tDCS shows promising effects in the treatment of severe disorders of consciousness. Patients with better clinical profiles may be more prone to benefit from such treatment.

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ANAPLASTIC OLIGODENDROGLIAL TUMORS: MANAGEMENT WITH STEREOTACTIC INTERSTITIAL BRACHYTHERAPY

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Introduction: We evaluated the efficacy and safety of interstitial brachytherapy (IBT) using 125 Iodine-Seeds (125I) for the treatment of anaplastic oligodendroglial brain tumors. Moreover prognostic factors were analyzed.

Methods: Between January 1991 and December 2010, 37 patients (M/F: 21/16; median age 47.9 years, range 20.8-63.4 years) suffering from anaplastic oligodendroglial brain tumors (anaplastic oligoastrocytoma III, n=17; anaplastic oligodendroglioma III, n=20) were treated at our institution with IBT using 125I either as a primary, adjuvant after incomplete resection or as salvage therapy after tumor recurrence. The prognostic factors (age, gender, histology, grading, Karnofsky Performance Status, tumor volume, tumor surface dose, implantation time, clinical symptoms and postoperative treatments) for disease progression and survival were retrospectively investigated.

Results: Actuarial 2-, 5- and 9-year overall- and progression-free survival rates after IBT for the entire group were 77%, 62%, 51% and 68%, 44%, 22%, respectively. Follow-up MR images showed a complete remission in 1 patient, a partial remission in 7 patients, a stable disease in 10 patients and a tumor progression in 19 patients. The median time to progression was 30.9 months (range 5.2-112.5 months; median follow-up 66.6 months, range 10.4 - 247 months). Neurological status improved in 11 patients and remained stable in 10 patients. There was no treatment-related mortality. Treatment related morbidity within one month was transient and occurred in 4 patients only. The variables gender, tumor surface dose, Karnofsky Performance Status, histology and grading had no significant impact on overall - and progression-free survival. Age <45 years, tumor volume <20ml, seizures as initial symptom, permanent implantation, and adjuvant external beam irradiation were significantly associated with an increased overall- and progression-free survival ($p < 0.05$).

Conclusion: This study indicates that stereotactic interstitial brachytherapy for the management of anaplastic oligodendroglial brain tumors is effective and safe. Due to a high local tumor control and a low rate of side effects, IBT should be considered as one arm in the multimodal treatment of anaplastic oligodendroglial tumors.

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SURFACE ELECTROGRAPHY AS A DIAGNOSTIC TOOL IN TROUBLESHOOTING DEEP BRAIN STIMULATION

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Objective: To develop a rapid and reliable non-invasive technique to detect hardware problems in deep brain stimulation (DBS).

Background: Hardware problems in patients with deep brain stimulation can be a challenge for the clinician. In our experience the available onboard tools of the implantable pulse generators (IPG) are often unsatisfactory, making an efficient trouble shooting difficult. Moreover they may give ambiguous information. Especially in therapy failures this can be a problem, because it remains open whether the reason for this failure is either medical or hardware related. False positive alerts may lead to unnecessary surgical steps like replacement of the leads or the extensions.

Method: The principle of surface electrography is that every single pulse emitted by the pulse generator can be recorded using standard skin electrodes, amplified and displayed by a medical oscilloscope. The voltage drop is proportional to the tissue impedance. The latter is a constant for an individual body. Differences in voltage drop or missing spikes are highly suspicious for contact problems respectively lead fractures. According to the used stimulation technology, constant current or constant voltage, the stimulation pulse shapes are either rectangular or more complex. Every single pole is analysed individually.

Results: The present procedure was performed in a total of 50 patients with DBS systems where routine measurements of the impedance using the standard procedure (self test of the IPG) had either given ambiguous results or values suggesting a fracture of the lead extension. Only in five of these patients surface electrography corroborated these findings and consecutive replacement of the lead extension finally confirmed the presumed fracture. In another five patients with sudden loss of the therapy and drop of impedance we observed a significant change of the pulse curve. In these patients, in the subsequent surgery, we found a fluid intrusion into the connectors of the header of the IPG as the cause of the impedance and therapy drop. This confirmed our pre-op findings. In all these ten patients efficient therapy resumed after surgical revision and they returned to normal surface electrography. We did not observe false positive results using this technique.

Outlook: Recently we have been able to transport our method to an iPad (Apple) based platform making this tool even more easily accessible.

Conclusion: We consider surface electrography as an easy and safe procedure in cases where hardware failures are suspected to be the reason for a loss of DBS therapy.

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BRAIN STEM STEREOTACTIC BIOPSIES: TECHNICAL APPROACH AND THERAPEUTICAL VALUE IN NEURONCOLOGY

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Introduction: The role of stereotactic biopsies for intrinsic brain stem lesions remained controversial until recently, both in children and in adults.This is mainly due to the complexity of their technical approaches and to the clinical risks associated to these procedures. However, even modern multimodality images becomes not sufficient now a days to obtain an accurate diagnosis, specially in brain stem gliomas, as they proved to have a different profile, in terms of histology and molecular biology, from other brain gliomas. This fact leads to specific tailored tratments for different sub-groups of patients, with also a prognostic value. The aim of this presentation is to evaluate safety, accuracy an reliability of brain stem stereotactic biopsies, but also usefullness in the management of these patients.

Methods: We reviewed the records of 189 consecutive patients, children and adults, undergoing stereotactic biopsies in our institution from 1984 to 2011, as they presented intrinsic brain stem lesions. Exophytic tumours were excluded. Under general anesthesia, targetting was initially obtained from Talairach stereotactic methodology, and since 2004 from frameless MRI feeding a Renishaw® Stereotactic Robot. Transfontal and trans-cerebellar approaches were performed, depending on the location of the lesion and its functional environment.

Results: We reviewed clinical features and anatomical locations. A positive diagnosis was obtained in 96.2% of the cases. Non tumoral diagnosis were confirmed in long term follow-up. Low-grade and high-grade gliomas represented the most frequent diagnosis; as it may be expected. But a large variety of other tumoral lesions was also found, specially in adults. There was no mortality related to the stereotactic procedure.Transient morbidity occured in 5.4% of the cases, and permanent impairment or worsening of previous deficits occured in 6.8% of the cases. Therapeutical choices guided by pathological findings were reviewed.

Conclusions: Stereotactic biopsies of brain stem lesions seem to be an accurate procedure to obtain pathological information with an acceptable risk. Adecuate diagnostic and prognostic information enables an appropriate therapeutical management in adults and in children. Moreover, recent data about molecular biology and genetical profiles of gliomas, contribute to enable more accurate and tailored therapeutical choices for different sub-groups of patients, as they provide treatment responsiveness and prognostic information.

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OPTIMIZING RESECTION OF LESIONS IN CENTRAL AREAS WITH PREOPERATIVE NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION

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Introduction: For tumours adjacent to eloquent areas as the motor cortex, precise preoperative planning and intra-operative mapping of the motor area are essential: the gold standard remains direct electrical cortical stimulation in awake patients; to shorten the duration of the awake procedure, a maximum of preoperative cortical mapping is mandatory.

Rationale: In preoperative mapping functional MRI or navigated Transcranial Magnetic Stimulation can be used for location of precentral motor areas. In the contrary of fMRI, the spatial accuracy of nTMS is high : the results obtained by comparison between navigated transcranial magnetic stimulation (nTMS) and direct electrical cortical stimulation (DECS) show a high correlation. By performing preoperative nTMS is, the awake procedure is shortened.

Methods: Preoperatively, Transcranial Magnetic Stimulation of the cortical motor area is performed under navigational conditions (Nexstim®), the motor threshold determined, and motor mapping of the central area realized and transferred to the neuronavigation system. Locations of the nTMS-mapped points are displayed as an overlay in the microscope field allowing to know where to start mapping, with quick determination of stimulation amplitude: stimulation is 'targeted"; a smaller, more tailored bone flap can be made, centered, or off-centered, with respect to the region of interest (ROI) based on functional, as well as anatomical, data. In order to shorten the awake mapping time, new navigated methods are presented for the stimulation locations and color-coded responses to be overlaid together with color-coded maps of all relevant gyri in the microscope field.

Results: In our 10 first patients, there was always a correlation between fTMS and DECS within 10 mm, considering the non-point accuracy of bipolar stimulation; the cortical mapping time was significantly reduced.

Conclusion: nTMS can delineate cortical motor response representation with a high accuracy, even in cases of anatomy severely distorted by presence of tumour and edema; We have observed good correlation, spatially to within 10 mm, between the results of motor area localization for preoperative nTMS and intraoperative DECS. Functional mapping in the preoperative phase maximizes the time available for resection during the awake phase.

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THE EFFECT OF SUBTHALAMIC NUCLEUS INHIBITION IN THE SURVIVAL OF DOPAMINERGIC VENTRAL MESENCEPHALIC GRAFT IN A RAT MODEL OF PARKINSON´S DISEASE

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Introduction: Parkinson´s disease (PD) is a challenging disease, which leads to progressive and disabling deterioration of motor and cognitive skills. Current surgical treatment as the inhibition of the subthalamic nucleus (STN) by deep brain stimulation (DBS) is able to improve temporarily motor symptoms. Regenerative approaches are under research to restitute dopaminergic neurotransmission and offer a more extensive and long lasting effect. Sparse data are available regarding the combination of both approaches. In this study we analyzed the impact of chemical suppression STN-ZI in mesencephalic graft survival of parkinsonian rats.

Method: For this purpose 39 adult rats were rendered parkinsonian by means of unilateral injection of 6-OHDA neurotoxin into the right medial forebrain bundle. Afterwards they were randomly assigned into two groups. Both groups were transplanted with E14 ventral mesencephalic (VM) grafts into the ipsilateral striatum. In the first group, quinolinic acid was stereotactically injected in the STN-ZI before the transplantation. Pharmacological induced rotation, cylinder and stepping tests were performed to evaluate the effect of each intervention. Histological analysis was post mortem performed using immunohistochemistry.

Results: Functional recovery was observed in the behavioral tests in both groups after transplantation. Survival of transplanted VM cells was observed in the striatum of both groups.

Conclusion: Functional recovery and graft survival were observed after striatal transplantation, despite of quinolinic acid injection in the STN-ZI. These findings might suggest that cell therapy could also be combined with other techniques of STN suppression as DBS. Further studies are necessary to confirm this hypothesis.

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PLASTICITY INDUCTION BY HIGH-FREQUENCY CORTICAL SUBDURAL STIMULATION PERMITS ENHANCED RESECTION OF TUMORS IN ELOQUENT AREAS

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Introduction: Functional areas located near or within brain gliomas prevent the complete resection of these tumors. It has recently been described that slow tumor invasion promotes neural reorganization, and even topographic plasticity, allowing a staged resection of those tumors. We aimed to simulate this producing a "virtual lesion" in the eloquent areas within or near a tumor using continuous high-frequency cortical electrical stimulation (HFCS), in order to increase extent of removal.

Methods: Three previously operated cases (two anaplastic astrocytomas and one oligodrendrogioma) located at or close to language areas, whose lateralization of language to the side of the lesion was documented by fMRI and/or Wada test underwent partial removal using awake cortical monitoring. We implanted a subdural grid over the eloquent cortex located within the tumor rest, and used continuous HFCS for 3 weeks, using a frequency of 130 Hz and a pulse width of 1 ms. The stimulus intensity was set to the threshold where mild speech disturbance was evident without any other neurological effects, while the patients received intensive logopedic rehabilitation.

Results: In the three cases, we successfully achieved the displacement of speech functions, and a more radical resection of the tumor was possible in a second surgery. A reorganization of the language areas was demonstrated with functional magnetic resonance and cortical stimulation and/or Wada test. In one patient, motor language areas were identified at the right hemisphere, where previously they were absent.

Conclusion: We demonstrate evidence of induced topographic plasticity using HFCS in eloquent areas within a tumor, allowing an increased tumor removal. Our results open the possibility to induce plasticity before the resection of brain tumors near eloquent areas, in order to increase extent of the resection.

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EXPERIENCE FROM OPTICAL MEASUREMENTS DURING 100 DBS IMPLANTATIONS

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Introduction: Optical measurements are relatively new tools for intra-operative guidance during stereotactic deep brain stimulation (DBS) implantations. The aim of the presentation is to give an overview of the optical techniques and to present experiences from measurements performed so far.

Methods: Laser Doppler perfusion monitoring (LDPM) and reflectance spectroscopy are the techniques used. A probe with four adjacent optical fibers and dimensions adapted to the Leksell® Stereotactic System is used to create paths for the DBS electrode along the pre-calculated trajectory. The reflected light intensity (TLI) at 780 nm is presented as a real-time curve representing grey-white tissue boundaries passed during the insertion. With the probe connected to the LDPM system and a mechanical device for mm-precision insertion, the blood flow can be presented as well.

Results: Optical measurements were successfully used during 100 DBS-implantations. Characteristic but different TLI-curves towards the subthalamic nucleus (STN), the ventral intermediate nucleus (Vim) and the globus pallidus internus (GPi) have been identified. In general, the TLI-curves start with a low intensity in cortex and increases to a maximum value in subcortical white matter and drops to an intermediate level characteristic for the target aimed at. LDPM also allows for simultaneous blood flow measurement. Higher values are found in sulci, at vessel structures and when entering the basal ganglia. Along one Vim-trajectory a bleeding was suspected and later confirmed with postop CT. Recorded data deviated significantly from the typical curve forms.

Conclusion: Real-time presentation of grey-white tissue boundaries during DBS implantation can be achieved by means of LDPM and reflectance spectroscopy. LDPM has the added advantage to measure the blood flow along the trajectory. Optical measurements is a fast and easy-to-use technique for guidance during DBS-implantations.

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REDUCED NEURONAL ACTIVITY OF THE PREFRONTAL CORTEX IN RATS SELECTIVELY BRED FOR DISTURBED SENSORIMOTOR GATING

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Introduction: Rats selectively bred for deficient prepulse inhibition (PPI), an operant measure of sensorimotor gating, may be used to study the pathophysiological mechanisms and therapeutic strategies for neuropsychiatric disorders with abnormalities in information processing, such as schizophrenia and Tourette`s syndrome. The medial prefrontal cortex (mPFC) and the nucleus accumbens (NAC) have been shown to be involved in the regulation of PPI. Additionally, lesions of the entopeduncular nucleus (EPN) alleviated the PPI in rats with low PPI. We here examined the neuronal activity in the mPFC, NAC and EPN, since these areas are possibly involved in the pathomechanisms of prepulse inhibition (PPI) of the acoustic startle reaction.

Methods: Male rats with breeding-induced high and low expression of PPI (n=6, each) were anesthetized with urethane (1.2 mg/kg). Extracellular single unit activity and local field potentials were recorded in the mPFC, NAC, and EPN for ten minutes each.

Results: In PPI low rats, the discharge rate, measures of irregularity and the burst activity were significantly reduced compared to the measures in PPI high rats ($p<0.05$), while analysis of the neuronal activity in the NAC and EPN showed no difference between groups. Additionally, the oscillatory theta band activity (4-8 Hz) was enhanced and the beta band activity (13-30 Hz) was reduced in all regions.

Conclusions: Reduced neuronal activity in the mPFC of PPI low rats may be one of the pathophysiological mechanisms leading to reduced sensorimotor gating. Interestingly, enhanced theta band activity has been found also in patients with Tourette's syndrome and dystonia, i.e., disorders, that are accompanied by sensorimotor gating deficits.

This work was supported by the Tourette Syndrome Association.

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THE HUMAN NUCLEUS ACCUMBENS AND THE BED NUCLEUS OF STRIA TERMINALIS IN PSYCHOSURGERY - ANATOMICAL AND IMAGING STUDY

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3 - Neurosurgery Department, Lisbon North Medical Center - Lisbon, Portugal

Introduction: The Nucleus Accumbens (Acc) is a ventral striatum structure poorly identified in the human brain. It is known to act as a motor-limbic interface, being involved in several emotional and psychomotor functions, frequently disturbed in neuropsychiatric disorders such as Obsessive Compulsive Disorder, depression and addiction. It is in the center of the Cerebral Rewarding Centers, receiving dopaminergic projections from the ventral tegmental area, via the medial forebrain bundle. This nucleus has recently become a target for stereotactic deep brain stimulation for some of these disorders, refractory to medical treatment. However it is still controversial which target is the best and similar results have been shown with stimulation of neighboring structures from the septal area, such as the Bed Nucleus of Stria Terminalis (BNST). Previous studies performed by our group have established the 3-D stereotactic coordinates and anatomy of the human Acc, but there were some difficulties concerning it´s precise posterior margin. It is assumed the Acc ends at the level of the anterior commissure (AC), but we have observed a sub-commissural area histologically indistinct from the Acc, continuous with the BNST, which deserve further anatomical and imaging clarification.

Methods: For the anatomical study, 10 Acc from 5 human brains were collected by autopsy, fixed, dissected, embedded and serially cut in coronal 5 µm thick slices every 0,5mm until 1cm caudal to the AC. The slices were stained with haematoxylin-eosin, marked with anti-D1 and anti-D2 antibodies and analyzed in a microscope, with and without fluorescence. Additionally, the imaging characteristics of the septal area were analyzed in a 3T MRI, using conventional sequences and Diffusion Tensor Imaging, in 5 patients, after informed consent.

Results: The sub-commissural area is histologically indistinct from the Acc, with the Nucleus Basalis of Meynert in ventro-lateral position, the anterior hypothalamic nuclei ventro-medially and the Bed Nucleus of Stria Terminalis merging above and medially. The human Acc has the same cellular structure as the dorsal striatum, except in its posterior sub-commissural part where voluminous neurons with large cytoplasm prevail. These neurons may correspond to the shell described in the rat and are similar and contiguous with the BNST. D1 and D2 receptors also predominate in the sub-commissural Acc. All these structures are better defined in MRI T1 Inversion Recovery sequence, in the coronal plane, where a best contrast between white and gray matter is achieved.

Conclusions: The Acc is longer than previously described, with a sub-commissural caudal extension, behind the AC, continuous with the BNST. These structures are easily defined in conventional MRI, especially in the coronal plane.

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ANALYSIS OF STEREOTACTIC ACCURACY IN PATIENTS UNDERGOING DEEP BRAIN STIMULATION USING NEXFRAME AND LEKSELL FRAME

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Objective: To determine and compare the accuracy of the Nexframe and the Leksell stereotactic frame in deep brain stimulation (DBS) procedures.

Background: The "frameless" Nexframe uses bone fiducials rather than a head mounted frame and is therefore considered more comfortable for patients undergoing DBS. The accuracy of lead implantation is of crucial importance but has not been extensively studied for the frameless system nor have the factors that potentially affect the accuracy.

Design/Methods: The location of 97 (Leksell frame n=47, Nexframe n=50) DBS leads was determined on postoperative MRI and CT imaging. The obtained stereotactic coordinates were compared with the expected intra-operative target coordinates. The resulting absolute errors in X (medial-lateral), Y (anterior-posterior) and Z (dorsal-ventral) coordinates (ΔX, ΔY and ΔZ) were then used to calculate the vector error (VE): $VE = \sqrt{((\Delta X)^2+(\Delta Y)^2+(\Delta Z)^2)}$. The vector error describes the total error in 3D space and represents our main outcome measure. Additionally, principal component analysis (PCA) were used to show the degree of similarity between each of the absolute X, Y and Z coordinates in Euclidean space.

Results: The (mean ± SD) vector error was 2.8 ± 1.3 for the Nexframe and 2.5 ± 1.2 for the Leksell frame (p = 0.43). For the Nexframe the absolute X, Y, and Z errors were 1.4 ± 1.3 mm, 1.7 ± 1.2 mm, 1.0 ± 0.9 mm. For the Leksell frame the absolute X, Y and Z errors were 1.4 ± 1.0 mm, 1.2 ± 1.0 mm, 1.3 ± 0.9 mm. In the anterior-posterior plane (Y coordinate), the Leksell frame was more accurate than the Nexframe (p=0.04). In contrast, the Nexframe was more accurate in the dorsal-ventral plane (Z coordinate) (p=0.04). There was no difference in accuracy between the two methods in the medial-lateral plane (X coordinate). PCA showed high similarity for both Nexframe (R-square 9.99 x 10-1) and Leksell frame (R-square 9.98 x 10-1).

Conclusion: This comparison of Nexframe and Leksell frame shows that both techniques have equivalent overall 3D accuracy. We are currently expanding the study to confirm the present results and evaluate factors that may affect the accuracy of lead placement.

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DEEP BRAIN STIMULATION AT THE CROSSROADS: HOW FAR IS ENOUGH?

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Introduction: Modern DBS celebrates this year its 25th anniversary: from the first paper of Benabid et al in 1987 on thalamic DBS contralateral to thalamotomy, until today, DBS as a method has expanded well beyond movement disorders and other neurological conditions, into the realm of psychiatry and behaviour. However, recent literature bears witness to suggestions of "new indications", or trials to "improve" at any cost the targeting technique. This presentation intends to describe some published questionable suggestions and applications of modern DBS.

Methods: We reviewed the DBS-related literature published over the last two years, and we identified publications that illustrate that the field of DBS today may need an ethical and sober reflexion about what is being done and why, and about the rational for proposed future applications of this technique.

Results: Three publications were chosen to address the issue of questionable future of DBS: A paper published in Stereotactic and Functional Neurosurgery in 2011 reported on a survey of North-American neurosurgeons: to the question whether it would be ethical to use DBS in the future for purpose of cognitive enhancement in healthy people, more than 50% of the responders answered by "yes". A paper from 2012 published in Movement Disorders Journal (MDJ) described attempts to delineate the STN´s motor area by performing an additional burrhole to place a cortical grid, in addition to microelectrode recording of the STN, resulting in epileptic seizures in 3 of 5 patients, urging the Editors of the MDJ to publish a comment asking "How far is enough" in technical advances in DBS. A paper published in Brain in February 2012, entitled "Functional and clinical neuroanatomy of morality" went so far as to suggest a possible future use of DBS for "antisocial behavior".

Conclusions: DBS has opened new hopes for many patients and new avenues for research. Even after 25 years of modern DBS, many issues related to this procedure are still not clear even in established routine neurological indications, and more so in psychiatric illnesses. There is a risk that the eagerness to devise "new" methods, the confabulations about new "indications", and the blind adherence to dogmas in performance of the surgery, will overshadow the main aims and purposes of DBS, and may lead to a demise of this technique, as has happened in the old era of brain stimulation.

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DBS IN CRITICAL CARE CONDITIONS

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The efficacy of Deep Brain Stimulation (DBS) is well established in the treatment of chronic neurological diseases such as Parkinson disease and primary dystonia. Emerging indications include refractory epilepsy, chronic cluster headache, major depression, obsessive compulsive disorder, disruptive behaviour and Gilles de la Tourette syndrome. Nevertheless in selected cases DBS may be advocated to treat acute neurological disease or sudden dramatic worsening of pre-existing diseases in emergency conditions such as status dystonicus, status epilepticus and post – stroke conditions. Status dystonicus is a rare although life-threatening disorder that develops in patients with primary and secondary dystonia. It is defined as "increasingly frequent and severe episodes of generalized dystonia, which necessitate urgent hospital admission". 8 patients underwent surgical electrode implant as an emergency procedure to treat severe acute life threatening condition, which requested admission to the Neurological Intensive Care Unit (NICU). All patients before surgery needed tracheal intubation and deep sedation to allow mechanical ventilation. All patients had status dystonicus, and intravenous sedation resulted ineffective to revert the pathological status. Turning on the DBS has allowed to recover from the acute life threatening condition permitting the patients to wean from the mechanical ventilation and be discharged from the intensive care unit in a few weeks after surgery. The availability of the Functional Neurosurgery Unit within the Hospital is a valuable adjunctive resource when DBS is called as emergency procedure to treat patients who need deep sedation and mechanical ventilation. Operated patients and surgical methodology are described and the indications are discussed in view of a larger request of DBS in patients who need deep sedation and assisted ventilation due to the above mentioned conditions.

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LASER DOPPLER FOR GUIDANCE DURING DBS - TYPICAL OPTICAL TRAJECTORIES TOWARD VIM AND STN

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Background: We have previously presented laser Doppler perfusion monitoring (LDPM) as tool for intra-operative guidance during DBS implantations. The aim of the present study was to establish the link between anatomy and total light intensity (TLI, tissue grayness) and blood flow along trajectories towards the ventral intermediate nucleus (Vim) and subthalamic nucleus (STN).

Mehtod: Twelve patients referred for DBS-implantation were included in the study. Stereotactic CT-imaging was used for planning of the trajectories and targets (Vim = 13, STN = 9). A mechanical device adapted to Leksell® Stereotactic System was designed for simultaneously TLI and blood flow measurements with mm-precision along the trajectories (n = 1285). Values were post-processed to optical trajectories ranging from the cortex towards the target. These were compared with anatomy as seen in the CT-images and brain atlas used in Surgiplan®.

Result: The TLI-curves showed a clear relationship with anatomy and characteristic median curves were determined towards Vim and STN. These normally started with low values in cortex and increased in white matter. Passed in the vicinity to putamen (Put), caudate nucleus (Cd) or ventricle presented a dip. High blood flow was seen in the vicinity to sulci and Cd/Put-region. High peaks were three times more common along Vim-trajectories.

Conclusion: The laser Doppler measurements presented typical but different TLI-curves towards Vim and STN. High blood flow spots along the trajectory can be revealed with mm-precision.

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ELECTRICAL FIELDS ATTRACT NEWBORN BRAIN CELLS

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Introduction: Neurogenesis is known to occur at the subventricular zone (SVZ), where the highest number of stem/progenitor cells in adult brain are hosted. Following proliferation in the SVZ, newborn cells mainly migrate rostrally towards the olfactory bulb. Although specific factors influencing neurogenesis have been identified, tools controlling the direction of migration of newborn cells are not available.

Methods: We applied electrical fields (EFs) to the rat motor cortex using a custom-made electrode construction. Animals received BrdU injections to examine neurogenesis related processes and were scored for behavioural parameters. At the end of the experiments, rats were sacrificed, brains removed and processed for evaluation.

Results: Results showed a striking increase cell proliferation in the SVZ following the application of cortical EFs. We also found a remarkable increase in the number of BrdU-positive cells in the area below the electrodes. Furthermore, double labeling of cortical BrdU-positive cells with NeuN showed that newborn SVZ cells not only migrate to the cortex, but also differentiate into mature neurons. Finally, based on the fact that subependymal 5-hydroxytryptamine (5-HT, or serotonin) plexus overlaps with the SVZ neurogenic area and the existing knowledge of the effects on 5-HT on neurogenesis, we proposed that enhanced 5-HT in the SVZ could be responsible for the proliferation boost following cortical EFs. We found clearly enhanced density of the serotonergic fibers in the SVZ and and increase in neuronal activity in the dorsal raphe nucleus (DRN), the brain's main serotonergic nucleus.

Conclusion: Our findings reveal a novel approach to influence the proliferation and migration of the adult brain's progenitor cells. We showed that the application of specific EFs can direct migration of newborn brain cells from the SVZ to the area of interest. In addition, our results suggest that this process is at least partly coordinated by altered serotonergic input to the SVZ.

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INTRAOPERATIVE CT: A STEP FORWARD IN DBS SURGERY

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Introduction: Deep brain stimulation (DBS) is a well established treatment for several movement disorders and psychiatric diseases. Its efficacy is greatly influenced by the accurate location of the DBS electrodes. Intraoperative compute tomography (i-CT) allows to determine the location of the DBS electrode and to reposition misplaced electrodes at the time of surgery.

Methods: A total of 20 DBS electrodes were stereotactically implanted (16 in the STN and 1 GPi for Parkinson's disease; 3 in Vim for essential tremor). T2-weighted MR images were used for direct (STN and GPi) and indirect (Vim) targeting using BrainLab software. Patients had a helical CT scan immediately after placing a Leksell seterotactic frame (Elekta, Atlanta, Georgia). CT scan was computationally fused with MRI. Microelectrode recordings (MER) (Alpha-Omega, Nazareth, Israel) were used to neurophysiologically define the surgical target. Two iCT scans (Medtronic O-arm image acquisition system, Minneapolis, Minnesota) were performed per brain side: one with the microelectrodes at the neurophysiological defined inferior border of the target and another once the DBS electrode was in place. iCT scans were computationally fused with preoperative MRI to determine the correct anatomical location of the DBS electrode. Accuracy of the iCT images was compared to that of a nonstereotactic helical CT scan performed within the next 72 h after surgery.

Results: No statistical significant differences were found between MRI coordinates and final DBS electrode coordinates on iCT images (mean differences X=0.311 (p 0.15), Y=-0.485 (p 0.07), Z=0.024 (p 0.93)) nor between iCT and postoperative helical CT scan coordinates (mean differences X=-0.025 (p 0.82), Y=-0.106 (p 0.45), Z=-0.133 (p 0.190)). Mean MER tracks were 2.89 per brain side. In two brain sides' one extra MER track was needed. The trajectory of the new track was easily determined using information obtained from the iCT scans. Once the team became familiarized with the iCT system surgical time was not increased.

Conclusions: iCT can be performed at any time during surgery providing accurate information about anatomical electrode position. This allows selection of the appropriate MER trajectory and reposition of misplaced electrodes during the same surgical procedure. Its use may improve DBS outcome and reduce the need for reinterventions. It may be extremely useful for those targets where MER or macrostimulation do not provide information about the anatomical location as well as for procedures performed under general anesthesia.

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THE IMPACT OF INTRAOPERATIVE MRI ON AN IMAGE-VERIFIED APPROACH TO DEEP BRAIN STIMULATION

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Introduction: Advantages of an MRI-verified approach to Deep Brain Stimulation (DBS) include minimizing the number of brain passes and associated reduction in haemorrhage risk with severe clinical sequelae [1, 2]. Long-term clinical outcome compares favourably to that of other methods [3]. Intraoperative MRI (iMRI) suites are ideally suited to the MRI-verified approach. We assess the impact of transferring DBS surgery to an iMRI suite at our institution.

Methods: The Leksell model G frame was used to obtain pre and postoperative stereotactic MR images in 25 consecutive patients undergoing DBS (44 leads) in our iMRI suite. FrameLink software was used to define the planned target on preoperative stereotactic images and to determine the stereotactic coordinates of implanted leads from intraoperative images. The perpendicular distance between actual location and planned target was calculated for each lead. The time to perform bilateral DBS before (n=50) and after (n=18) the introduction of iMRI was recorded.

Results: The mean ± SD distance between planned and actual lead location was 0.9 ± 0.5 mm (range 0.1 – 2.0 mm). This targeting error was broken down into its vector components: the mean ± SD error was -0.1 ± 0.6, -0.1 ± 0.7 and -0.0 ± 0.4 mm in the X, Y and Z axes respectively. 98% of all leads were within 2.0 mm of planned coordinates. Only 1 of 44 leads was considered anatomically suboptimal after a single brain pass (absolute distance from planned target = 2.04 mm); successful relocation was performed during the same procedure with 1 additional brain pass. Mean ± SD procedure time for bilateral electrode implants was 4 hours 48 min ± 35 min before and 3 hours 50 min ± 35 min after the introduction of iMRI, respectively ($p<0.0001$). Improved workflow meant that two bilateral DBS implants could be performed on an iMRI surgical list compared to one prior to the introduction of iMRI.

Conclusions: MRI-verified DBS surgery offers a high degree of surgical accuracy and precision. The introduction of iMRI has significantly reduced DBS operating time and improved surgical workflow in our institution. In addition, the logistics of relocating a sub optimally placed lead within the same procedure is greatly simplified.

References:

1 - Holl EM et al. Neurosurgery 2010; 67: 437-447
2 - Zrinzo L et al. Journal of Neurosurgery 2012; 116: 84-94
3 - Foltynie T et al: Journal of Neurology, Neurosurgery, and Psychiatry 2011; 82: 358-363

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DEEP BRAIN STIMULATION FOR THE EARLY TREATMENT OF THE MINIMAL CONSCIOUSNESS STATE AND VEGETATIVE STATE

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Introduction: To present results of DBS for the early treatment of minimal consciousness state (MCS) and vegetative state (VS) caused by hypoxic encephalopathy or traumatic brain injury in eleven patients.

Methods: Eleven patients were evaluated neurologically and electrophysiologically for possible treatment with deep brain stimulation. Among these patients, seven patients were in vegetative state and four patients were in minimal consciousness state. The stimulation sites in all patients were centromedian-parafascicular nucleus complex. Somatosensory, motor and brain stem auditory evoked potentials, and 24 hour recordings of EEG were performed before surgery. PET CT was performed before and after DBS implantation. Patients were stimulated during the day for 30 min every three hours with different intensity and frequency parameters.

Results: Two patients in MCS regained consciousness, independent walking without help, become able to speak, showing impressive speech comprehension, but needed some assistance with their everyday life. Other nine patients remained bedridden and their status remained unchanged but showed improvement in Rappaport Coma/Near coma scale.

Conclusion: The DBS is not yet "evidence-based treatment" of the vegetative and MCS. This report shows that if the patient fulfills neurophysiologic, PET and clinical criteria he should be treated with DBS at the very early stage of MCS.

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DEEP BRAIN STIMULATION IN PATIENT WITH PSP DIAGNOSIS; REPORT OF TWO CASES

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Introduction: Progressive supranuclear palsy (PSP) is a neurodegenerative disease, secondary to mithocondrial disfunction, caracterized by neurofibirillary tangles accumulation and neuropil threads in subthalamic nucleus, pallidum, red nucleus, substantia nigra, striatum, pontine tegmentum, oculomotor nucleus, medulla and dentate nucleus. The "classic" PSP syndrome is characterized by gait disorder, ophthalmoparesis (down gaze palsy), cognitive dysfunction and parkinsonism. Symptomatic drugs have been tried in several trials. Dopaminergic, serotoninergic, noradrenergic, anticolinergic and GABA-ergic agonists are the most evaluated. Responsiveness to LD is probable different between subtypes of PSP, being poor in classical RS, and initially moderate in PSP-P. Until this time, there is no evidence enough to recommend a specific symptomatic treatment in PSP.

Material and methods: A seventy years old male patients, with diagnosis of PSP performed three years prior to admission at our department. Neurological examination on admission: vertical gaze paralysis, disarthria, disfagia, dismetria on the left limbs, adiadocinesia. Deambulation possible with help with enlarged gait base. DBS of the right peduncolo pontine nucleus PPN. Electrode implantation was uneventfull.

Result: at 18 months after surgical procedure the patient presents a slight improvement in deambulation, actually he is independent in many daily activities. A case of a 68 years old male patient with diagnosis of PSP a year prior to surgery. Neurological examination on admission: severe disarthria, vertical gaze paralysis, ipertonus in the left superior limb. Gait is possible only with bilateral sustain. DBS of the right PPN was performed. The procedure was uneventfull.

Result: Improvement of gait stability was observed at one month after surgical procedure. At one year the patient is able to walk without relevant help. In our opinion considering that PSP is progressive DBS is a promising procedure.

Conclusions: In the last years the PPN has been targeted in Parkinson's disease with gait instability and frequent falls. In PSP patients falls and instability are highly invalidating. Even if to date there are only few cases of DBS for PSP disease and good evidences are far away, these initial responding reports might represent a basement for further randomized studies.

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THE SILENT LOSS OF NEURONAVIGATION ACCURACY

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Introduction: Neuronavigation has become an intrinsic part of preoperative surgical planning and surgical procedures. However, even after successful co-registration with only a small deviation, in numerous cases the accuracy is insufficient. To quantify the decrease of neuronavigation accuracy and identify possible origins, we performed a prospective quality-control study.

Methods: Between April and July 2011 a neuronavigation system was used in operations on 55 patients. We used two different neuronavigation systems and investigated them separately. Co-registration was performed with laser-surface matching, paired-point matching using skin fiducials, anatomical landmarks, or bone-screws. The initial target registration error (TRE1) was measured using the nasion as anatomical landmark. After draping and during surgery the accuracy was checked and deviations due to surgical manipulations or duration were recorded.

Results: After completion of the co-registration procedure, mean TRE1 was 2.9mm (standard deviation [SD] 3.29). TRE1 was significantly dependent on patient positioning, lesion localization, type of neuroimaging, and co-registration method. The following procedures decreased neuronavigation accuracy: attachment of surgical drapes (ΔTRE2 measured at Mayfield frame=2.69mm, SD 1.73), skin-retractor attachment (ΔTRE3 measured at a bone-measurement point=1.17mm, SD 1.01), craniotomy (ΔTRE3=1.02mm, SD 1.35), and Halo-ring installation (ΔTRE3=0.51mm, SD 0.52). Overall ΔTRE was 1.3mm (SD 1.5) at 30 minutes after co-registration, and increased up to 4.43mm (SD 1.8) after 5.5 hours of surgery.

Conclusions: The draping procedure and surgical manipulations, particularly skin-retractor use, contributed substantially to the overall decrease in neuronavigation accuracy. Improvements of headholders, patient positioning, and co-registration techniques would improve neuronavigation accuracy.

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SYNCHRONOUS MICROELECTRODE RECORDINGS FROM PARIETAL CORTEX AND THALAMUS OF VEGETATIVE AND MINIMALLY CONSCIOUS PATIENTS

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Introduction: Direct microelectrode recordings from the cortex and thalamus of patients in vegetative or minimally conscious states are not available. The CATS study (ClinicalTrials.gov Identifier: NCT01027572) is an ongoing prospective multi-institutional study on the effects of bilateral deep brain stimulation of the anterior intralaminar thalamic nuclei and adjacent paralaminar regions of thalamic association nuclei in vegetative patients and in patients in minimally conscious state. The study protocol includes microelectrode recordings during surgery for DBS electrode implantation.

Methods: During surgery for the implantation of the macroelectrodes we obtained from multiple microelectrodes single neuron recordings of spontaneous and sensory and motor evoked activities from both thalami. In two patients we also recorded from the overlying parietal cortex synchronously with the microelectrodes in the thalamus.

Results: Recordings in one vegetative and one minimally conscious patient showed some persisting cortico-thalamic synchronization. Both patients, after long-term stimulation had an improvement of the CRS-R and Coma/Near coma scores. However none returned to a fully conscious state.

Conclusions: Despite the limited number of patients studied, persistence of indications of electrophysiological coupling between limited areas of the homolateral parietal cortex and the thalamus does not seem to prelude to a complete recovery of consciousness.

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RESISTANCE TO HYPOXIA-INDUCED, BNIP3-MEDIATED CELL DEATH CONTRIBUTES TO THE INCREASE OF CD133+ CELL POPULATION IN HUMAN GLIOBLASTOMA-DERIVED CULTURES IN LOWERED OXYGEN TENSION

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Brain tumor stem-like cells (BTSC) are responsible for tumor initiation, propagation and resistance to standard therapies. Previous reports showed hypoxia-induced increase of BTSC expressing CD133 together with over-expression of other stem cell-related genes and more pronounced clonogenic capacity of the cultures. In this study, we investigated the mechanisms responsible for hypoxia-dependent induction of CD133+ subpopulation in glioblastoma-derived cell cultures.

Glioblastoma-derived cell lines were propagated under free floating culture conditions and subjected to either normoxic (21%) or hypoxic (3%) environmental oxygen tensions. Growth kinetic was assessed with CellTiter 96® Cell Proliferation Assay. CD133 expression was investigated with flow cytometry. Additionally, quantitative rtPCR-based expression analysis of stem cell-related and pro/anti-apoptotic genes of bulk cultures as well as FACS-sorted CD133± subpopulations followed by Western blot protein analysis was performed. To modify the epigenetic regulation of gene expression hypoxic cultures were treated with 10 µM of de-methylation agent 5'-Azacitidine.

Cell cultures exposed to hypoxia showed several fold increase of CD133+ BTSC population. Interestingly, growth rate of hypoxic cultures was significantly lower than their normoxic counterparts. Both increase of CD133+ subpopulation and deceleration of the growth kinetic were reversible following transfer to normoxic conditions. Exposure to hypoxia induced a BNIP3-dependant apoptosis preferentially in CD133- cells as shown by gene expression (up to 28 fold increase of BNIP3 mRNA levels) and protein analysis. In contrast, CD133+ cells showed a down-regulation of BNIP3 expression, owing to the methylation of its promoter and overexpression of anti-apoptotic genes Bcl-2 and Survivin (up to 8 and 6 fold respectively) that led to their better survival under hypoxia. Application of AZA resulted in dramatic increase of BNIP3 expression levels in CD133+ cells under hypoxia and complete abrogation of hypoxia-induced increase of CD133+ subpopulation.

Resistance of CD133+ BTSC against hypoxia-induced BNIP3-mediated apoptosis is dependent on the selective silencing of BNIP3 promoter and contributes to their better survival in lowered oxygen tension. This could be abrogated by AZA application indicating the possible efficacy of novel therapy focused on eradication of BTSC by modifications of epigenetic regulation of gene expression.

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SPINAL CORD STIMULATION MODULATES CEREBRAL FUNCTIONS AND NEUROBIOLOGY: AN FMRI STUDY AND 1H MRS STUDY

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Introduction: Electrical stimulation of the spinal cord based on the hypothesis posed by Melzack and Wall is an effective, minimally invasive surgical technique to treat chronic neuropathic pain refractory to best medical treatment. The hypothesis of stimulating low-threshold myelinated fibres in the dorsal column and thereby inhibiting transmission of nociceptive stimuli does however not clarify the entire mechanism of pain relief. Other authors suggested that supraspinal structures may play a role in the descending pain alleviating effects of spinal cord stimulation (SCS). We investigated the changes in cerebral neurobiology and functions during spinal cord stimulation using fMRI and proton magnetic resonance spectroscopy (1H MRS)-.

Methods: Forty patients diagnosed with Failed Back Surgery Syndrome and treated with an externalized spinal cord stimulator participated in the 2 studies (20 patients in the fMRI and 20 patient in the 1H MRS – protocol). 20 Patients participated in a blocked fMRI design with stimulation and rest phases of 30s each, repeated 8 times in a row. During scanning, patients were asked to rate pain intensity over time using an 11-point numerical rating scale with verbal anchors (0=no pain at all to 10=worst pain imaginable), by pushing buttons (left hand: lesser pain, right hand: more pain). This scale was back-projected to the patients on a flat screen allowing them to manually direct the pain indicator. To increase the signal to noise-ratio, the 8 min block measurements were repeated three times. The other 20 patients underwent a specific 1H MRS)-protocol during baseline without stimulation and after 9' of electrical stimulation of the spinal cord in three regions of interest: left thalamus, right thalamus and rostral anterior cingulate cortex.

Results: In addition to activation of the contralateral primary sensory-motor cortex, marked deactivation of the bilateral medial thalamus and its connections to the rostral and caudal cingulate cortex and the insula were found, Secondly, this study also showed that immediate pain relief obtained by short-term SCS correlated negatively with activity in the inferior olivary nucleus, the cerebellum and the rostral anterior cingulate cortex. In the ipsilateral thalamus, we found a significant increase of GABA ($p< 0.05$) and decrease in glucose ($p<0.05$) between baseline and after 9' of stimulation. Similar results were present both in the absolute values of GABA and glucose and in the relative ratio's in comparison to total creatinine (Cr + PCr). In the contralateral thalamus and rostal anterior cingulate cortex, no statistically significant alterations were found.

Conclusion: These results indicate the key role of the medial thalamus as a mediator and possible therapeutic target for chronic neuropathic pain and the involvement of a corticocerebellar network implicating the modulation and regulation of averse and negative affect related to pain. The observation of a deactivation and increase of GABA of the ipsilateral anterio--medial thalamus might be used as a sufficiently reliable surrogate marker for good response to SCS.

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FRAMELESS NEURONAVIGATION SYSTEM (NEXFRAME) IN DEEP BRAIN STIMULATION. VALIDATION OF ACCURACY COMPARING NEUROPHYSIOLOGICAL AND ELECTRODES COORDINATES

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Introduction: Stereotactic systems are traditionally used in order to get the right target in deep brain stimulation (DBS). Recently, the use of the 3 tesla MRI has enabled us to recognize directly the targets and consequently, the elaboration of these images on the neuronavigator allowed us placing the electrode using a frameless technique (Nexframe, Medtronic) in spite of the traditional frame. Compare with frame, we evaluate the advantages and reliability of the frameless technique.

Methods: We present a series of 57 patients operated so far, beginning in january 2010. Median age is 55 years. They are 35 male and 22 female. We treated 18 generalised distonic syndrome, 36 parkinson disease, 2 essential tremor and 1 epilepsy. Surgical planning has been done through 3T-MRI fused with axial tomography. The targets were subthalamic nucleus (STN) for Parkinson's disease and ventroposterolateral part of internal pallidum (GPI-VPL), for distonia. We obtained simultaneus multitracking microrecording. The lead was 3389 for Parkinson and 3387 for dystonia. All electrodes have been locked on the skull with the stimlock system. All distonic patients received RC (rechargeable system) while parkinsonian patients had PC. Electrode position has been postoperatively confirmed by axial tomography, fused with preoperative MRI. There was no major complications.

Results and Conclusions: From january 2010 to may 2012, we used frameless system (Nexframe, Medtronic). It's a technique guided directly by the image, it means that we can directly visualize the nuclei on 3T-MRI and reach them with a navigation system. We think is more comfortable, less invasive and less time consuming, which may compensate the cost of the material. There' re a few data about lacking of precision through any step of the procedure: firstly anatomical stereotactic coordinates, neurophysiological stereotactic coordinates and finally stereotactic coordinates of the tip of the electrode. We plotted and compared all groups of coordinates. In order to confirm reliability of the system, we found a very low displacement between neurophysiological coordinates and electrode coordinates: from 1 mm to 2 mm in the 95% of the electrodes. Therefore, for what concern our experience, based on postoperative radiological comparison, those data confirm the same reliability and precision of the frame. We think that the Nexframe with the image guided surgery is a good alternative of stereotactic frame in DBS surgery.

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ROBOTIC IMPLANTATION OF DEEP BRAIN STIMULATION ELECTRODES, ASSISTED BY INTRA-OPERATIVE, FLAT-PANEL CT

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Introduction: There are two mandatory skills in deep brain stimulation (DBS) surgery: accuracy and control. Robotic and intra operative imagery seems to offer an appropriate technological answer to these key points. We present our preliminary experience using rosa® stereotactic robot assisted by intra-operative O'Arm® flat panel CT scan in sub-thalamic (STN) DBS surgery.

Method: 8 STN-DBS surgeries (16 leads) were performed for idiopathic Parkinson disease. Non-stereotactic Mri was performed under general anaesthesia before surgery. The Leksell® G stereotactic frame was attached to the patient's head. Stereotactic CT was performed and matched with the pre-operative MRI. Target localization is based on MRI images, using ROSA® robot planning software. Robotized frame-based registration is performed. Burr holes are drilled at the entry point indicated by the robot's laser probe. We installed the Bengun and placed a guide-tube in line with the central trajectory (without entering the brain tissue). A three-dimensional (3D) flat-panel CT scan and matching with pre-operative imaging data was performed. We used the planning software to measure the possible error in the tube position and corrected latter through micro-movements of the robotic arm. Microelectrode recording and clinical testing were realised. We then defined the optimal DBS lead position. The microelectrodes were removed and replaced with the quadrupolar DBS lead. A final CT scan was performed and matched to check the correct placement of the lead. The same protocol was performed for the other side. We measured first the accuracy of guide-tube position before correction of the robotic arm and after correction thanks to the intra operative FCT control.

Results: For 15 guide-tubes, accuracy at the target was under 1 mm. In one case, error of the guide-tube position before correction was 1.2 mm. In 4 cases, there was no measurable error of position of the guide-tube. After correction, no measurable error in the position of guide-tube was objectified. Central trajectory for DBS lead position was chosen in 15 cases. After, matching between CT and pre-operative MRI, all DBS leads were inside STN. Mean UPDRS III improvement was 55%.

Conclusion: The combination of intra-operative, flat panel CT with robotized surgery provides an accurate, user-friendly solution to the key technical challenges in DBS lead implantation.

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DEVELOPMENT AND EVALUATION OF STEREOTACTIC FRAME-CT TABLE POSITIONING ADAPTOR TO IMPROVE THE ACCURACY IN FUNCTIONAL NEUROSURGERY

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Introduction: Frame based stereotactic and functional neurosurgery plays an important role worldwide. Its reputation was based on its high accuracy and precision. The accuracy is dependent upon perfect image acquisition by reducing movement artifacts, head- roll, yaw and pitch in relation to the frame and frame- roll, yaw and pitch in relation to the scanner gantry. We developed a stereotactic frame CT table adaptor (SFCTA) to eliminate roll, yaw and pitch. We describe our initial experience.

Materials, patients and methods: The SFCTA was developed to attach the CT table to the CRW stereotactic ring. Tha adaptor can easily tilt the head in antero-posterior and lateral planes and it can rotate the frame from side to side. The adjustments in the X,Y & Z planes are monitored by an integrated water level. Sixteen consecutive patients were studied, eight just before the adaptor was introduced and eight after its introduction. These were seven males and nine females with age from 30-75 years. Five were to target the Gpi, two the anterior cingulum, one the Vim and the rest the STN bilaterally (32 targets in total). All patients had their surgery performed under GA, an MRI was obtained the day before awake, if the MRI images were not of good quality the MRI was repeated under GA otherwise only stereotactic CT is obtained on the day of surgery. On the day of surgery, patients were put asleep, the CRW frame ring was attached to the skull parallel to the glabella-inion line. The SFCTA was used to fix the CRW ring to the CT table. The CT frame localizer was fixed to the frame ring and was positioned in the gantry at zero angle in the X,Y&Z planes using the SFCTA. Antero-posterior and lateral scout view was then obtained and any roll, yaw and pitch were corrected using the SFCTA. The volumetric CT was obtained at 1.25 mm slice thickness.

Results: The mean angle of the frame to the CT gantry in the three planes using the SFCTA was 0.38 degrees compared to 1.83 degrees prior to the use of the SFCTA. The average time needed to position the frame in the CT gantry at zero angle prior to the SFCTA introduction was 8 minutes with an average of three scouts to get an acceptable position compared to 4 min and 2 scouts using the SFCTA.

Conclusion: Using SFCTA was useful in positioning the frame in the CT gantry more accurately in shorter time and reduced X-ray exposure.

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NEW EVIDENCES IN THE ANATOMY AND FUNCTIONAL ROLE OF INFERIOR FRONTO-OCCIPITAL FASCICULUS PROVIDED BY ANATOMICAL DISSECTION, DTI AND DIRECT INTRAOPERAT

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Introduction: The anatomy and functional role of the inferior fronto-occipital fascicle (IFOF) remain poorly known and debated. Particularly the anatomical distribution and the functional role of the frontal terminations of this bundle have not been well studied. We accurately analysed the course and anatomical distribution of IFOF terminations within the frontal lobe, classifying the fibers in different functional subcomponents considering the results of anatomical dissection, intraoperative cortico-subcortical mapping, DTI analyses and existing literature.

Materials and Methods: Ten hemispheres (5 left and 5 right) were dissected with Klinger's technique. Our dissection data were compared to 4 Tesla Diffusion Tensor Imaging studies on 5 healthy subjects and to the results of intra-operative subcortical stimulation during awake surgery.

Results: We found two layers of IFOF. The first one is superficial and antero-superiorly directed. It terminates in the inferior frontal gyrus. The second is deeper and consists of three portions: posterior, middle and anterior. The posterior component terminates in the middle frontal gyrus (MFG) and dorso-lateral pre-frontal cortex (DLPFC). The middle component terminates in the middle frontal gyrus and lateral orbito-frontal cortex (OFC). The anterior one is directed to the orbito-frontal cortex (OFC) and to the frontal pole. The DTI confirmed these anatomical findings. The superficial layer and the posterior component of the deep layer constitute the anatomical background of the semantic role of IFOF, which connects the occipito-parietal extrastriate, temporo-basal and frontal cortices. The middle component of the deep layer could play a role in a "multimodal integration" among different non-language parieto-frontal networks. Finally, the anterior component of the deep layer might be involved in emotional and behavioural aspects, decision-making and visuo-spatial activities.

Conclusions: The distribution of IFOF fibers within the frontal lobe corresponds to a fine functional segmentation. IFOF can be considered a "multi-task" bundle connecting different, parallel and distributed networks according to the more modern "hodotopic" organization of brain functions.

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PRACTICAL USE OF AN AUDITORY DEVICE TO IMPROVE GAIT IN PATIENTS WITH PARKINSON'S DISEASE

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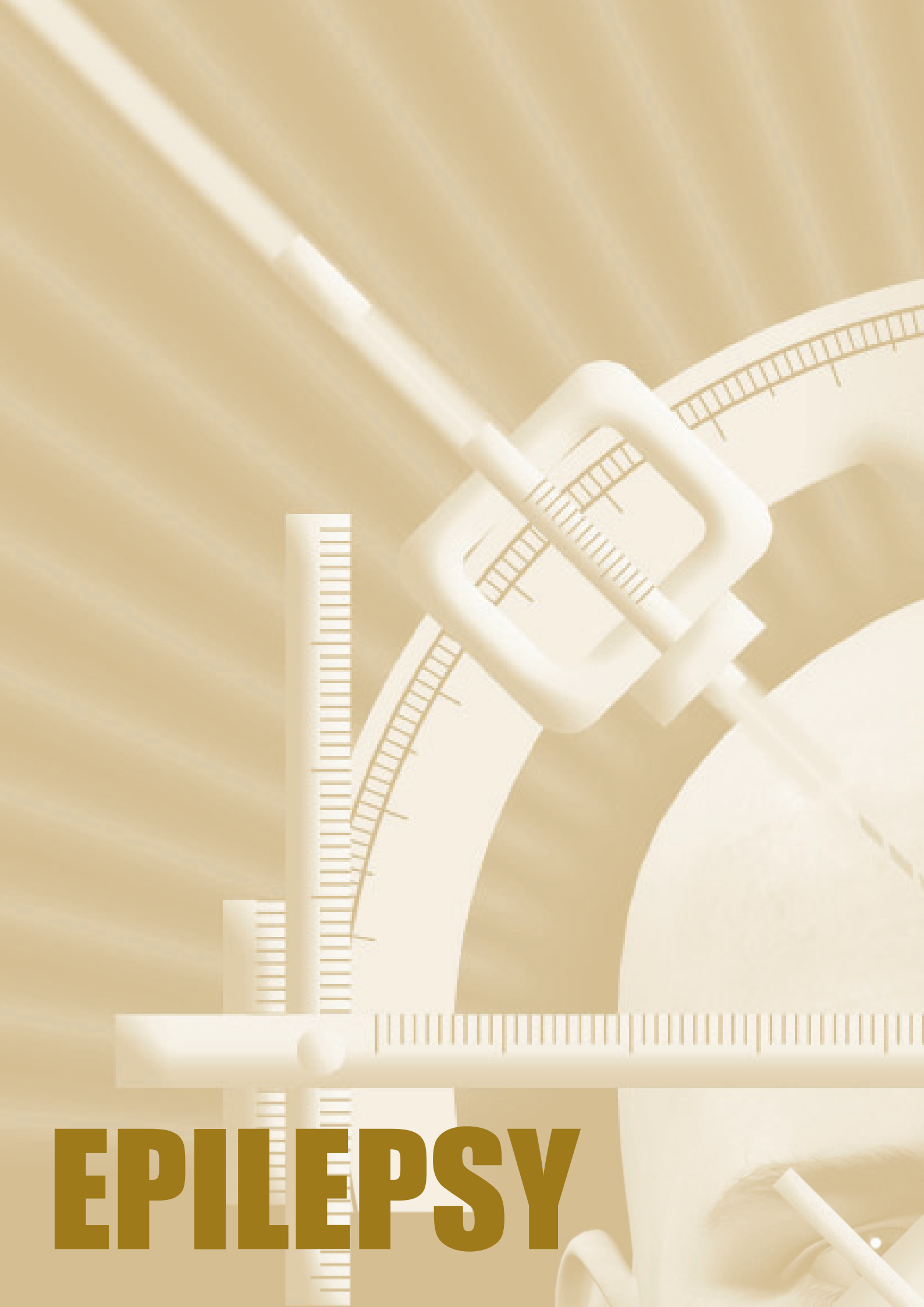
Introduction: One of the most debilitating motor symptoms of Parkinson's disease (PD) is gait dysfunction. Despite the benefits of current pharmacological and surgical therapies for patients with PD, treatment effectiveness and options for gait difficulties remain limited. Evidence exists to support the use of spatial and rhythmic external cues to increase stride length and regulate cadence. However a portable device has not been reported to be available for the patient's daily use, Therefore we analyzed the effects on gait of a new device that generates auditory rhythmic cues matching step frequency to the auditory rhythm aiming to improve walking in PD patients.

Purpose: To study the effect on gait in PD subjects with and without freezing and with and without DBS, of a new portable external auditory device that generates rhythmic auditory cues.

Method: A volunteer sample of 10 PD patients between 45 to 65 years old (3 women and 7 men) (5 with previously implanted STN DBS - 5 without DBS) were studied, all with difficulty in walking, included: Difficult for the initiation, maintenance or completion of the gait, dysfunctional turning, frequently freezing and tendency to fall, whom did not improve with pharmacological adjustments, physical therapy or changes in the electrical parameters of the DBS programming. Auditory rhythmic cues matching step frequency were administered through a new external portable device (Listenmee-Brainmee ©). All patients received a Gait Analysis Laboratory, using several cameras (video and infrared) placed around a walkway, which were linked to a computer. The patient had markers located at various points of reference of the body. Mean step frequency, walking speed, stride length and double support duration were collected. with and without the use of the external device, in a medication OFF- State. The systematic study of the patients motion, involved the analysis of the videos by a group of experts on gait (orthopaedics - neurologist) whom where not aware if the device was turn on or off, The results are reported in terms of change in object of analysis parameters (protocol laboratory MOVYSIS), and subjective quality of life.

Results: All patients improved in the motion analysis. Rhythmical auditory cueing induced speed changes in all subjects. Freezers and non-freezers showed the same positive response to rhythmical auditory cues. And all patients reported improved in their quality of lives and the desire to continuing permanently the use of the device.

Conclusions: Listenmee © is a safe and effective adjunct help for symptomatic improvement of gait in patients with PD. Future possibilities may be the potential therapeutic use in early stages of the disease. Further analysis will be continuing for chronic responses.



EPILEPSY

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AMYGDALO-HIPPOCAMPOTOMY: LONG-TERM (2 YEARS) CLINICAL RESULTS

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Introduction: Since 2007 we performed selective amigdalo-hippocampotomy, with hippocampal disconnection instead of removal, for treatment of refractory temporal lobe epilepsy (TLE) due to mesial temporal lobe sclerosis (MTLS). The surgical technique and results are presented.

Methods: 21 MTLS patients (14 females) aged 20-58 years (mean:41y) were operated with this technique: selective ablation of lateral amygdala plus peri-hippocampal disconnection (2/3 anterior on dominant hemisphere), including the para-hippocampal gyrus. In 20 patients the follow-up time was 24- 44 months (average: 32 months).

Results and Discussion: Operative time was reduced with this technique in 30-40minutes (15-20%) in average and no risk due to intra-subarachnoidal vascular dissection was present. The histopathology diagnosis was MTLS in 20 patients (in one patient material was lost). Surgical outcome for epilepsy(≥ 2 year follow-up): good/very good in 19 patients (95%), with Engel Class I-A in 15 (75%) and II-A in 4 (20%); bad in 1 patient (5%) in Class IV (patient with an ipsilateral posterior temporal focus appeared later). Surgical morbidity: one patient with hemiparesis (hypertensive haemorrage 12 hours after surgery), 2 with memory worsening, 3 with quadrantanopia. In 3 cases late psychiatric depression developed.

Conclusions: Advantages: Amygdalohippocampotomy is safer and is as effective as amygdalohippocampectomy, and is a time-saving procedure.

Disadvantages: Some isolated epileptiform EEG activity may be seen post-surgically. The surgical technique is video-illustrated in the presentation.

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STIMULATION OF THE ANTERIOR NUCLEUS OF THALAMUS FOR THE TREATMENT OF EPILEPSY: INITIAL EXPERIENCE AT THE UNIVERSITY HOSPITAL SANTA MARIA, LISBON

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Introduction: Deep brain Stimulation (DBS) is a new therapeutic modality for the treatment of Epilepsy. It is based on the assumption that the interference with the Anterior Nucleus of Thalamus (ANT), a key structure of the limbic system, can modify the neuronal circuitry mechanisms involved in the limbic epilepsy and led to a clinical relieve of this kind of seizures. The first robust study with this purpose was the Medtronic multicenter SANTE study hold on 110 patients with refractory partial seizures. It showed a reduction in the number of seizures of 41% and 58% respectively after 1 and 3 years, despite only 14% patients got seizure free. The present study was aimed to evaluate the clinical outcome of this procedure in our first treated patients.

Methods: Four adult (2 male, 2 female) epileptic patients were bilaterally implanted with DBS electrodes (model 3387, Medtronic® branched to an Activa PC® pulse generator) in the ANT between January and November 2011. The ages ranged from 26 to 38 years (mean: 33y). All patients had temporal lobe epilepsy refractory to long term anti-epileptic medication; two had already been operated, one with a vagal nerve stimulation implant, one other with selective amygdalo-hippocampectomy, both without satisfactory clinical results. All were submitted to our epilepsy surgery protocol. The DBS parameters were: pulse width - 90 µs, frequency - 145 pulses/min, amplitude - 5V, 1 min ON, 5 min OFF. The post-operative follow-up time was 6 to 12 months (mean:m.).

Results: All patients were operated under general anesthesia. In 2 patients the electrode approach trajectories were extraventricular owing to the ventricular complex venous arrangement; in 1 the trajectories were transventricular and in 1 were transventricular on the right side and extraventricular on the left. No operative morbidity was registered. In 2 patients there was a reduction of the number of seizures and in all patients there was an improvement of the intensity and duration of the seizures. Two patients have no more drop attacks and one no more secondary generalized tonic-clonic seizures. All patients felt better concerning epilepsy and quality of life.

Conclusions: Although a few patients were treated and a short post-implant follow-up time passed, our initial experience with the ANT for Epilepsy shows some positive results essentially on the improvement of seizures severity and quality of life, without significant morbidity.

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TAILORED IMAGE-GUIDED TEMPORAL POLECTOMY AND AMYGDALO-HIPPOCAMPECTOMY FOR MTLE

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Introduction: MTLE is the most common surgically remediable epilepsy syndrome and hippocampal sclerosis is the most frequently encountered lesion (60-70% of cases). Surgery has shown to be the most effective curative treatment for MTLE. Regarding the seizure outcome, as well as the possible adverse effects of surgery (visual field deficit, postop memory worsening), it is still a matter of debate if selective amygdalo-hippocampectomy or associated temporal lobectomy should be performed in MTLE. Moreover, in the last option, the extent of temporal lobe resection is still not clearly determined. In this study, we present the surgical technique and report our experience in systematic tailored image-guided temporal polectomy and amygdalo-hippocampectomy approach to MTLE in terms of outcome and complications.

Methods: We prospectively studied 35 consecutive patients (16 females and 19 males, mean age 25 years: 6-56), who underwent tailored image-guided temporal polectomy and amygdalo-hippocampectomy for MTLE. Surgical procedures were performed or supervised by a single neurosurgeon. Study inclusion criteria consisted of 35 patients who had unilateral hippocampal abnormality visible on MRI (23) and 12 associated with normal MRI. All the patients underwent a standard presurgical evaluation. Invasive monitoring was performed in 5 patients. Pre and postoperative high resolution MRI, including 3D T1-weighted images, neuroophtalmological and neuropsychological evaluation. We classified the clinical outcome into seizure-free and seizure recurrence. Superior quadrantanopia, memory impairment and other neuropsychological disorders were reported. Co-registration between pre--op and postop 3D T1-weighted MRI was performed to measure the extent of temporal pole as well as hippocampal resection.

Results: The mean follow-up period of 16 months (range : 12 to 48 months), 31 patients (88.6%) were seizure-free group. 4 patients (11.4%) presented seizure recurrence (one patient had only aura recurrence and another had a significative decreased in seizure frequency). The surgical procedure allowed to significantly decrease the AED in 33 patients (94%). Six patients (17%) presented a superior quadrantanopia. The mean length of resected T1 was 24.32(±3.74)mm and resected hippocampus was 25.1(±4.25)mm. 10 patients (28%) presented a transient worsening of the postoperative verbal memory (left side). Two (5.7%) developped a permanent depressive disordes (patients operated on the right side).

Conclusions: Tailored image-guided temporal polectomy and amygdalo-hippocampectomy for MTLE is a safe and effective curative procedure for resistant MTLE. It may improve the efficacy of selective AH, whereas lowering the morbidity regarding the visual feld and memory impairments due to exptended temporal cortex/hippocampus

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ELECTRODE LOCATION AND CLINICAL OUTCOME IN HIPPOCAMPAL DBS FOR MTLE : A CORRELATION STUDY

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Introduction: Hippocampal DBS has been shown efficacy in the treatment of MTLE. However, the variability of the reported responses justifies a better understanding of the mechanism by which DBS reduce seizure frequency, as well as identification of optimal targets. We address this issue by determining the correlation between electrode location and clinical outcome.

Methods: 8 MTLE patients implanted in the hippocampus and stimulated with high-frequency DBS were included in this study. Five underwent invasive recordings with depth electrodes to localize ictal onset zone prior to chronic DBS. Position of the active contact(s) of the implanted electrode was calculated on postoperative MRI or CT and projected on the stereotactic atlas of Mai. The distance between the active contact(s) related to 1) the ictal onset focus determined invasively, 2) the anatomical structures possibly influenced by electrical stimulation, was calculated and correlated with the clinical outcome.

Results: The distances between active electrode location and estimated ictal onset zone were 11 ± 4.3 or 9.1 ± 2.3 mm for patients with a >50% or <50% reduction in seizure frequency. In patients (N = 6) showing a > 50% seizure frequency reduction, 100% had the active contacts located < 3 mm from the subiculum. The 2 non-responders patients were stimulated on contacts located > 3mm to the subiculum.

Conclusion: Decrease of epileptogenic activity induced by hippocampal DBS in refractory MTLE seems to correlate with a modulatory effect on the subiculum, rather than a direct inhibitory effect on the ictal onset zone.

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LONG- LONG-TERM RESULTS OF VAGAL NERVE STIMULATION FOR ADULT PATIENTS WITH INTRACTABLE EPILEPSY, WITHOUT CHANGING THE ANTIEPILEPTIC MEDICAL TREATMENT

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Introduction: Several studies have given evidence of VNS efficacy, although patients´ medication was usually modified during the assessment period. The purpose of this prospective study was to prospectively evaluate the long-term effects of VNS, on epileptic patients on unchanged antiepileptic medication, at the 18 months of follow-up.

Methods: Forty three patients underwent a complete epilepsy preoperative evaluation protocol, andwere selected for VNS implantation. After surgery, patients were evaluated on a monthly basis, increasing stimulation 0.5 mA at each visit, up to 2.5 mA. Medication was unchanged for at least 18 months since the stimulation was started. The outcome was analysed in relation to patients´ clinical features, stimulation parameters, epilepsy type, MRI results, and history of prior brain surgery.

Results: Of the 43 operated patients, 62.8% had a similar or greater than 50% reduction in their seizure frequency. High stimulation intensity, younger age of onset of epilepsy, longer duration of epilepsy before surgery, and generalised seizures, appear to be positive predictive factors of favourable outcome, although they did not reach statistical significance. Most side effects were well tolerated.

Conclusions: VNS is an effective therapy even in a situation of unchanged medication. It produces a significant long-term seizure number reduction (≥50%) in 62'8% of our patients. Stimulation was more effective when intensity was set over 2 mA. Patient characteristics predictive of VNS responsiveness remain subject to investigation.

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PROSPECTIVE EVALUATION OF GAMMA KNIFE SURGERY IN HYPOTHALAMIC HAMARTOMAS: ABOUT A SERIES OF 64 PATIENTS

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Rational: Epilepsies associated to Hypothalamic Hamartomas are frequently drug-resistant with a severe psychiatric and cognitive comorbidity. We have organized a prospective trial in order to evaluate the safety and efficacy of radiosurgery using the Gamma Knife (GK).

Material and Method : Between January 1999 and December 2007, 64 patients were investigated, included and treated by GK in Timone University Hospital. Preoperative work-up and 3 years evaluation included: seizure diary, neuropsychological testing, psychiatric evaluation, endocrinological evaluation, visual field and acuity. Till now, follow up of more than 3 years is available for 40 patients. The hamartomas were of topological Type I (Regis et al) in 8 patients, Type II in 14 patients, Type III in 12 patients, Type IV in 1 patients, Type V in 1 patients and mixed Type in 3 patients. The median of the marginal dose was 17 Gy (Mean: 17,8+- 1,6; min=14; max= 20). The median of the volume was 419 mm3 (Mean 556,7 +- 394; min=31; max=1600). The median number of isocenters was 8 (Mean 9,4 +- 5,5; min=1; max= 31). 25 patients (62,5%) have been treated twice due to partial result.

Results: The median follow up was 62 months (36-107). At last follow up the rate of Engel I was 47,5 %, Engel II 17,5% (I+II 65%) & Engel III (20%). Global Psychiatric and Cognitive comorbidity was considered cured in 28%, improved 56%, stable 8% and have continued to worsen in 8%. No permanent neurological (specially no mnesic nor visual deficit) side effect is reported. A non-disabling transient poikilothermia was observed in 3 patients (7,5%). A transient increase of seizure frequency is reported in 7 patients (17,5%). Microsurgery was proposed due to insufficient efficacy of GKS in 5 patients (Type II, Type III, type IV in one patient each, mixed type in 2 patients). The postoperative outcome (after GK and microsurgery) was Engel I (40%), Engel III (40%) and Engel IV (20%).

Conclusion: This prospective trial is demonstrating the very good safety efficacy of Gamma Knife radiosurgery in the long term. Beyond seizure reduction, the improvement of the psychiatric, cognitive condition and school and social insertion is turning out to be the major benefit of GKS in this frequently catastrophic epilepsy group.

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TARGETING DBS TO ANTERIOR NUCLEUS OF THE THALAMUS FOR REFRACTORY EPILEPSY

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Introduction: DBS of the anterior nucleus of the thalamus (ANT) has been suggested as a novel treatment option in refractory epilepsy. The procedure described in previous reports has been performed using indirect atlas based targeting, using transventricular trajectory and with or without microelectrode registration (MER). Here we report an experience of implantation of bilateral electrodes in 13 patients using transventricular (n=19) and transparenchymal (n=7) approaches. We have especially concentrated on different levels of targeting, including defining the target on MRI, surgical trajectory and intraoperative identification of the ANT using MER.

Methods: The usefulness of 3T MRI STIR images in identification of ANT was studied comparing stereotactic atlas based coordinates to visual information from 3T STIR images. The potential difference in accuracy between transventricular and transparenchymal implantations was evaluated from postoperative CT / stereotactic CT fusion images. MER signal from 10 trajectories was analyzed with respect to pre-surgical plan and postoperative CT-MRI fusion images.

Results: ANT was possible to visualize directly in 3T MRI STIR images using mamillo-thalamic tract as a landmark. Stereotactic coordinates used in the literature (5-6 lateral, 12 mm superior, 0-2 mm anterior to MCP) resulted in localization of the target in the border of ANT and VA in 23 plans out of 26 in STIR images. In 15 transventricular implantations out of 16 (94%) electrodes were within 1,6 mm distance from the target according to postoperative CT- stereotactic CT fusion images. There was no significant difference in the accuracy between two trajectories. MER signal showed bursting activity in the ANT, but similar activity was recorded from surrounding structures, especially VA. Registrations along the superior-inferior axis of the ANT showed considerable variation in the level of bursting activity.

Conclusions: ANT as a DBS target was visualized in 3T MRI STIR images. We observed some variation in the localization of ANT, and therefore stereotactic target should be adjusted according to visual information. We found transventricular trajectory both safe and accurate, however, it was not applicable to all patients due to vascular anatomy. The value of MER was limited since it was not specific to ANT, and secondly, due to variation in the level of spiking activity in the ANT.

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SINGLE PULSE ELECTRICAL STIMULATION IS A PROMISING TOOL FOR LOCALIZING ELOQUENT CORTICES AND DELINEATING THE SEIZURE FOCUS USING NETWORK ANALYSIS

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Introduction: Single pulse electrical stimulation (SPES) can be used in patients undergoing chronic intracranial electrode monitoring for epilepsy surgery in order to define connectivity among brain areas that participate in networks. Bipolar current stimulation with single pulses across the implanted array can be used to generate a profile of cortico-cortical evoked potentials without the risk of evoking seizures or behavioral changes to the patient. SPES can be used to delineate functional networks involved in sensori-motor and language function as well as the pathological network of areas that are involved in seizure genesis and spread. We systematically mapped all electrodes implanted using SPES and defined networks by: 1) transforming the locations of the electrodes to a Brodmann's area-defined space 2) coregistering the electrode contacts to a preoperative magnetic resonance imaging (MRI) scan using resting state functional connectivity (RSFC) analysis in the same patient and 3) comparing the results to high frequency electrical stimulation mapping (ESM).

Methods: Extra-operative ESM and SPES for the analysis of CCEP was performed using subdural implanted electrodes in 10 patients with medically intractable epilepsy. Electrode coordinates were localized in MRI space in order to perform co-registration to Brodman areas and RSFC. fMRI was recorded at rest in a 3T GE scanner prior to implantation. High frequency ESM was performed under clinical guidelines for defining language and sensorimotor function.

Results: CCEP revealed intracerebral pathways that linked functional and pathological areas into networks. Cortico-cortical connectivity was assessed with respect to Brodmann's areas. Electrodes over eloquent cortices defined with functional stimulation mapping were reliably localized to their respective Brodman area. Areas involved in seizure genesis and early spread showed high degree of connectivity. RSFC results remarkably overlapped and complemented the findings of CCEP.

Conclusion: Single pulse electrical stimulation can provide valuable information regarding functional and pathological networks of the brain, without the risks of high frequency stimulation. The combined use of sophisticated functional imaging data and SPES are promising tools to increase the accuracy defining the network of areas involved in normal function and pathological dysfunction and may improve the outcome of epilepsy surgery.

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CONTRIBUTION OF SEEG IN THE PRESURGICAL EVALUATION OF DRUG RESISTANT FOCAL EPILEPSY

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Introduction: to report our experience on safety and usefulness of Stereotactic-Electro-Encephalography (SEEG) in a large series and to report the scientific knowledge on severe drug resistant focal epilepsies (DRFE).

Methods: From 2000 through 2010, 522 patients underwent surgery for DRFE in the Epilepsy Unit. SEEG was performed in 193 patients. All procedures were undertaken under a coupling of cerebral Stereotactic Teleangiogram and a stereotactic MRI in T1 weighted gadolinium-enhanced sequences. The positioning of electrodes was based upon available non-invasive information and hypotheses about the localisation of epileptogenic zone (EZ). After recording several habitual seizures, identification of EZ is a complex process based on the whole electroclinical semiology.

Results: a majority of patients (168 patients, 87%) had a successful localisation of EZ using SEEG. Among them 147 patients (76%) were scheduled for surgery or Gamma Knife radiosurgery (GK). SEEG for other 21 patients (11%) was conclusive but no surgery was indicated because of EZ was multifocal or in high functional area. In 13 patients (7%), SEEG failed to localise the EZ. 92 patients (80 treated by surgery and 12 by radiosurgery GK) had a postoperative follow-up for at least 1 year. Seizure free patients at 1 year follow-up was ILAE class 1 in 49% and Engel's class 1 in 60%. 9 patients had complications. Among them only three patients (1,5%) displayed permanent deficit.

Conclusion: SEEG is reliable and relatively safe for localizing EZ in DRFE. Availability of radiosurgical and microsurgical capabilities offers a unique opportunity to propose the best indications for better functional results.

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INVOLVEMENT OF THE ANTERIOR NUCLEUS OF THE THALAMUS DURING FOCAL TEMPORAL SEIZURE : AN EXPERIMENTAL STUDY IN THE NON HUMAN PRIMATE

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Introduction: About one third of epileptic patients are pharmacoresistant and are not eligible for resective surgery[1]. In this population, electrical deep brain stimulation (DBS) could be an alternative treatment. Several studies [2],[3],[4] and in particular the SANTE study[5] have suggested that DBS of the anterior nucleus of the thalamus (AN-DBS) could potentially reduce the number of seizures of those patients,. However, results are heterogenous and indications still remain unclear. More evidence from animal studies are required to improve our knowledge of neuronal networks involved during temporal seizures and in particular the implication of AN in temporal seizures. In the present study, we aimed at 1 - developping a model of focal temporal seizures in the non human primate. 2- study the implication of AN during temporal seizures using time frequency analysis and coherence analysis between local field potential recorded in the AN and in the hippocampus/entorhinal cortex (HC). 3- determine the electyrophysiological features of interictal and ictal activities recorded in the AN.

Methods: The study was conducted on a non human primate (macaca fascicularis). This experiment was approved by the ethical commitee of the Grenoble institut of Neurosciences. We first developed a stable, predictable primate model of focal temporal seizures by intrahippocampal injection of penicillin and documented it's pharmacoresistance. We then stereotactically implanted DBS electrodes in the AN and in the hippocampus with the use of pre operatory MRI fused with intra operatory ventriculography. A cannula fixed to the skull allowed "on demand" penicillin injection into Hc at the onset of each experimental session.

Results: A model of semi-chronic temporal seizures was obtained after injection of single dose of penicillin G into the entorhinal cortex, allowing to record and analysis 116 spontaneous seizures in four sessions. MRI, per operat electrophysiological and post-mortem studies confirmed the correct targeting of the structures of interest. Depth EEG recordings showed spikes and seizures in the AN and in the HC, with a maximal amplitude in the HC. The local field potential of AN and Hc changed abruptly at the onset of the seizure, with a significant activity in the alpha and beta band. Furthermore, a synchronisation between both structures was noticed throughout the seizure.

Conclusion: This study was a preliminar phase of a scientific research with the aim to sense seizures using DBS implanted in the AN. The present study showed that AN is involved during focal temporal seizures . This structure could be used to detect remotely temporal seizures. However, the potential therapeutical role of AN-DBS remains to be clarified in future studies.

Bibliography:

1 - Sillanpaa M, Jalava M, Kaleva O, Shinnar S. Long-term prognosis of seizures with onset in childhood. N Engl J Med 1998; 338: 1715–22.
2 - Lee KJ, Jang KS, Shon YM. Chronic deep brain stimulation of subthalamic and anterior thalamic nuclei for controlling refractory partial epilepsy. Acta Neurochir Suppl. 2006; 99: 87-91.
3 - Zumsteg D, Lozano AM, Wennberg. Mesial temporal inhibition in a patient with deep brain stimulation of the anterior thalamus for epilepsy. Epilepsia. 2006 Nov; 47(11): 1958-62.
4 - Fisher R, Salanova V, Witt T et al. Electrical stimulation of the anterior nucleus of thalamus for treatment of refractory epilepsy. Epilepsia, 2010; 51(5): 899-908.
5 - Hodaie M, Wennberg RA, Dostrovsky O, Lozano AM. Chronic anterior thalamus stimualtion for intractable epilepsy. Epilepsia 2002; 43(6): 603-608.

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SYNCHROTRON-GENERATED MICRORADIOSURGICAL HIPPOCAMPAL TRANSECTIONS

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Introduction: Synchrotron-generated microplanar beams (microbeams) are characterized by the ability to restrict the delivery of high-dose x-ray radiation to microscopic tissue slices . Doses up to 1000 Gy induce tissue damage limited to the irradiated cells while the adjacent tissue remains unhindered. We have obtained the radiosurgical equivalent of multiple subpial transections generating sensorimotor cortex transections in rats with status epilepticus following local injection of kainic acid. Microradiosurgical transections induced seizure control while motor function was not affected. We have recently investigated the ability of microbeams to generate hippocampal transections. This original approach offers an interesting new way to study the hippocampal function and to develop novel treatment avenues for mesiotemporal epilepsy.

Methods: An array of synchrotron generated microbeams (size: 75 µm; center to center spacing: 400 µm; incident dose: 600 Gy) was delivered to the left hippocampus of 10 naive 3 week-old Wistar Han rats.This group was paired with ten untreated controls of equivalent age and weight. 7T MR imaging was performed on the treated animals 3 months after irradiation to evaluate the development of edema and/or radionecrosis.Immunohistology was performed within 48 hours and then at 3 and 6 months. Behavioral testing using an 8-arm maze was performed 6 months after irradiation.

Results: Microradiosurgical hippocampal transections induced by 75 µm beams delivering an incident dose of 600 Gy induced no evident MR and behavioral abnormalities.The treated rats gained weight regularly, showing no difference with the control group.7 T MR imaging revealed no sign of radio-induced edema or radionecrosis and no distortion or atrophy of the hippocampus. Immuno-histology with pH2AX (an acute marker of DNA irreversible damage and apoptosis) performed 24 hours after the procedure revealed immediate cell death along the microbeam paths and no damage elsewhere. Clear-cut microradiosurgical hippocampal transections remained stable over time, as demonstrated by immunohistology performed at 3 and 6 months. Viability of hippocampal neural progenitors was not affected by the treatment. Behavioral testing showed no difference between the treated animals and the controls.

Conclusions: Microbeams transections are associated with preservation of hippocampal architecture and neurogenesis. No behavioral abnormality was observed. Microradiosurgical hippocampal transections provide a novel tool for the study of hippocampal function and the treatment of mesiotemporal epilepsy.

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RESULTS OF STEREOTACTIC RADIOFREQUENCY AMYGDALOHIPPOCAMPECTOMY IN THE TREATMENT OF MESIAL TEMPORAL LOBE EPILEPSY

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Purpose: Stereotactic single trajectory radiofrequency amygdalohippocampectomy was used to treat mesial temporal lobe epilepsy (MTLE). The aim of the study was evaluate complications and effectiveness of this procedure.

Methods: A group of 61 patients with MTLE was treated under local anaesthesia. Amygdalohippocampectomy was performed using a string electrode with a 10 mm active tip and 16-38 lesions (median = 24) were performed in all patients along the 30-45 mm trajectory (median = 35) in the amygdalohippocampal complex.

Results: The procedure was well tolerated by all patients with no severe permanent morbidity, meningitis was recorded in 2 patients, hematoma was detected in 4 patients, clinically insignificant in 3 of them and one patient required temporary ventricular drainage. 35 patients were followed up over at least two years and the clinical outcomes were evaluated by Engel's classification. MRI volumetry and neuropsychological examinations were performed before and 1 year after treatment. One year after treatment 77% of patients were assessed as Engel´s Class I, 14% of patients was classified as Engel´s II and in 9% of patients treatment failed. Two years after SAHE 76% of subjects were classified as Engel´s Class I, 15% of patients was assessed as Engel´s II and in 9% of patients treatment failed. The hippocampal volume reduction was 58±17% on the left and 54±27% on the right side. One year after SAHE the intelligence quotients of treated patients increased. Patients showed slightly significant improvement in verbal memory (p=0.039) and semantic long-term memory subtest (LTM) (p=0.003). Patients treated on the right side improved in verbal memory, delayed recall and LTM. No changes in memory were found in patients treated on the left side. There was a trend between the larger extent of the hippocampus reduction and the improvement in visual memory in speech-side operated.

Conclusions: Stereotactic amygdalohippocampectomy is a minimally invasive procedure with low morbidity and good results that can be the method of choice in selected patients with MTLE.

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EPILEPSY SURGERY IN TUBEROUS SCLEROSIS COMPLEX – A SINGLE CENTER EXPERIENCE

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Introduction: Epilepsy is one of the elements of Tuberous sclerosis clinical complex. Although many patients have medically refractory seizures, for a long time they were not considered surgical candidates because of the belief that focal resection would not be enough in patients with multifocal cortical abnormalities and the concern of postoperative neurological deficits in patients with lesions in eloquent cortex. According to the most recent literature data, resection of single lesions, even when located in eloquent cortex, as been shown to be both effective and safe. The authors reviewed their experience in treating patients with Tuberous sclerosis whenever eligible to be surgical candidates, evaluated their results in what concerns to safety and effectiveness and compared them to results published in literature.

Methods: The authors performed a retrospective descriptive analysis of the patients with Tuberous sclerosis complex operated between January 2007 and March 2012 in Epilepsy Surgery group of Hospital Egas Moniz, through the collection of data concerning the surgery description, Neurological status and Seizure Outcome (using Engel Classification) after epileptogenic lesion surgical excision.

Results: During this period, 7 children with tuberous sclerosis complex were operated in our center. 6 patients were male (86%) and the mean age at the time of surgery was 36 months (14 to 84 months). All patients were subjected to excision of cortical tubers, guided with pre-operative imaging and video-electroencephalography. In two patients surface EEG was not enough to localize the epileptogenic area, so they were submitted to invasive EEG monitoring with subdural grids prior to lesion resection; in one patient 2 lesions were excised at the same time and one patient required a second surgery for completion of tuber resection. Most lesions (7) were located on frontal lobe (88%), 3 of them (38%) adjacent to the primary motor cortex. The Engel outcome was class I in 5 patients (72%), class II in one patient (14%) and class III in another patient (14%) after a mean follow up of 16 months.

Conclusions: The results of our group are comparable to previous studies, showing that resective surgery in patients with tuberous sclerosis patients may promote a good seizure control in patients with drug-resistant epilepsy and that with the aid of cortical and subcortical mapping, neurological deficits can be prevented in lesions located in or near the eloquent cortex.

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COMPARISON OF FMRI AND BRAIN MAPPING WITH CORTICAL STIMULATION TO LOCATE CORTICAL ELOQUENT AREAS IN EPILEPSY SURGERY CANDIDATES

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Objective: To determine whether the eloquent area identified by fMRI is concordant with that identified by brain mapping using cortical stimulation.

Methods: Patients who required implantation of cortical grids on eloquent areas for continuous EEG monitoring underwent presurgical fMRI and postsurgical extra operatory brain mapping with cortical stimulation. A postsurgical structural MRI was obtained and reconstructed with Eclipse software in order to determine the position of the grid. By image fusion, the location of the grid contacts where the eloquent area was identified was compared to the location of the eloquent area by fMRI.

Results: Six eloquent areas were compared, five motor and one for language (Wernicke area). In all motor areas fMRI and brain mapping were concordant in the identification of the eloquent area. For Wernicke area both methods were concordant in not identifying it on the left side (the patient had right language dominance). This patient underwent left temporal lobectomy, no postsurgical neuropsychological sequelae were present.

Discussion: In this study fMRI and brain mapping with cortical stimulation were 100% concordant in identifying eloquent areas. Isometric sequences with coronal slices were the best for 3D reconstructions of structural MRI. An MRI processing protocol has been established and will be used for all future cases. Further study, especially for language areas, is still necessary.

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A WIRELESS SUBDURAL GRID FOR CHRONIC ECOG MONITORING AND CORTICAL STIMULATION

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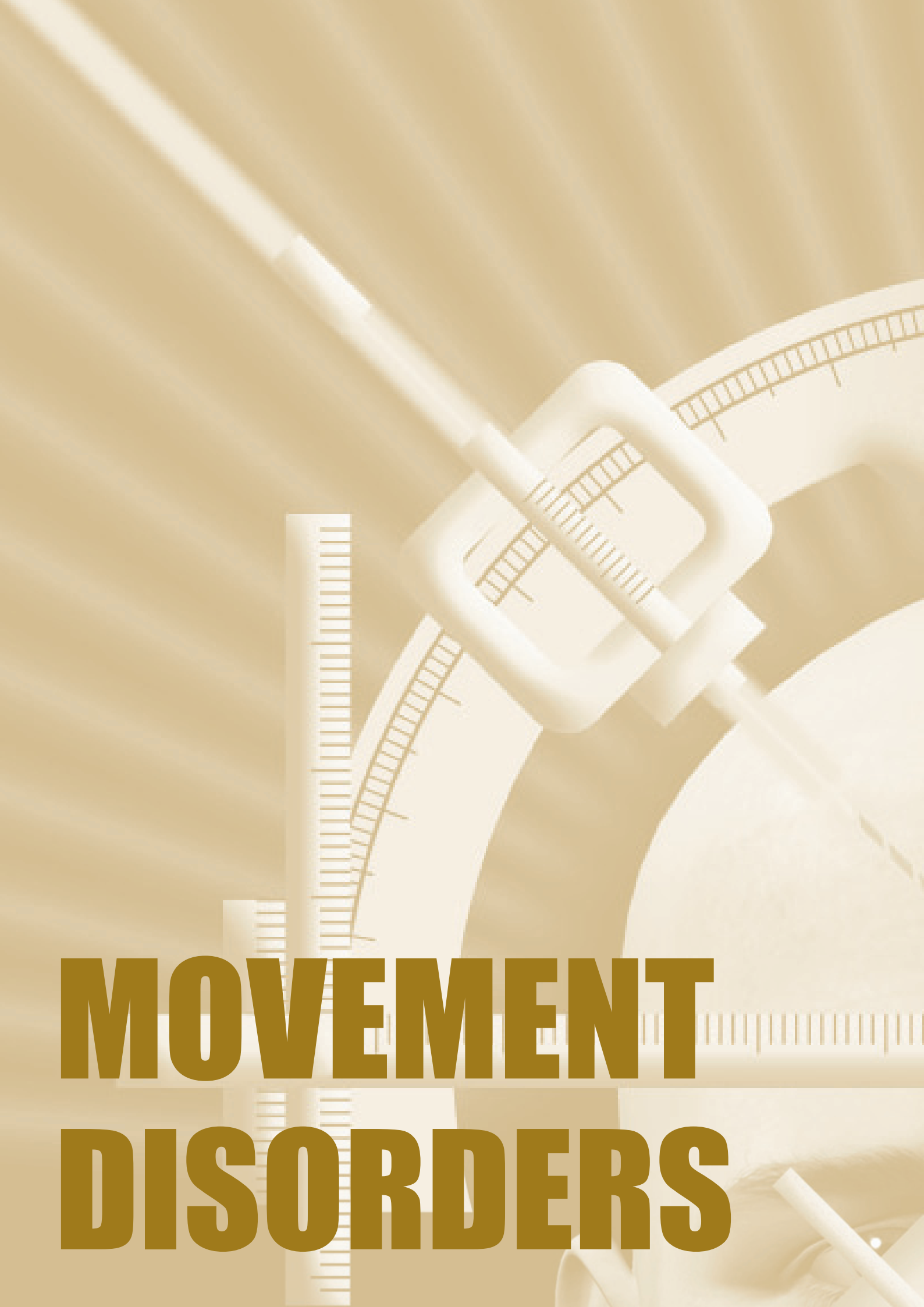
Introduction: The main limitation of the existing technology for monitoring of brain signals(EEG, EcoG) is that these signals are transmitted to the reception device through connecting cables. Our group has developed a wireless subdural grid that can be used for invasive monitoring and seizure focus localization and for cortical stimulation in patients with epilepsy as well as an experimental device for the study of brain-computer interfaces.

Materials and methods: We have developed an implantable device able to acquire, store, process and transmit radio signals recorded from electrodes placed on the cerebral cortex . Each cortical electrode can generate an appropriate stimulation signal useful to map and modulate cortical function.Electrode impedance is measurable in real time.
The device parts in contact with cortex are covered by a thin layer of inert material to prevent adhesions. An innovative technology (eccimer laser deposition) was used to markedly enhance the recording/stimulating surface of the cortical electrodes . The intracranial device is recharged though electromagnetic induction.

Results: A 16 channels device developed for primate testing underwent the following tests:
• Heating induced by MR : minimal increase of temperature was found within the device during MR imaging using 0.5 Tesla, 1,5 and 3 Tesla intensity.
• Power consumption: in power down mode the device consumption is lower than 1.6mA (about 80 hours of battery life); the maximum consumption is 35mA (about 4 hours of battery life) while acquiring and transmitting 16 channels ECoG signals.
• Plastic enclosure: the implantable device has an plastic enclosure in Peek material. It is pressure-proof until 4 Bar and complies with the impact test.
• Evoked Potentials: the evoked measured signal are in accordance to the SSEP and VEP literature signals
• Impedance: The range of measurable impedance values in DC and AC, start from 200Ω to 3MΩ, with 24nA current injected between any electrodes and reference electrode. The measurable frequency points are: 16Hz, 32Hz, 64Hz, 128Hz, 256Hz, 512KHz.
• Cortical Stimulation can be done using a fixed potential, biphasic pulse, with the possibility to change the pulse width and amplitude voltages. With biphasic pulses the maximum stimulus potentials is +/- 3.3 Volt (about 3mA current delivered).

Conclusions: The device tested provides chronic wireless cortical monitoring but also the ability to modulate cortical function.



MOVEMENT DISORDERS

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DEEP BRAIN STIMULATION IN THE MANAGEMENT OF GENERALIZED DYSTONIA CULMINATING IN LIFE-THREATENING STATUS DYSTONICUS CONDITION : A CASE-CONTROL STUDY

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Objective: To study the role of internal Globus Pallidus deep brain stimulation (DBS) in treating patients with generalized dystonia of various etiologies and who developed status dystonicus in the course of their disease.

Background: In dystonia of various etiologies, intense, generalized, life-threatening episodes of muscle contractures called status dystonicus may occur. They are usually refractory to pharmacological therapy and require management in intensive care unit. Internal Globus pallidus (GPi) DBS has been proposed in the treatment of primary and secondary dystonia.

Method: We performed a retrospective case-control study and included 12 patients who presented with dystonic storm and 38 controls with generalized dystonia but in whom symptoms did not culminate in dystonic storm. We compared patients, disease and clinical management characteristics within the two groups. Multivariate analysis involving logistic regression aimed to identify predictors of disease worsening towards dystonic storm and to compare DBS efficacy according to disease duration and the duration of the dystonic storm episode.

Results: The final clinical outcome in patients with dystonic storm treated with DBS is variable. Nine out the twelve patients who developed dystonic storm recovered with improvement of their severe dystonia. It seems that prognosis is depending more on the underlying pathological process than on the severity of dystonic symptoms. We could not experience a supplementary increase of mortality due to surgery for DBS in patients with dystonic storm. The role of the internal globus pallidus DBS in treating medically refractory dystonia was rarely reported. To our knowledge, here we report the largest series of patients with generalized dystonia who developed during the time course of their disease dystonic storm and who were treated with deep brain stimulation. It was considered that surgical management of patients with dystonic storm could be contraindicated in the acute stages because of other organ system dysfunctions with increase of the morbidity and mortality.

Conclusion: DBS can be considered early as first line therapy in the management of severe, life-threatening status dystonicus condition.

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STIMULATION-INDUCED SIDE EFFECTS IN THE POSTERIOR SUBTHALAMIC AREA: DISTRIBUTION, CHARACTERISTICS AND VISUALIZATION

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Introduction: The posterior subthalamic area (PSA) is an emerging but relatively unexplored target for DBS treatment of tremor. The aim of the study was to explore the area further by evaluating the spatial distribution and the characteristics of stimulation-induced side effects in this area.

Methods: Twenty-eight patients with essential tremor (ET) implanted with 33 DBS electrodes were evaluated concerning stimulation-induced side effects by testing each contact separately one year after surgery. The location of the side effects were plotted on axial slides of the Morel Stereotactic Atlas and a 3-dimensional model of the area for visualization was created.

Results: Visualization of the contacts eliciting stimulation-induced side effects demonstrated that identical responses can be elicited from various points in the PSA and its vicinity. The majority of contacts inducing muscular affection and cerebellar symptoms, including dysarthria, could not be attributed to an effect on the internal capsule. Paresthesias, affecting various body parts were elicited throughout the area without a clear somatotopic pattern. Conclusion: Stimulation-induced side effects in the PSA and its vicinity were difficult to attribute to certain anatomical areas as the same response was induced from various locations. Therefore, this study could not provide a meaningful somatotopic map with regard to stimulation-induced side effects in the PSA.

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UNILATERAL CAUDAL ZONA INCERTA DEEP BRAIN STIMULATION FOR PARKINSONIAN TREMOR

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Introduction: The subthalamic nucleus is currently the target of choice in deep brain stimulation (DBS) for Parkinson's disease (PD), while thalamic DBS is used in some cases of tremor-dominant PD. Recently, a number of studies have presented promising results from DBS in the posterior subthalamic area, including the caudal zona incerta (cZi). The aim of the current study was to evaluate cZi DBS in tremor-dominant Parkinson's disease.

Methods: 14 patients with predominately unilateral tremor-dominant PD and insufficient relief from pharmacologic therapy were included and evaluated according to the motor part of the Unified Parkinson Disease Rating Scale (UPDRS). The mean age was 65 ± 6.1 years and the disease duration 7 ± 5.7 years. Thirteen patients were operated on with unilateral cZi DBS and 1 patient with a bilateral staged procedure. Five patients had non-L-dopa responsive symptoms. The patients were evaluated on/off medication before surgery and on/off medication and stimulation after a minimum of 12 months after surgery.

Results: At the follow-up after a mean of 18.1 months stimulation in the off-medication state improved the contralateral UPDRS III score by 47.7%. Contralateral tremor, rigidity, and bradykinesia were improved by 82.2%, 34.3%, and 26.7%, respectively. Stimulation alone abolished tremor at rest in 10 (66.7%) and action tremor in 8 (53.3%) of the patients.

Conclusion: Unilateral cZi DBS seems to be safe and effective for patients with severe Parkinsonian tremor. The effects on rigidity and bradykinesia were, however, not as profound as in previous reports of DBS in this area.

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STIMULATION LOCATION PREDICTS CLINICAL OUTCOME DURING SUBTHALAMIC DEEP BRAIN STIMULATION FOR PARKINSON'S DISEASE: RESULTS FROM RANDOMIZED TRIAL

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Introduction: As deep brain stimulation (DBS) has become an established therapy for the treatment of Parkinson's disease (PD), there has been considerable interest in determining the most effective anatomical location(s) to target during lead implantation and subsequent selection of stimulation parameters. These questions have arisen as a result of three observations. First, DBS parameters and electrode location(s) act synergistically in each patient to define the stimulation spread to surrounding neural structures. Second, there is now evidence to suggest that the stimulation target of DBS may not be the subthalamic nucleus (STN) itself, but rather nearby anatomical structures in the subthalamic region. Third, there is substantial variability among PD patients with regard to the anatomical regions that are affected during DBS. Hence, this study was designed to determine the degree to which stimulation location was a predictor of clinical outcomes in STN DBS for PD.

Methods: We used a previously published method to create patient-specific computational models of DBS for each patient. The method was applied to the cohort of patients enrolled in the previously published randomized constant-current STN DBS trial (Okun, et. al., Lancet, 2012). The purpose of the models is to predict the volume of tissue activated as a function of lead location and stimulation parameters. Subsequently, each model was registered to an atlas brain to allow comparison among all patients in the trial. A novel statistical approach was employed to determine locations where stimulation was significantly correlated with changes in motor and non-motor outcomes after DBS. Clinical outcomes were assessed by subtracting pre-operative scores from post-operative scores for the motor section of the Unified Parkinson's Disease Rating Scale (UPDRS) as well as a battery of cognitive, mood and neuropsychological tests.

Results: Our results indicate that both electrode location and stimulation location were predictors of UPDRS motor scores. Improved outcomes were observed in patients who were stimulated in regions dorsal to the STN, corresponding to zona incerta and fields of Forel.

Conclusions: DBS of the subthalamic nucleus has been shown to be a robust therapeutic technique for the motor symptoms of PD. The effects of STN DBS on non-motor features of PD have been somewhat variable; both improvement and worsening have been reported in the mild to moderate range, depending on the specific tests conducted. Our results show that stimulation location is a significant predictor of motor outcomes from STN DBS for PD. Non-motor outcomes are being evaluated using the same analysis method.

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COMBINED INTERLEAVING STIMULATION OF STN AND SNR FOR REFRACTORY GAIT DISTURBANCES: PRELIMINARY FINDINGS OF A RANDOMIZED CONTROLLED TRIAL

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Objective: To evaluate (1) safety and (2) effects of combined [STN+SNr] deep brain stimulation compared to conventional stimulation on single STN contacts [STNmono] in a randomized controlled cross-over clinical trial.

Background: Axial symptoms - particularly gait disturbances and imbalance - emerge in advanced disease stages of Parkinson's disease and generally show poor response to conventional STN-DBS and dopaminergic medication. Advanced programming with 'interleaved pulses' allows to stimulate both rostral subthalamic (STN) and caudal nigral contacts of the quadripolar electrode (SNr). Here, we set out to test whether the combined stimulation of [STN+SNr] in terms of, interleaving pulses' can improve these unmet symptoms compared to [STNmono].

Methods: A total of 12 patients will be enroled into this ongoing 2 x 2 cross-over clinical trial with a three week follow-up in each therapeutic condition. The primary outcome measure is the change of the cumulative 'axial UPDRS subscore'. Secondary outcome measures specifically assess 'freezing of gait', 'balance function', 'quality of life', 'non-motor symptoms', and 'neuropsychiatric symptoms'.

Results: Preliminary observations will be demonstrated. As of today, the combined [STN+SNr] stimulation is well-tolerated by all patients enroled. Of note, no acute or delayed side effects or neuropsychiatric interference were observed.

Conclusions: Our ongoing study may help to define novel stimulation paradigms in order to address unmet axial symptoms in PD. We hypothesize that additional nigral stimulation may provide a valuable add-on in patients who experience sufficient primary STN stimulation for segmental symptoms and motor fluctuations, however develop resistant axial symptoms in parallel to the disease progression in the long-term.

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SURGICAL COMPLICATIONS IN DEEP BRAIN STIMULATION SURGERY (DBS)

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Introduction: Despite optimal neurosurgical care for patients undergoing DBS and excellent clinical results, a number of complications need to be dealt with. Therefore identification of risk factors and especially prone patient groups is essential.

Methods: We retrospectively analyzed risk factors like preexisting disorders and complications in all patients, who consecutively have undergone DBS in our department since the first surgery in 1999 until now.

Results: Looking at the perioperative complications of the 612 patients (age 5 to 83 years, mean age 55,8 years), hemorrhage occurred in 15 patients, 10 of which were asymptomatic, 2 had a transient and 1 a permanent hemiparesis and 2 patients died. 6 postoperative MRI-scans showed local infarction, in one case with a transient hemiparesis. 2 patients died due to unrelated complications. Two dislocated electrodes had to be revised. Overall the perioperative complication rate was 4,4% with a permanent morbidity of 0,3% and a mortality of 0,6%. As late onset complications skin complications appeared in 19 patients (3,2%, 1 to 48 month after surgery), painful scaring or dislocation of the generator in 20 patients, 3 patients have to be revised due to defects of the hardware. No single risk factors for hemorrhage or skin complications could be found.

Conclusion: Overall DBS is a safe surgery with an acceptable complication rate. Skin and hardware related complications are the major problem long term after DBS. Long term teaching and surgical contact with the patients helps to avoid complications early. No special risk factors could be detected. Therefore the indication for surgery and the benefit/risk consideration needs individual evaluation.

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DEEP BRAIN STIMULATION IMPROVES SURVIVAL IN PATIENTS WITH SEVERE PARKINSON'S DISEASE

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Introduction: Bilateral sub-thalamic nucleus deep brain stimulation (STN-DBS) has been shown to improve motor function, motor fluctuations, health-related quality of life (HRQoL) and to reduce medication usage and drug-induced dyskinesia in patients with severe Parkinson's disease refractory to medical therapy. Little however, has been described on the impact of STN-DBS on the survival of these patients. We aim in this study to examine the impact of sub-thalamic nucleus deep brain stimulation on the survival of patients with severe Parkinson's disease.

Methods: This was performed through a retrospective analysis of a patient database and the hospital case notes of all patients seen in the joint medical/surgical Parkinson's disease (PD) clinic at our institution between January 2002 and November 2011 and offered a DBS procedure. Comparisons were made between those patients offered surgery but declined and those that agreed and underwent DBS-STN. Patients who were medically unfit for surgery at initial consultation or failed psychometric analyses were excluded.

Results: A total of 147 patients were offered STN-DBS at our institution between January 2002 and 2011. 106 Patients with a mean age of 59 years underwent the procedure while 41 patients with a mean age of 61 (P-Value = 0.897) declined surgery and opted to continue with medical management. There was a predominance of men in both cohorts. 43.9% of patients who declined surgery are deceased compared with 20.8% of patients who underwent surgery (P-Value 0.007).

Conclusions: Our data has shown that there is a statistically significant improvement in survival for patients with severe Parkinson's disease who undergo DBS. We hope that this study will prompt treating physicians/surgeons to consider survival among the benefits of DBS when counselling patients for STN-DBS.

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IS DEEP BRAIN STIMULATION COST EFFECTIVE? A COMPARATIVE STUDY OF PROCEDURE AND MEDICATION COSTS IN SEVERE PARKINSON'S DISEASE

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Introduction: Bilateral sub-thalamic nucleus deep brain stimulation (STN-DBS) is an established surgical treatment for patients with severe Parkinson's disease (PD). Nevertheless in these times of global economic strain and increasing budgetary pressures on health authorities, treatments will be expected to show sound financial as well as clinical rationale for continued expansion of these services. Our aim in this study was to examine the cost effectiveness of deep brain stimulation compared with purely medically managed severe PD.

Methods: We performed a retrospective analysis of a patient database and hospital case notes of all patients who underwent a STN-DBS procedure at our institution over a 5-year period between January 2002 and December 2007. We analysed the total cost of all aspects of the surgical procedure and consequent residual medication in the 67 patents treated during this period. This was compared with the total projected drug cost of continued medical management alone over the same period based on patients' drug requirements immediately prior to surgery. Additional comparisons are made with the cost of medical treatment in 5 patients who were offered surgery but declined.

Results: 67 patients (50 male and 17 female) with a mean age at operation of 59 years had the DBS-STN procedure performed under general anaesthetic. The total cost of all aspects of the surgical procedure was £25 775.00 (€31,973.883). This is compared with a median projected total drug cost of £28,050.25 (€34,796.33) a saving of 8% or £2,275.25 (€2,822.447). Taking into account residual medication after surgery over a 5 year period and the frequently required apomorphine for patients who do not undergo surgery, there was 32% cost saving with surgery, amounting to £14,867 (€18,442.511). When compared with the drug costs for a cohort of patients that declined surgery, DBS with reduced drugs remained 8% cheaper or £2,731.50 (€3,388.43).

Conclusions: Our data has shown that STN-DBS is cost effective over a 5 year period when compared to both projected and actual medication costs of PD patients managed purely medically. This conclusion assumes that the costs of consultations with health and social care personnel as well as institutional care costs are no different. Anecdotal evidence suggests that that these additional costs may be lower in the surgically treated group so that our findings may be an underestimate of the economic savings achieved by DBS in this group.

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SKIN-EROSION AND INFECTION IN DEEP BRAIN STIMULATION: FOLLOW-UP OF TREATED PATIENTS

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Objectives: To report our experience on hardware related skin-erosion and infections following DBS and to evaluate statistical correlation between this complication and several clinical parameters.

Methods: This is a single center prospective cohort study that includes all patients who underwent DBS for various movement disorders, from June 1999 to July 2011, with a minimum 6 months follow-up. Statistical analysis was performed using different tests.

Results: One hundred and fifty-four procedures were performed in 145 patients. Diagnoses included Parkinson disease (122 patients, 84.1%), essential tremor (12 patients, 8.3%) and generalized dystonia (11 patients, 7.6%). The mean age was 60.1 ± 11.4 years (range 14-74 years). The DBS leads were bilaterally implanted in 135 (93.1%) patients. The median follow-up was 42.6 (range 6.5-133) months. Twenty patients (13%) had skin erosion or infection, with a median presentation time of 8 months (range 0.2-92 months). Two (10%) patients developed complications within the first month after the electrode implantation. In three cases treatment was initially conservative (antibiotherapy). The rest of the patients and one of the initially conservatively treated patients needed a surgical revision. Five of them required a unilateral removal of the stimulation system, whereas in 4 cases a bilateral hardware removal was necessary. Eleven patients did not require to have their stimulation system removed showing good outcomes after treatment. The median follow up was 33.9 (range 13.6-40.9) months for the partially explanted group and 36.5 (range 5.6-96.0) months for the group that did not require their bilateral stimulation to be removed. There were no intracranial infections. We found a significant greater risk of skin erosion-infection in parkinsonian patients (compared to non-parkinsonian) and in cases in which the implantable pulse generators were bilaterally implanted ($p<0.05$). No statistical significance was found regarding the length of the procedure or age at surgery.

Conclusions: Although skin erosion-infection in DBS is almost an inherent condition in the long-term follow-up, more than half of our patients maintained the bilateral stimulation system after adequate medical and surgical treatment. An additional 25% of patients required partial removal of the system. Bilateral implantation of batteries and parkinsonian patients are statistically correlated to suffer this complication more frequently.

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QOL ASSESSMENT IN GENERALIZED DYSTONIC PATIENTS TREATED BY DEEP BRAIN STIMULATION: A PRIMARY VS SECONDARY DYSTONO-DYSKINETIC SYNDROME COMPARATIVE STUDY

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Background: Despite quality of life (QoL) assessment is a key issue in disabling condition like dystonia for understanding the whole impact of surgical treatment on day-by-day life, available questionnaires are not adapted to patients suffering from severe movement disorder.

Objective: We developed a specific one: The Brethome-QoL scale, in order to compare the impact of Deep Brain Stimulation (DBS) on quality of life in two populations of generalized dystonic patients.

Method: Twenty-one DYT1 patients (Group 1), known to be good reponders to DBS, and thirty-seven patients presenting with dystono-dyskinetic syndrome secondary to perinatal hypoxia (Group 2), underwent continuous electrical stimulation of the globus pallidus internus between 1997 and December 2010. They were evaluated by the BFMDRS, as a gold standard outcome measure, and by the B-QoL during the course of DBS. The scale is made of three different parts concerning respectively, functional, personal and surgical aspects. A positive Brethome Scale Index (BSI) indicates a feeling of improvement after DBS with a maximal score over a 100.

Findings: On Group 1, we found a better feeling of improvement on functional aspects ($p<0.01$) whereas in Group 2 the reverse profile is reported with more satisfaction for personal aspects ($p<0.05$). Unexpectedly, anoxic patients show the same level of improvement (BSI = 47/100) as DYT1 patients (BSI = 35/100) on personal aspects. We confirm an actual positive impact of DBS on functional aspects for both groups, with a superiority of gain in DYT1 patients (BSI=62.5/100; $p<0.01$) as expected. Patients, whatever the etiology, are satisfied about surgical outcomes (83%).

Conclusion: QoL assessment, using a scale dedicated to severe disabling patients treated by DBS, appears to be more adapted than the "standard" scale (BFMDRS). B-QoL scale allows us to take into account several aspects of Qol which can be modified under treatment and sometimes underestimated by generic survey.

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CONVERGENCE OF PARALLEL CIRCUITS WITHIN SUBTHALAMIC NUCLEUS: EVIDENCE FROM MULTICHANNEL-MICROELECTRODE RECORDING STUDY

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Background: Experimental studies in primates have stated that specific cortical areas involved in the processing of motor, cognitive and emotional information are connected through parallel circuits to separate territories within the striatum, globus pallidus, and subthalamic nucleus suggesting a segregated model of information processing. However, behavioral changes in PD patients after STN DBS in the same subjects who experienced significant motor improvement suggest that the greatest convergence of different circuits is reached within STN. The present study approaches this hypothesis by multiunit recording during microelectrode mapping of subthalamic area.

Methods: Twelve consecutive PD patients underwent multiunit recording through a 32-channel-microelectrode based in an assembly of microwires used for electrophysiological mapping of STN during therapeutic implantation of DBS electrodes for standard dorsolateral STN target. Once, the neurophysiologist recognized the neuron activity pattern typical of STN and neurological examination, the patient was asked to perform the tasks. Neuronal signal recording was time-locked with the interactive workstation that presented emotional images (IAPS Image Bank), a decision-making task and an analysis of the motion performance of the contralateral hand. The signal was submitted to off-line spike-sorting analysis and correlated to behavioral responses to the three-modality tasks.

Results: The electrode set-up allowed outstanding signal-to-ratio neuronal recording that permitted STN electrophysiological activity pattern recognition as well as in routine microelectrode recording. Eight of the twelve patients were able to perform all the tasks during the procedure. Over all, 276 neurons were studied (average 30,66±7,599 per patient). Most of the neuron firing were related to the motor task (54,9%). Interestingly, other 16,7% were active during decision-making period of cognitive task, while 19,8% of the neurons were only responsive to the positive and negative emotional valence images randomly presented. We have also observed that 16,5% of all neurons were multimodal (responsive to all the tasks).

Discussion and Conclusion: Although, the target aimed for therapeutic purpose was the dorsolateral part of STN, thought to be the sensorimotor region of the nucleus, substantial neuron activity was related to limbic and associative information processing. This data is consistent with the hypothesis the basal ganglia modulates motor activity as complex behavioral series that are strongly influenced by the cognitive and emotional context in which they are executed.

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CONSTANT-CURRENT VS. CONSTANT-VOLTAGE SUBTHALAMIC NUCLEUS STIMULATION FOR PARKINSON'S DISEASE

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Introduction: STN DBS is an established therapy for advanced Parkinson's disease (PD). Motor efficacy and safety has been established for constant voltage (CV) devices and more recently for constant current (CC) devices. CC stimulation adjusts the output voltage to provide constant current irrespective of impedance, while the current applied by CV stimulation will depend on the tissue impedance which may fluctuate over time.

Objective: To compare the safety and clinical impact of CC STN DBS to CV STN DBS for non-motor features of advanced PD.

Methods: Patients were included if they had undergone STN DBS surgery for idiopathic PD and had been implanted with a Medtronic Activa PC. This single center trial was designed as a double blind, randomized, prospective study with cross over after two weeks. Motor equivalence was evaluated with the motor UPDRS.PD diaries and subjective and objective evaluations of quality of life, depression, cognition and emotional processing were evaluated on both CV and on CC stimulation. Multivariate factor analysis was performed to identify significant difference between the stimulation modalities.

Results: 8 patients were recruited (6 men, 2 women).1 patient did not complete the study. The average age at surgery was 56.7 years (47-63). Disease duration at the time of surgery was 7.5 years (3-12). Patients were recruited 23.8 months (22.5-24) after surgery. At study baseline this group showed an average response to stimulation of 69% (51-97) as measured by the motor UPDRS. LED was reduced by 67% (15-88). Comparing CC to CV, there were small non-significant UPDRS subscale differences for bradykinesia and for postural instability/gait. Patients were poorly compliant with PD diaries and these did not yield useful information. There was a small, non-significant deterioration in quality of life scores (PDQ-39, Q-LES-Q) with CC stimulation. There was a trend in two measures of depression (Hamilton, QIDS-SR) toward a lower score (less depression) with CC stimulation, but a third (BDI) showed equivalence. Cognitive testing (MMSE) and emotional processing (Montreal Affective Voice) were equivalent for CC and CV.

Conclusion: CC STN DBS is safe. For equivalent motor efficacy, no significant difference could be identified between CC and CV stimulation for non-motor evaluations in PD patients 2 years after surgery.

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ANATOMICAL CONNECTIVITY OF PRELEMNISCAL RADIATIONS AND ITS IMPORTANCE IN THE SURGICAL TREATMENT OF PARKINSON'S DISEASE. A MRI-DTI AND PET-CT STUDY

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Introduction: Electrical Stimulation of posterior subthalamic area (PSA) has been reported superior to STN in controlling Parkinson´s disease (PD) symptoms.

Objective: To define the optimum target for PD control by the stereotactic coordinates and the connectivity studied through high resolution tractography in a group of 21 DBS electrodes inducing over 80% improvement in symptoms of contralateral extremities in a follow up from 24 to 48 months. The stimulated volume was defined according the distance of contacts used for DBS therapy and the connectivity studied by MRI using DTI sequence with 3T/120 directions. The effect of stimulation of PSA on cortical, subcortical and brain stem structures was studied by PET-CT using 18 FDG as marker, before and after efficient electrical stimulation.

Results: A critical volume of 4.7 x 3.6 x 2.8 mm was defined by the contacts used for bipolar stimulation in patients with excellent control in PD symptoms and corresponded to PSA located between red nucleus, STN and caudal Zi. Tractography identified 3 main components of fibers converging in this target: one between deep cerebellar nuclei and ventral thalamus, other between Gpi and dorsal pons and a third between mesencephalic tegmentum and orbitofrontal (OF) cortex. Cerebellar component ended in the ventral-lateral thalamus and from there projected to the motor primary and supplementary cortices. PET-CT showed a decreased metabolic activity in motor cortices, the stimulated PSA and ventral-lateral thalamus.

Conclusions: PSA optimum target correspond to an area of fibers marked as prelemniscal radiations that link brain stem, thalamus, Gpi and orbitofrontal cortex and may be identified by high resolution tractography. Gpi projects to PSA and from here continued to the posterior brain stem area identified as the peduncle- pontine nucleus.

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HEALTH ECONOMICS AND SURGICAL TREATMENT FOR PARKINSON'S DISEASE IN A WORLD PERSPECTIVE

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Background: During the last two decades, there has been a worldwide rebirth in the neurosurgical treatment for movement disorders. However, most of the studies in this field have been published by a limited numbers of leading centres in developed countries. As a consequence, knowledge is biased on the current practices of stereotactic surgery for Parkinson's disease (PD) in a global perspective. The aim of this study was to investigate the clinical practice of stereotactic neurosurgery for PD worldwide.

Methods: An invitation to participate in an Internet-based survey was sent to functional neurosurgeons working on movement disorders worldwide. A total of 353 neurosurgeons from 51 countries, that operated 13,200 patients in 2009, answered questions regarding the source of their financial support, their surgical practice for PD, complications, and the composition of their team members. Results obtained are presented by the level of the countries' economical development according to the World Bank, as well as by the source of financial support. Papers on stereotactic surgery for PD published in the last ten years were classified according to the country's income.

Findings: Surgical procedures performed in high-income countries, were more commonly financed by the public health care system. In these countries, deep brain stimulation was the treatment of choice, whereas lesions were kept for selected cases. In contrast, patients frequently financed surgeries themselves in lower- and upper-middle countries, and lesions were most commonly performed in the patients.

Interpretation: National health care programs have been successful in high-income countries to support neurosurgical treatments of parkinsonian patients. Decision makers in these countries have been aware of the medical needs of these patients to rely on a public health system reinforce this policy. Global educational and training programs that aim to support efforts to scale up public health system-financed PD surgical treatment are warranted.

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MOTOR CORTEX STIMULATION FOR UPPER LIMB FIXED DYSTONIA

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Introduction: Fixed dystonic postures secondary to ischemic, traumatic or post-surgical lesions located in the basal ganglia and brainstem constitute a major therapeutic challenge and limit motor rehabilitation efficacy. They are often refractory to conservative treatments. Aberrant cerebral plasticity developed after deep brain lesions is thought to lead to abnormal cortical representation of the affected part of the body, and then to pathologic fixed postures.

Methods: To assess the efficacy of Motor Cortex Stimulation in patients with upper limb fixed dystonia, 10 patients were submitted to computer-assisted and EMG monitorized implant of intracranial epidural electrodes over the central cortical sulcus contralateral to the affected limb. Patients were followed up from 1 to 9 years (9 patients), except for patient 10, whose follow-up was limited to four months.

Results: Seven of nine patients showed more than 30% improvement in the Disability of Shoulder, Arm and Hand Scale (DASH), and an overall 70% increase in the score of the SF-36 physical activity subscale with significant and stable improvement of the quality of life during stimulation. The partial recovery of hand dexterity observed in most of the treated patients additionally contributed to a significant improvement of their quality of life.

Conclusion: Although the pathophysiology of fixed dystonia is unknown, our results suggest a major role of the motor cortex in this condition and reinforce the hypothesis that post-lesional delayed cortical rearrangements might take place in these forms and be the target of effective therapeutic neuromodulation.

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WHAT DO MEDICAL STUDENTS KNOW ABOUT DEEP BRAIN STIMULATION?

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Objective: To evaluate knowledge of medical students about deep brain stimulation (DBS) at the beginning and at the end of their medical formation.

Background: DBS is a well-established therapy for movement disorders such as dystonia, Parkinson´s disease (PD) and tremor and it is currently under investigation as a therapeutic option in neuropsychiatric disorders. Little is known about medical students´ knowledge about this powerful tool when they enter university and what they learn about it during their medical formation.

Methods: A 10-item questionnaire with open and closed questions was designed. Questions addressed indications for DBS, its costs, impact on parkinsonian symptoms, complications, battery life, possible targets and percentage of PD patients who might profit from DBS. Students at Hannover Medical School were asked to complete the questionnaire in the preclinical study period and in the next to last year of the study.

Results: The group of "beginners" included 209 students (duration of study: 3 months) and the "advanced" group 170 students (duration of study: 48-72 months). Of all students 63.6% were female and 36.4% were male. Age ranged between 17-46 years, mean 21.9 years in the first group and 25.1 years in the second. In the first group 22.7% had heard about DBS in medical lectures earlier and 15.7% had gained insight by television before. In comparison 98.76% had heard of DBS in medical lectures in the second group and knowledge was enhanced by television with 55.2%. In group one 63.4% of the students knew that DBS is routinely used in PD patients as compared to 83.3% in the second group. Knowledge about other movement disorders was much less common. In the first group only 36.6% knew that DBS is a routinely used treatment for tremor, and only 10.3% knew that DBS is used in patients with dystonia, whereas 71.5% of students in the second group knew about the routine use of DBS in tremor but only one third knew about its use in dystonia (34%). Outcome after DBS, its costs, the frequency of side effects, and established and future targets were nearly unknown.

Conclusions: DBS is partly known among medical students in the preclinical phase with a moderate gain of knowledge during further study. We advocate to teach students appropriately and to expand clinical knowledge during the clinical phase of medical studies.

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MOTION ANALYSIS IN THE ASSESSMENT OF THE EFFECTIVENESS OF STEREOTACTIC SURGERY FOR MOVEMENT DISORDERS

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Introduction: The tremor and dystonia of patients with movement disorder in clinical practice is mostly characterized qualitatively based on visual observation. Simple devices are suggested for quantitative assessment.

Methods: (1) PAM, a passive marker based motion analyzer, with digital infrared video-camera measuring the position of markers on each frame. The measurement of rest and postural tremor was performed with markers on the second phalanx of both index fingers. Tremor intensity was calculated as the root-mean-square of acceleration, derived from displacement. The frequency domain and cross-coherence analysis also have been performed. The system has been used for analysis of limb and head tremor. Face dystonia and dyskinesia have been recorded with 17 markers. A real-time Octave algorithm may quantify the proximal and distal upper limb bradykinesia in Parkinson's disease. (2) a digitizing tablet with spiral drawing test. Tracking a spiral with a pen on a commercially available digitizing tablet characterizes tremor and dystonia of patients with movement disorders affecting their upper limbs. (3) a wireless calibrated 3-D accelerometer system is a valuable tool for intraoperative and ambulatory monitoring.

Results: The detailed motion analysis with spectrograms has been performed, developed by the authors and implemented in MATLAB (Mathworks, Sherborn, MA, USA). Healthy control groups and patients with movement disorders were tested, 443 patients performed the spiral test, and 469 patients were tested with PAM. For 98 patients the quantitative motion analysis has been used for indication of stereotactic ablative surgery or deep brain stimulation. Typical trajectories and spectrograms will be presented with illustrative cases prior and after surgery.

Conclusions: Motion analysis is a valuable tool for clinical diagnosis, for assessment of treatment and for monitoring and optimal setting of deep brain stimulation parameters.

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IMPACT OF "MICROLESION EFFECT" (MLE) AFTER DBS ON SIMPLE AND BALLISTIC TASKS IN PATIENTS SUFFERING FROM PARKINSON'S DISEASE AND DYSTONIA

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Introduction: Many patients undergoing DBS show an improvement of symptoms right after lead-implantation even before stimulation due to a so-called microlesion effect (MLE), the precise mechanism of which remaining unknown. It is assumed that the MLE is caused by inactivation of neurons surrounding the electrode by local edema. Previous studies on the MLE in Parkinson`s disease (PD) as well as in dystonia used motor scales taken by expert neurologists to assess clinical improvement. In the present study, the focus is not on MLE-induced clinical improvement but on kinematic parameters (velocity) of limb movements and how they may be affected by the MLE.

Methods: We investigated 9 PD patients with subthalamic (STN) electrodes and 7 patients with cervical dystonia with electrodes in the Globus Pallidus internus (GPi). Patients were studied pre-operatively and on the first post-operative day without stimulation. Repetitive finger tapping (FT) and repetitive alternating forearm pronation and supination movements (PSM) tasks were each recorded for 25 seconds. In ballistic movement tasks, patients executed repetitive fast ballistic movements with hitting the target (punching bag) with the fist (BT movements), in another paradigm subjects stopped just before the target. A calibrated goniometer was used to record elbow joint position and to compute angular joint movement velocity. Both tasks were performed for 40-45 sec. Peak angular velocity was used as the criterion for evaluation. Kinematic data were pooled for both arms of an individual.

Results: PD patients executed all motor tasks with higher speed after implantation with PSM and BT movements being carried out significantly faster whereas dystonic patients performed motor tasks with significantly reduced velocity. Moreover, PD patients improved significantly in motor UPDRS score and H & Y scale (during the off-medication and off-stimulation state) compared to the pre-op status (motor UPDRS: $p < 0.001$, H & Y scale: $p < 0.001$), as did dystonia patients in both TWSTRS and GDS (TWSTRS: $p < 0.004$, GDS: $p < 0.001$).

Conclusions: Microlesions of the STN can accelerate movements in PD and lesions of the GPi can inhibit excessive movements in dystonia. Since these two movement disorders are at opposite ends of the spectrum, these opposite effects are therapeutic. However, it should be noted that not only excessive, but also normal movement is affected by microlesions and, in the case of dystonia, probably also by stimulation.

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ASSESSMENT OF ANATOMICAL POSITION OF ACTIVE CONTACTS LOCALIZATION IN PATIENTS WITH DBS-STN WITH PARKINSON´S DISEASE USING MRI

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Objetives: The aim of this study is to describe a new method to correlate the precise localization of active electrode contact of deep brain stimulation (DBS) in the subthalamic nucleus (STN) in patients with Parkinson´s disease (PD).

Methods: Localization was determined in 35 patients with PD and treated with DBS-STN. MRI preop and postoperative has been corregistered and the precise position of each electrode contact evaluated in correlation with a stereotactic volume created in correlation with AC-PC line, thalamic heigth and III ventricle width. A 3-dimensional (3-D) atlas STN model was created based in Morel Atlas and electrode contacts were corregistered in the STN atlas model defining the active contact as intra or extranuclear. Active contact is defined as the contact that induce the best clinical benefit reducing the motor UPDRS. Finally the 3-D atlas STN model was corresgistrated with the stereotactic volume created.

Results: Active contact was placed at 11.52±1.45 mm in left hemisphere and 11.17±1.46 mm in the rigth hemisphere from midline (X coordinate); At 1.22±1.79 posterior (left) and 1.08±1.91 posterior (right) to midcommisural point (Y coordinate) and 1.42±1.88 mm (left) and 1.55±1.91 (rigth) below intercommisural line (Z coordinate). 64.30% of the active contacts in left hemisphere and 76.2% in rigth hemisphere were placed within the STN in their dorsal portion. In other patients, the active contact placement were extranuclear in the dorsal region of the STN and their electrical field reached the dorsal STN region.

Conclusion. We obtained a localization method of active contact in a stereotactic space with the creation of a 3-D Atlas model in patients with DBS. Active contacts were placed in the dorsal region of the STN or their stimulation field reached STN motor region.

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NEURONAL SINGLE UNIT ACTIVITY IN THE GLOBUS PALLIDUS INTERNUS IN DYSTONIA AND TOURETTE'S SYNDROME

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Introduction: Altered processing in the basal ganglia has been described in dystonia and Tourette 's syndrome (TS). Deep brain stimulation (DBS) of the globus pallidus internus (GPi) is a standard treatment for dystonia, and has been also successfully used to alleviate symptoms in TS. In this study we evaluated possible differences of neuronal discharge rates and patterns in the GPi of patients with dystonia and TS.

Methods: Nine patients with dystonia (5 men and 4 women, mean age 52 years; 1 with secondary dystonia and eight primary dystonia) and six patients with TS (2 men and 4 women, mean age 30 years) were studied during functional stereotactic neurosurgical operations for implantation of DBS electrodes. All surgery was performed under general anaesthesia. Single-unit activity recordings in the GPi were obtained during routine microelectrode recording and mapping to delineate nuclear borders and to identify the sensorimotor subregions.

Results: Based on comparison of dispersion of interspike intervals (ISIs) from neurons recorded in the GPi no differences were found between patients with dystonia and TS with respect to mean firing rates, mode of ISIs and peak mean frequency of bursts. Further, both linear (discharge density histogram) and non-linear (Poincaré maps' geometry) analysis of the firing patterns revealed similar firing morphology in both groups.

Conclusion: Our data did not show significant differences in SUA of pallidal neurones in patients with dystonia as compared to TS during general anaesthesia. This may be due to altered neuronal activity during sleep (note that the movement disorders are not present during sleep).

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IDENTIFICATION OF THE VENTROINTERMEDIATE THALAMIC NUCLEUS USING Q-BALL CALCULATION

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Introduction: Localization of the thalamic nuclei for targeting in deep brain stimulation (DBS) is challenging, as they are not clearly identifiable on standard MR sequences. The dentate-rubro-thalamic tract connects the thalamic ventrointermediate nucleus (Vim) with the cerebellum. We evaluated the reliability of Q-ball calculation (QBC) in predicting the position of the functional target compared to coordinate based localization of the Vim in patients who underwent DBS for essential tremor (ET).

Methods: 5 patients who received bilateral implantation of electrodes in the Vim for treatment of ET in 2011 and 2012 were included in this retrospective study. Conventional targeting was based on atlas coordinates and standard MRI alone. We analyzed the connectivity by QBC of the dentate nucleus with the thalamus and thereby retrospectively identified the Vim. Co-registration of the connective-imaging target compared to the atlas-based pre-op targeting and with the postoperative CT coordinate of the active contact of the implanted lead, which was correlated with the best clinical effect on tremor, was performed. Euclidian distances were calculated between the coordinate of the active contact of the implanted lead and the seed voxel for QBC and the connective imaging target.

Results: We were able to localize the Vim according to connectivity with the cerebellum via the dentate-rubro-thalamic tract in all patients on both sides. The average localization of the active contacts was 14.6mm lateral (SD 1.24), 5.37mm (SD 0.94) posterior and 2.21mm cranial of MC (SD 0.69). The lead contacts were found medial to the connectivity target in 7/10 of the implanted electrodes and inside the connectivity target in 3/10 cases, respecting a sufficient distance to the internal capsule for prevention of stimulation side effects. The average distance between the active contact and the connectivity target was 3.38mm (SD 1.57). The active contact was found at an average of 1.5mm (SD 1.22) anterior of the connectivity target. The antero-posterior as well as the vertical position showed a good correlation with the sites of effective DBS.

Conclusions: Connectivity analysis of the Vim position by QBC provided direct visualization of the nucleus in all cases. Our preliminary results suggest that the reliability of QBC in determining the pre-op targeting of the Vim is comparable to atlas-based targeting. Larger prospective calculations are needed to determine the robustness of this method in providing refined information useful for neurosurgical treatment of tremor.

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FOREIGN BODY REACTION IN DBS: A COMPLICATION NOT DESCRIBED IN THE LITERATURE

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Introduction: We describe a complication related to the neuro-stimulation hardware system in DBS - foreign body reaction checked in the context of the program on DBS in advanced Parkinson's disease, developed since January 2006. We describe the process of detection of this reaction and its possible etiology and the surgical procedures developed to try its resolution, which appear not reported "hardware complication" in the literature.

Material and Methods: A total of 115 patients were operated by DBS-STN between January 2006 - April 2012. In three cases our group verified a rapid and persistent development of an exuberant inflammatory skin and subcutaneous reaction, located at the subclavicular right area - overlying the area of the Activa PC neurostimulator. An infectious etiology was completely ruled out and evidence was obtained (through negative skin contact tests) against any allergy to the components of the DBS implanted systems.

Results: The presence of a marked inflammatory reaction was detected in the 3 cases, 6-8 weeks after the Activa PC® system implantation. Although the clinical anti-parkinsonian effects with DBS were excellent, the severity of this reaction was so intense that led to multiple surgical revisions and finally to the explantation of the system in all the patients. In every case we obtained the histologic confirmation of the existence of a foreign body granuloma. At last, two patients re-implanted had excellent results, one of them with a "modified" DBS system coated with silicone. The third patient still waits for the re-implant surgery with a silicone coated device.

Conclusions: The foreign body reaction is a rare and serious complication of implanting DBS systems with Activa PC® generators. The reason is not known but one possibility is that its activation with certain electrical parameters may induce a reaction of "electrolysis" on the walls of the generator PC in contact with subcutaneous tissue triggering an uncontrolled inflammatory cascade reaction. The report of such a severe although unusual complication is very relevant for defining a policy for the correct surgical handling of this occurence.

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ZONA INCERTA DOES NOT SIGNIFICANTLY OUTPERFORM VENTRALIS INTERMEDIUS NUCLEUS AS THE TARGET OF DEEP BRAIN STIMULATION FOR TREATMENT OF TREMOR

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Introduction: The zona incerta (ZI) is a promising, relatively new target for deep brain stimulation (DBS) for tremor, irrespective of its origin. However, only little comparative research has been done including both the ZI and the ventralis intermedius nucleus of the thalamus (Vim),[1] which is the most common target for DBS in tremor control.

Methods: In telephone interviews, 16 essential tremor (ET) patients (9 ZI, 3 Vim, 4 ZI/Vim) and 8 Parkinson's disease (PD) patients (4 ZI, 3 Vim, 1 ZI/Vim) were asked about efficacy, adverse events and tolerance. The primary outcome measure for efficacy in ET was the Washington Heights-Inwood Genetic Study of Essential Tremor (WHIGET) scale; for PD, item 16 of the Unified Parkinson's Disease Rating Scale (UPDRS) was used. Adverse events and tolerance were measured using a questionnaire.

Results: In ET, Vim-DBS (WHIGET reduction 1,60 ±1,35, p=0,010) as well as ZI-DBS (1,77 ±1,28, p=0,000) caused a significant reduction in tremor score, without a significant difference between the targets (p=0,964). In PD, both Vim-DBS (UPDRS-16 reduction 2,40 ±1,52, p=0,041) and ZI-DBS (2,00 ±0, p=0,025) reduced tremor scores significantly, without a significant difference between the targets (p=1,000). Concerning adverse events, the only observed influence of target choice was a higher number of sensory side effects in Vim-DBS in PD (p=0,0183). Development of tolerance occurred in 80% of Vim patients and 41,7% of ZI patients, the difference between them not being significant (p=0,149).

Conclusion: ZI-DBS and Vim-DBS reduced tremor significantly in both ET and PD. There was no significant difference in efficacy between the targets. In PD, a higher occurrence of sensory side effects was recorded in Vim-DBS. A non-significant trend of lower development of tolerance in ZI-DBS compared to Vim-DBS gives rise to speculation that ZI might be preferable over Vim. The results prompt further research, preferably in the form of a prospective study.

Reference:

1 - Sandvik U, *et al.* Thalamic and subthalamic deep brain stimulation for essential tremor: where is the optimal target? Neurosurgery 2012 Apr; 70(4): 840-5

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INTRATHECAL BACLOFEN THERAPY FOR THE TREATMENT OF SPASTIC HEMIPARESIS

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Introduction: Intrathecal baclofen (ITB) therapy has been established as a viable option in the treatment of spasticity. Ambulatory patients with spastic hemiparesis appear to pose special challenges for ITB therapy due to potential muscle weakness. The purpose of this study is to evaluate the effectiveness of ITB therapy in ambulatory patients with spastic hemiparesis due to cerebral vascular accidents (CVA) and traumatic brain injury (TBI).

Methods: We followed 20 ambulatory patients with spastic hemiparesis who underwent implantation of a pump for ITB therapy in our hospital from 2005 to May 2012. The underlying pathology of the spasticity was CVA in 8 patients and TBI in 12 patients. They all had a positive bolus test with 50μgr (17 patients) or 100μgr (3 patients) of baclofen with a good response in the lower limb's but moderate or absent in the upper limb's spasticity. The average follow -up period is 3.1 years. Patients were evaluated for the spasticity with Modified Ashworth scale. Post- op fluoroscopy was applied in order to define the level of the catheter tip.

Results: Different responses to the ITB treatment were noted in the upper compared to the lower limb. The spasticity of the lower limbs was reduced in all patients (from 2.6 to 0.6 in the Modified Ashworth scale). On the contrary, only 8 patients (40%) experienced a significant decrease in upper limb's spasticity (MAS from 2.6 to 2). Post – op fluoroscopy confirmed the more rostral placement of the catheter (at the higher thoracic level) in the group of patients who demonstrated a decrease in upper limb's spasticity compared to the group of minimal response from the upper limb. In the subgroup with minimal upper limb's response the attempts to increase the baclofen dose was accompanied by lower limb muscle weakness that deteriorated the patients walking ability.

Conclusions: Initial results show that the level of the catheter tip placement plays an important role on the upper limb's response to the ITB treatment. Current results have lead to the modification of our surgical technique in this category of patients, aiming for a higher catheter tip placement.

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EIGHT-YEAR FUNCTIONAL OUTCOME OF BILATERAL SUBTHALAMIC NUCLEUS STIMULATION IN PARKINSON'S DISEASE

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Short and long-term benefits of SubThalamic Nucleus stimulation (STNs) on motor and cognitive functions are well documented in patients with Parkinson's Disease (PD). Nonetheless, a wider perspective of treatment effectiveness is often lacking, since disability progression after chronic STNs is frequently neglected.

Objectives: This study provides a 8-year follow-up of PD patients under chronic STNs focusing attention on functional outcome measures.

Design: prospective cohort study.

Methods: 34 consecutive PD patients (age at surgery: 60.2 ± 7,1 years, disease duration: 12,3 ± 3,4 years) were yearly assessed for eight years after bilateral STN implant. Motor symptoms were evaluated with (ON) and without (OFF) levodopa treatment, under bilateral stimulation. Disease-related disability, neuropsychological and mood changes and quality of life (QoL) were comprehensively studied.

Results: Motor symptoms (UPDRS III) improved of 52% in "OFF" condition whereas the ON condition was not significantly modified by STNs. No difference from the baseline (T0) was observed concerning the activity of daily living (UPDRS ADL) and QoL (PDQ-39). Axial symptoms worsened, as well as dysphagia and MMSE score. Complications and side effects: two procedires were aborted owing to intracranial haemorrage, 2 patients had hardware problems and one transient postoperative seizures.

Conclusions: STNs allows stable and longlasting control of cardinal motor symptoms, as tremor bradykinesia and rigidity. However, even if initially improved, disease-related disability progressively develops, due to the scarce effect of STNs on axial symptoms (gait, posture, balance, speech and swallow problems) and to cognition deterioration.

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RANDOMIZED MULTICENTER TRIAL COMPARING BILATERAL GLOBUS PALLIDUS INTERNUS DBS AND SUBTHALAMIC NUCLEUS DBS FOR ADVANCED PARKINSON'S DISEASE

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Objective: We compared bilateral globus pallidus internus (GPi) deep brain stimulation (DBS) to subthalamic nucleus (STN) DBS in Parkinson's Disease (PD), to study differences in functional improvement between the two targets, based on the expectation of a higher rate of motor improvement in STN-DBS but a lower rate of complications in GPi-DBS.

Background: Continuous bilateral STN DBS is an effective surgical treatment for patients with advanced PD who have severe limitations in functioning despite optimal pharmacologic treatment. Clinical experience with DBS (especially STN) has increased over the last two decades. This has resulted in increased concerns about adverse effects, especially for the cognitive, mood, and behavioral features.

Methods: The study is a randomized controlled trial. We have enrolled 128 patients with advanced PD who had — despite optimal pharmacological treatment — at least one of the following symptoms: severe response fluctuations, dyskinesias, painful dystonias, or bradykinesia. Patients have been randomly assigned to bilateral GPi DBS or STN DBS. The primary outcome measures are the number of patients with major cognitive, mood, and behavioral adverse effects and the off-on phase weighted AMC Linear Disability Scale (ALDS, functional health) one year after surgery. Secondary outcome consists of symptom scales, activities of daily living scales, a quality of life questionnaire, adverse effects, and medication use. Additionally, patients undergo an extensive neuropsychological and a standardized psychiatric assessment. Five centers in the Netherlands are participating. Patient and assessors were blinded for treatment allocation (GPi vs. STN DBS).

Results: The GPi and STN baseline parameters are comparable. At 12 months, data of 125 patients were available (62 GPI, 63 STN). We did not detect a statically significant difference considering major cognitive, mood, and behavioral adverse effects (40 GPi, 36 STN, p 0.61). Improvement on the weighed off-on ALDS is comparable between both groups (GPi 3.0±14.5, STN 7.7±23.2, p 0.30). However, the STN group improved more regarding functional health in the off phase as compared to the GPi group (ALDS: GPi 11.8±18.9, STN 20.4±27.9, p 0.04). Similar results on difference scores are found on the UPDRS motor examination (GPi 11.4±16.1, STN 20.3±16.3, p 0.03). Dyskinesias improve more with GPi DBS (GPi 3.00±3.69, STN 1.06±4.47, p 0.01). Adverse events are similar in both groups. The other secondary outcome measures did not show significant differences, except for a trend towards better scores on the Parkinson's Disease Sleep Score in the STN group.

Conclusions: The STN appears to be the preferred target based on motor symptoms and functional health outcome. No significant difference was seen between the two groups concerning cognitive, mood and behavioral adverse effects.

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ABNORMAL EARLY SYNCHRONIZATION OF PINK1-/- M1 CORTICAL NEURONS IS DECREASED BY HIGH FREQUENCY STIMULATION OF THE SUBTHALAMIC AREA

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Introduction: High frequency deep brain stimulation (HF-DBS) is established as a therapeutic method for movement disorders such as Parkinson's disease. However a clear understanding of how HF-DBS of the subthalamic nucleus (STN) disrupts the pathological beta oscillations in the motor cortex (M1) and the basal ganglia network is still lacking. One hypothesis is that HF-DBS decreases M1 pathological rhythms by antidromic stimulation of the corticosubthalamic pathway. We tested this hypothesis in cortico-STN slices from wildtype (wt) and PINK1KO (familial form PARK6) mice.

Material & Methods: We first tested the hypotheses that the in vitro activity of the mouse motor cortex (M1) network is (1) different in PINK1 KO mice (a model of the familial form PARK6) from that in wt mice, at postnatal days P13-15, i.e. far before the first motor signs of PINK1 KO mice (16 months) and (2) that high frequency stimulation of corticofugal fibers affects this pathological activity. We used ultra-fast two photon imaging of fura-2 loaded cortical neurons to simultaneously record the activity of hundreds of M1 neurons and we stimulated internal capsule fibers close to the lateral pole of the subthalamic nucleus (STN, 60 µs width pulses at 130 Hz) in a new horizontal tilted slice comprising part of M1, STN and cortico-STN fibers. Somatic fluorescence signals were expressed as relative fluorescence changes ($\Delta F/F$) after substraction of the background. Fluorescent traces were analyzed with custom developed routines in MatLabTM and calcium events identified using asymmetric least squares baseline and Schmitt trigger threshold. In our implementation we used 5% of baseline noise as high threshold and 2% as low threshold. Events were defined as correlated if they had simultaneous onsets (± one frame). To distinguish random correlations from those due to network properties we performed a Monte Carlo simulation which generated samples of randomly generated data for each experiment. By comparing the actual data and randomly generated data we determined the threshold number of cells spiking simultaneously over which the correlation cannot be due to stochastic coincidence. Such clusters of correlated events were called correlation episodes.

Results : We found that the percent of active cells in slices from wt (n=47) and PINK1-KO mice (n=53) was significantly higher in control (20% vs 14% per field). Episodes of correlated activity had a significant higher frequency in PINK1-KO compared with WT (4.1 vs 1.8 episodes per 137 s). These episodes of correlation in M1 were cut down during 100Hz HFS of the STN area.

Conclusion: These results suggest that frequent episodes of correlated activity may be presymptomatic signature in M1 of the motor disease to come 2) HFS of the STN area seems to decorrelate M1 activity. Further experiments are needed to characterize the underlying mechanisms.

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GAMMAKNIFE THALAMOTOMY FOR TREMOR. OUTCOME IN THE MARSEILLE SERIES AND CORRELATIONS WITH NEUROIMAGING FEATURES OF THE THALAMIC LESION

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Objective: The aim of the present study is to analyse the MRI postoperative imaging features of the post-radiosurgical thalamic lesion and establish correlations with the clinical results.

Methods: Between April 2004 and March 2012, a Vim Gammaknife thalamotomy was performed in 88 patients for intractable essential or Parkinsonian tremor in Marseille University hospital. Follow-up included serial MRI scans (3D MP-RAGE, axial T2, coronal Flair) at 3, 6 months, 1 and 2 years and a comprehensive clinical evaluation by expert neurologists (Whiget tremor scale, functional scale). Each MRI scan was analysed by a single investigator. The presence or absence and the size of post-Gadolinium enhancement were analysed. The amount of edema around the target was assessed according to a semi--quantitative scale (Grade 1 to 5) The shape of the lesion was also analysed (cocade-like, nodular homogeneous, irregular with heterogeneous enhancement). According to the features of the lesion based on imaging and irrespective of the clinical results, the patients were classified into three subgroups of normo, hyper or hyporesponders.

Results: The percentage of patients presenting a good outcome was 70% (blind analysis from an expert neurologist from another center (improvement of tremor and ADL scale). A workable MRI follow-up was available (> 3 MRI Scans) for 70 patients (Follow-up > 1 year) and allowed the response profile to be classified into three groups. **Hyperresponder:** (4%): 3 patients had an extensive MRI lesion (>10 mm) with massive edema extending beyond the internal capsule. One presented with a transient contralateral hemiparesia. **Hypo-responders:** 25 % patients displayed very minimal changes (hardly visible or no post-gadolinium enhancement, very limited hyper T2 or Flair (max diameter < 4 mm). Most patients (87,5%) without clinical benefit had this pattern of weak response on imaging. There was no significant discrepancy between the stereotactic coordinates of the target and the center of the lesion as depected on neuro-imaging studies. **Normoresponders:** 71 % of patients displayed very significant MRI changes with a quite stereotyped pattern ('cocade'-like lesion) usually at 6 months (3-18 months) and had most of the time an excellent clinical response. A single patient presented a late adverse reaction 22 months after radiosurgery with marked contralateral ataxia. His MRI demonstrated a left thalamic bleeding (Flair and T2* hypo-intense lesion with massive surrounding edema). To date this case is unique in our series but a similar pattern was already reported by Lim and col.

Conclusion: The analysis of the serial postoperative MRI scans demonstrated a variable interindividual and intraindividual response in time and intensity. Among the patients with poor clinical benefit, the hyporesponder type pattern was very frequent (87,5%). The factors accounting for this difference needs are discussed but need to be clarified and further investigated.

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EFFICACY AND SAFETY OF DBS IN TREMOR OF MULTIPLE SCLEROSIS

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Background: Tremor is a frequent complication of multiple sclerosis and can be severely disabling in up to 15% of MS- patients. DBS is cost effective in tremor of Parkinson's disease and has been used in patients with MS. However its efficacy and safety in this condition is not well documented. We reviewed the literature to evaluation DBS effecacy and saftey in rubral tremor.

Methods: English literature was searched for studies published on the used of DBS in MS using Medline, EMBASE, Pubmed, google scholar and the Cochrane database. A seconday search was carried out using the refrences of papers detected in the primary search to make sure that all relevant papers were included. Studies were included if the patients treated were treated by DBS for MS-tremor and the outcome or safety results were published. Duplicate publications were discarded.

Results: A total of 151 MS-tremor patients treated with DBS were found in 28 studies. Inclusion criteria were refractory tremor, MS stable for last six months, extended disability status scale of >7 and MMSE of >24. 98/115 (85.2%) had significant tremor supression at six weeks compared to 38/55 (69.1%) at one year. 60/80 (75%) had gained significant improvement in activities of daily living compred to 19/29 (65.5%) at one year. Symptomatic cerebral haematoma occurred in 4 (2.6%), permanent neurological deficit was noted in 4 (2.6%), tranisent neurological deficit (lasted up to 3 months) in 2.6%, seizures in 5.6% with infection in 3.85%. DBS surgery in these patients was also associated with MS relapse in four patients (2.6%).

Conclusion: DBS in MS-tremor seems to be wothwhile in the short term, longer term studies with economic models are required to establish its cost effective in these patients.

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IMPACT OF BILATERAL SUBTHALAMIC NUCLEUS DEEP BRAIN STIMULATION ON PHARYNGO-OESOPHAGEAL MOTILITY: RESULT OF A RANDOMIZED CROSS-OVER STUDY

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Introduction: While the role of dopaminergic nigrostriatal loop on the control of movements, little is known on its impact on gastro-intestinal motility. Deep brain stimulation (DBS) of subthalamic nucleus, which is currently used to treat advanced form of Parkinson's disease (PD), improve significatively levodopa responsive motor performances. Recently, DBS has been shown to stimulate gut cholinergic contractions through a central dopaminergic loop. We therefore took the opportunity to investigate the effect of DBS on oesophageal motility in PD patients in an interventional randomized study.

Method: 17 patients (age: 62 ± 9 years) with chronic bilateral high frequency of the subthalamic nucleus for at least 6 months were enrolled in this study and randomized with stimulator either turned OFF (2h) then ON (2h), or turned ON (2h) and OFF (2h) thereafter. Oesophageal high resolution manometry was performed at the end of each period, with a 5 min resting period followed by ten swallows of 5 mL.

Results: No groups effect (ON-OFF vs OFF-ON) was observed for the different parameters analyzed. During the ON period, a significant increase of the distal contractility index was found (OFF: 1640 ± 719 vs ON: 2035 ± 598 mmHg.cm.s; p=0.03), whereas no difference in the distal front velocity was noted compared to the OFF period (OFF: 3.3 ± 0.4 cm/s vs ON: 3.1 ± 0.2 cm/s; p=0.49). In addition, a decrease of the integrative relaxation pressure of the lower oesophageal sphincter was noted for 1s (OFF: 7.7 ± 1.7 mmHg vs ON: 4.5 ± 1.4 mmHg; p=0.05) and 4s (OFF: 11.1 ± 1.8 mmHg vs ON: 7.2 ± 1.8 mmHg; p=0.05) during the ON period compared to the OFF period, while the resting pressure of the lower esophageal remained similar during the two periods (OFF: 22.2 ± 2.8 mmHg vs ON: 18.7 ± 2.5 mmHg; p=0.27). This resulted in a significant rise of the intrabolus pressure (OFF: 4.5 ± 1.9 mmHg vs ON: 2.4 ± 1.3 mmHg; p=0.03). Last, no difference was observed during the two periods for resting or relaxation pressure of the upper oesophageal sphincter, nor the pharyngeal contraction amplitude and velocity.

Conclusion: It is concluded that DBS increases oesophageal body contractions and enhances the lower oesophageal sphincter opening. This suggests therefore that the central nigro-striatal loop is involved in the control of gut motility and its impairment may participate on the gastro-intestinal symptoms often associated with PD.

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GAMMA KNIFE RADIOSURGERY THALAMOTOMY FOR INTRACTABLE TREMORS: A BLINDED ASSESSMENT

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Objective: To assess the safety and efficacy of Gamma Knife thalamotomy for the treatment of severe tremors.

Background: Thalamic DBS is a well-recognized treatment for intractable tremors. However, some patients are poor candidates for invasive neurosurgery, wether due to the use of anticoagulants, serious medical co-morbidities or advanced age. Gamma-knife radiosurgery could be a safe alternative.

Design/Methods: 50 patients (mean age: 72.4 yo) with severe refractory tremor (36 essential 14 Parkinsonian, 32 men and 18 women) and contraindication for DBS were treated with unilateral Gamma-knife thalamotomy. VIM targeting was achieved with Leksell Gamma unit with a single exposure through a 4mm collimator helmet. The GKS dose at the maximum was 130 Grays. Tremor severity assessment (Whiget tremor rating scale), impairment in activities of daily living and cognitive assessment (Mattis dementia rating scale, verbal fluency) were done before surgery and at 6 and 12 months. MRIs follow-up is done at 3,6 and 12 months. A neurologist, specialised in movement disorders from another center (Grenoble France), did a blinded assessment of the tremor severity for each patient with a video done before and at 12 months after thalamotomy.

Results: 38 patients had a left thalamotomy and 12 patients had a right. The blinded assessment showed an improvement by more than 50% (55.1 for the right hand tremor and 57.5 for the left). Every component of the tremor were improved (rest, postural and intention), writing was improved by 46%. The activities of daily living were improved by 72.6%. The cognitive assessment remained stable. The delay of improvement was variable from 1 to 12 months. The only side effect was a transient hemiparesis due to excessive edema around the thalamotomy. Follow-up MRI showed T2-hyperintense signal changes with mild gadolinium enhancement. 12 patients had no effect on tremor. Analysis of MRI revealed a very limited lesion with no enhancement. These patients were considered as hyporesponsive to Gamma Knife.

Conclusions: Gamma-knife thalamotomy is a safe and efficient procedure for treating severe tremor with an improvement of 55%. Side effects are rare and transient. The absence of effect on tremor is probably due to a hyporesponse to Gamma Knife.

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LONG-TERM FOLLOW-UP OF PALLIDAL DBS FOR PRIMARY DYSTONIA

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Introduction: Pallidal DBS (GPi-DBS) is considered a rescue therapy for intractable primary dystonia. However, the clinical outcomes differ greatly among individuals. We assessed the efficacy and safety of GPi-DBS in primary dystonia patients in the long-term follow-up.

Methods: 49 patients with medically refractory primary dystonia were operated for bilateral continuous high-frequency GPi-DBS (mean age 35.1±14.8, mean disease duration 13.6±11.6 years). 26 patients had generalized and 23 – segmental dystonia (mean age of onset 13.8±11.7 and 30.3±15.8 years, respectively). Severity of dystonia was evaluated according to Burke-Fahn-Marsden rating scale before surgery and in the postoperative follow-up. The stereotactic coordinates of active electrode contacts were calculated. We performed a comprehensive analysis of functional outcomes using Global outcome scale (GOS), disability subscale of BFMDRS, and quality of live (QoL) questionnaire SF-36. The large neuropsychological battery was applied. Mean follow-up period was 43.7±23.4 months (1–9 years).

Results: Mean clinical improvement in BFMDRS motor score following GPi-DBS at the last follow-up was 59.8±16.1% in generalized and 68.6±18.5% in segmental dystonia. In 14 patients, the double monopolar stimulation mode was used. Beneficial outcome was associated with minor disease duration (ρ =–0.7, p=0.000), elder age of dystonia onset (ρ=–0.457, p=0.001), and minor disease severity (ρ=–0.386, p=0.007). In 88% of patients, we observed excellent and good results (GOS). Disability subscore of BFMDRS decreased by 61.7±22.3%. Physical and mental health components of QoL achieved normal values. No significant permanent cognitive or affective deterioration was observed. We faced no intraoperative, but technical complications (electrode fracture – 1 case, migration of pulse generator – 2 cases), and postsurgical infection – 1 case. In 2 patients, the correction of electrode position was required for optimizing the clinical effect. The most frequent adverse effect of GPi-DBS was dysarthria (18.4%) followed by heaviness in legs (8.2%), which could be improved by adjusting the stimulation parameters.

Conclusions: GPi-DBS is relatively safe procedure that causes long-term sustained improvement of clinical state, function, disability, and QoL in patients with generalized and segmental primary dystonia. Duration of disease, age of dystonia onset, and severity of motor symptoms are essential for predicting the outcome following DBS.

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INTRATHECAL BACLOFEN THERAPY AND QUALITY OF LIFE

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Introduction: Spasticity is a major complication of some chronic CNS diseases/conditions, leading to increase dependence of careers and low quality of life in these patients. Among many therapeutic options, intrathecal baclofen (ITB) has proven benefits for the treatment of spasticity. With this formulation, the drug goes directly to the receptor site resulting in higher efficacy with less systemic adverse effects.

Methods: A retrospective review of all patients implanted in our department was made based on operative log records, patient charts, outpatient follow-up visits and telephone interviews. Between January 1999 and April 2012, 66 patients were operated. We included 63 cases in this study with ages between 12 and 75 years (mean: 44). Forty two (71%) of these patients were males.

Results: More than half of the patients (69,8%) had spinal cord injury (traumatic-47,6%, tumor/infection/myelitis-14,3%, multiple sclerosis-7,9%) followed by cerebral palsy (12,7%) and stroke (7,9%). The improvement assessed by modified Ashworth scale (MAS) was between 1 and 2 points in every item and in Penn's spasm frequency scale also between 1-2 points. Patients reported consistent better quality of life after ITB mainly due to improvement in body transfers (wheelchair, bed, etc.), daily activities and physiotherapy related exercises/activities. The main complain was the pump volume compressing the surrounding structures. The main morbidity associated to the device was catheter malfunction, with the need of surgical intervention on 19,0% of the patients. Infection occurred in 6,9% of the cases (4% late infections).

Conclusion: The results show that ITB therapy was effective for spasticity control, with low discomfort and morbidity, and a long term significant gain in patient's quality of life.

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RAPIDLY PROGRESSIVE GENERALIZED DYSTONIA IN DEAFNESS-DYSTONIA SYNDROME WITH COCHLEAR IMPLANT AND RESPONSE TO PALLIDAL DEEP BRAIN STIMULATION

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Objective: To report on a case of genetically proven deafness-dystonia syndrome presenting with deafness, rapidly progressive severe generalized dystonia, mild cognitive impairment and behavioral abnormalities, efficiently treated by internal globus pallidus (GPi) deep brain stimulation (DBS).

Background: Mohr-Tranebjaerg syndrome (MTS) is a rare X-linked disorder characterized by the association of dystonia and progressive sensorineural hearing impairment. Here we report the clinical and genetic findings as well as the surgical management of cochlear implant and DBS in a ten years old boy with MTS carrying a mutation in the DDP1 (deafness-dystonia peptide 1 gene) which encodes TIMM8A

Methods: Clinical examination revealed at birth imperforate anus and later on, during the first 3 years of life, intellectual disability orientating clinicians towards a diagnosis of chromosome 15q24 microdeletion syndrome. Hearing impairment was diagnosed at age 3 and the child benefited from cochlear implant at age 8. Motor impairment occurred with very rapidly progressive dystonia toward generalization within 6 months, with functional disability and loss of weight. The association of hearing impairment and progressive dystonia suggested the diagnosis of deafness-dystonia syndrome. DNA investigation identified a hemizygous pathogenic mutation in the TIMM8A gene (splice-site mutation described and reported once by Kim et al.). The child benefited from bilateral GPi stimulation after cochlear implant explantation that was necessary to avoid artifacts interfering with MR imaging during MRI-targeted DBS procedure. Dystonia severity before and after DBS was assessed by the Burke Fahn Marsden dystonia rating scale.

Results: Already 6 days after DBS onset, the child was able to sit unaided and progressively recovered autonomous feeding and gait. After reaching steady state for motor improvement, cochlear implant was reinserted 7 months after DBS onset, without any surgery related complications.

Conclusions: Splice-site mutation in TIMM8A gene can be associated with different phenotypes including early onset and rapidly progressive generalised dystonia. Cochlear implant does not interfere with DBS therapy in the same patient.

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PALLIDAL DBS FOR DYSTONIA ASSOCIATED WITH BASAL GANGLIA CALCIFICATION: A REPORT OF TWO CASES

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Introduction: Basal ganglia calcification (BGC) is a rare clinical neurodegenerative entity. It is characterized by concentric calcium deposits within the walls of small and medium-sized vessels in certain brain areas. Commonly, lenticular nuclei (especially the internal globus pallidus (GPi)), caudate nuclei, thalami, dentate nuclei, cerebellum, white matter, or cerebral cortex are symmetrically affected. In the most cases, BGC remains an occasional neuroimaging finding, which is largely benign. At the same time, idiopathic and secondary BGC may lead to progressive neurologic dysfunction with extrapyramidal, cerebellar, pyramidal, cognitive, behavioral, and psychiatric abnormalities. Treatment is mainly symptomatic. One successful case of GPi-DBS for dystonia with putaminal calcification was published. Here we report two cases of dystonia associated with BSG treated with pallidal DBS. The first patient is a 42-year-old man suffering pharmacoresistant generalized dystonia. The disease primary presented as dystonia of the right arm at the age of 13 and progressed gradually involving both arms, neck, trunk, face and legs (motor BFMDRS 80). Standard MRI revealed hypointensive areas in GPi on T1- and T2-weighted images; cranial CT scan confirmed the areas of bilateral calcifications. The other patient is a 12-year-old boy with severe intractable dystonia. The disease manifested as a write cramp with rapid progression to generalized dystonia. On admission, the patient was disabled with marked impairment of gait, standing, daily life activities, feeding, and swallowing (BFMDRS 116). Cranial CT showed symmetric BGC not exceeding the volume of GPi. In both patients, the infectious, toxic, or traumatic causes were excluded; endocrinological, developmental, mitochondrial, metabolic disease or other systemic disorders were absent. The implantation of pallidal electrodes was performed using standard stereotactic technique. In the postoperative follow-up, both patients experienced progressive amelioration of dystonia. Clinical improvement in the first patient achieved 50.6% (BFMDRS 39.5) after 1.5 years of GPi-DBS. In the other patient, following one year of pallidal stimulation motor BFMDRS (60.5) improved by 47.8%.

Conclusions: Dystonia associated with bilateral GPi calcification might be considered as a promising indication for pallidal DBS. Taking into account possible progression of neurodegeneration, general prognosis could be poorer compared to primary dystonia.

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REPORT OF GPI-DBS IN TWO PATIENTS WITH PANTOTHENATE KINASE-ASSOCIATED NEURODEGENERATATION: LONG TERM FOLLOW-UP AND VIDEO ILLUSTRATION

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Introduction: Pantothenate kinase-associated neurodegeneration (PKAN) is a rare autosomal recessive disorder characterized by progressive iron accumulation in the basal ganglia (a typical eye-of-the-tiger sign is recognized in the brain magnetic resonance imaging). PKAN can be integrated in the NBIA Syndromes and presents in childhood with dystonia and Parkinsonian symptoms. There is rapid clinical progression and insufficient symptomatic drug therapy. DBS has been reported, in a recent revision article, as a treatment option in at least 22 published cases (Brain. 2010 Mar; 133(Pt 3): 701-12). We present 2 cases of GPI DBS with approx 2,5 years follow-up.

Methods and Results: Both cases were implanted bilaterally in the globus pallidus internus based on direct T1 visualization and aiming at the junction of the anterior 3/4 to the posterior 1/4s of GPI boundaries in axial views; on coronal views the traject was calculated to aim the lateral border of the optic tract and the lowest contact to rest at 4 mm below the midcommissural line.

Case 1 – 7 years old girl with clinical and genetic features of PKAN, the disease started at the age of 3 with gait disturbance and progressive generalized dystonia. At presentation the patient was bedridden in status dystonic with midazolan infusion after a flu H1N1 infection. Pre-op BFMDS was 102 for the motor scale and 27 for disability scale. After DBS (there was a small and apparently assymptomatic isquemic lesion in the caudate nucleus) there was marked improvement of dystonia, midazolan infusion was discontinued and the patient regained capacity for oral feeding but at 6 months follow-up there was a deterioration of the dystonia and loss of benefit. 2 years after surgery the BFMDS was 57 for motor score and 28 for disability scale (under midazolam and on stimulation).

Case 2 - 9 years old girl which disease presented at the age of 1 year with gait disturbance and postural tremor; when surgery was decided, she presented generalized dystonia, dysarthrophonia and dysphagia. Pre-op BFMDS was 78,5 for the motor score and 20 for for disability scale. DBS surgery was uneventfull and the patient improved the dystonia, including oromandibular distonia. 29 months after surgery, the patient maintain the benefit, BFMDS motor score is 35 and 17 for disability scale; the feed back of the family and caretakers is very positive and she is speaking and attending school.

Conclusions: GPI-DBS can be significantly effective in Pkan dystonia as we particularly verified in case 2, however this is a progressive disease and we expect clinical deterioration on the long run. With this work, we hope to contribute to a pool of experience that helps to clarify the efficacy and usefullness of DBS in PKAN patients.

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PALLIDAL DEEP BRAIN STIMULATION IN PATIENTS WITH DYSTONIA. OUTCOME IN A SERIES OF 16 PATIENTS

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Introduction: High-frequency deep brain stimulation (DBS) of the globus pallidus internus (Gpi) is an established treatment option for medically refractory dystonia. However, factors predicting clinical outcome are not well defined. We present the clinical data of 16 patients with severe dystonia of different etiologies who underwent pallidal DBS.

Methods: We included 6 patients with DYT1-negative primary generalized dystonia (one of them with confirmed THAP1 (DYT6) mutation), 5 patients with cerebral palsy, one with genetically confirmed Pathotenate Kinase Associated Neurodegeneration, and 5 patients with severe cervical dystonia (4 idiopathic and 1 tardive dystonia). In all patients, DBS electrodes were implanted bilaterally within the GPi. Mean follow-up time was 6 months (range - 6 months - 7 years). All patients were evaluated pre-surgery, immediately after surgery, at 3 months, 6 months and then yearly, using the Burke-Fahn-Mardsen Dystonia Rating Scale (BMFDRS) in the case of generalized dystonia, and the Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) in the case of cervical dystonia.

Results: All patients experienced improvement, especially those with primary generalized DYT1-negative, as well as cervical dystonia (in this subset especially the tardive dystonia case). Patients with secondary dystonia achieved less motor benefit, but an improvement in the quality of life due to less disability. Two years after surgery, one generalized dystonia patient had a delayed infection necessitating removal of the entire system. It was replaced one year later, again with a good benefit. No other significant adverse events have been noted in this series.

Conclusions: DBS is a good option for refractory dystonia, regardless of the etiology, but particularly for primary generalized, cervical dystonia and tardive dystonia. DBS is less effective in secondary dystonia but benefits might also be relevant for daily functioning. A multidisciplinary experienced clinical team is paramount for success in this setting.

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DEEP BRAIN STIMULATION AND ABLATIVE SURGERY FOR PD BETWEEN 2002 AND 2012

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Introduction: Parkinson's disease (PD) is a common neurodegenerative disease affecting more than 4 million people worldwide. When medical therapy fails to provide the desired quality of life, surgical treatment is considered. In 2001, the number of publications on deep brain stimulation (DBS) surpassed that on ablative surgery [1]. The aim of this study is to review the distribution, authorship and content of scientific publications related to surgery for PD in the last 10 years.

Methods: A comprehensive review of the literature using the PUBMED database from 2002 until May 2012 was conducted using the following search terms: "Parkinson's disease" AND "thalamotomy" OR "pallidotomy" OR "deep brain stimulation."

Results: Of 1698 papers reviewed, 1322 met the inclusion criteria. 1194 articles were related to DBS, 91 related to pallidotomy and 37 to thalamotomy. We observed a progressive increase in publications on DBS and a likewise reduction in papers on lesioning over this timescale. A non-neurosurgeon was first author in 71% of all publications. 75% of publications were in non-neurosurgical journals. In neurosurgical journals, a neurosurgeon was the first authors in 60% of publications. Amongst non-neurosurgical first authors, over 50% were either neurologists or neurophysiologists.

Conclusion: Surgical ablation in the treatment of advanced PD continues to wane. On the other hand, the appetite for DBS has markedly increased over the last ten years. Publications on DBS are often driven by non-neurosurgeons.

References:

1 - Hariz MI: From functional neurosurgery to "interventional" neurology: Survey of publications on thalamotomy, pallidotomy, and deep brain stimulation for parkinson's disease from 1966 to 2001. Mov Disord 2003;18:845-853.

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DBS GPI IN A PATIENT WITH PREVIOUS STEREOTACTIC BRAIN LESIONS FOR GENERALIZED DYSTONIA

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Objective: We analyze the results of multiple stereotactic surgical procedures for dystonia performed in a single patient, between 1982 and 2008.

Background: Several different anatomical targets have been used in functional stereotaxy for dystonic syndromes in last decades.

Methods: The patient is a woman born 1963, suffering from generalized dystonia since the age of 7 (1970). Due to the progression of dystonia, she underwent three successive stereotactic lesional procedures. The ventriculography was used for target localization in: the right ventralis oralis anterior (Voa) nucleus of thalamus in 1982; the right posteroventral part of internal globus pallidus (GPi) in 1987; and the left dentate nucleus (DN) in 1990. We did not have access to any objective information about the patient status following the surgical procedures. Subjectively, there was no durable effect. Finally, in 2008, a bilateral deep brain stimulation (DBS) of GPi was performed. MRI of the brain and the Burke-Fahn-Marsden dystonia rating scale (BFMDRS) has been repeatedly performed in conjunction with the DBS.

Results: The MRI showed previous thermolesions: i) in the right Voa and pulvinar of the thalamus, ii) on the border of the posterior part of the right pallidum, putamen and the internal capsule and iii) in the cerebellum near the left DN. Both DBS electrodes were placed properly in the GPi. The BFMDRS scores were 63, before DBS GPi; 57, three months after surgery; 43, one year; and 27, two years after DBS implantation. Functionally, the patient regained the gait ability.

Conclusion: Despite multiple brain lesions due to previous stereotactic procedures, bilateral DBS of the GPi appeared as an effective treatment option in a patient with generalized dystonia.

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IMPROVED GAIT INITIATION WITH DEEP BRAIN STIMULATION

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Introduction: Gait initiation in Parkinson's disease (PD) may present as propulsion leading to falls. Deep brain stimulation (DBS) of the subthalamic nucleus (STN) improves cardinal symptoms and often also gait performance. The impact of STN DBS on initiation is only sparsely described. We aimed to describe the impact of STN DBS on standing gait initiation.

Methods: Gait initiation was assessed in 10 healthy elderly and 11 PD patients with bilateral STN DBS "on" and "off", without medication. Gait was initiated from stance, when a visual cue was given. Motion-time, -timing and -ranges were recorded in four dimensions (time and 3D space) with a Vicon Motion-assessment system. Weight transposition was recorded with a floor--embedded force-plate.

Results: STN DBS improved timing of consecutive events and movement ranges. Improved parameters were comparable to non-diseased. Weight displacement path and amplitudes were improved to what was seen in the control group: "Off" treatment, patients propagated weight onto stance-foot and beyond. "On" DBS-patients and controls projected weight first onto swing-heel, then contra-lateral to stance-foot and finally forward.

Conclusion: Parkinson's disease patients show heterogeneous strategies in initiating gait "off" treatment. STN DBS enables the patient to select a proper movement pattern characterized by not only larger movements but also consecutive timing.

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PREDICTORS OF SURVIVAL IN PARKINSON-PATIENTS TREATED WITH DEEP BRAIN STIMULATION

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Introduction: Deep Brain Stimulation (DBS) in the subthalamic nucleus (STN) has been offered patients with advanced Parkinson's disease (PD) at Aarhus University Hospital (AUH) since 1998. International studies have confirmed the continuous effect of DBS after five years. Only one study has followed the patients in ten years (Castrioto et al. Arch. Neurol. 2011). The aim of our study was to examine predictors of survival after 10 years of treatment.

Methods: Medical records for patients treated with DBS between 1998 and 2002 at AUH were examined and patient age at surgery, disease-duration at implant and pre-surgery levodopa-challenge amongst others, were noted.

Results: Of 66 patients, 65 patient records were retrieved. 44 patients had survived treatment 10 years or longer. On average, patients were operated at age 59+/-8 and had the disease for 15+/-6 years before surgery. Six months after surgery, STN DBS reduced symptoms similar to levodopa prior to surgery ($p>0.05$). The >10years surviving cohort was younger than the non-surviving group ($p<0.05$) at surgery while disease-severity (motor symptom-score, UPDRS-III) were comparable. Also, response to levodopa were similar ($p>0.05$). More women than men and those having the akinetic-rigid PD subtype lived more than 10 years with STN DBS (x2, $p<0.05$ in both).

Conclusion: The levodopa-challenge may be a predictor of outcome after STN DBS. Our initial assessments of patient records predict increased survival after DBS for women and akinetic-rigid patients. Upcoming studies will investigate long-term treatment-effect, adverse events and development of cognitive decline in the group of survivors.

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PEDUNCULOPONTINE STIMULATION, A NEW FRONTIER IN DEEP BRAIN STIMULATION

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Locomotor disability and gait disturbance are severe complications of movement disorders pathologies. These morbidities can be seen in patients with Parkinson's disease, Progressive Supranuclear Palsy and Multisystem Atrophy. Unfortunately these morbities are L-Dopa unresponsive. In addition, classical targets in deep brain stimulation, such as subthalamic nucleus and Globus Pallidus stimulation don't help with locomotor outcome.

A 54 years old male patient with probable MSA-P who underwent bilateral pedunculopontine (PPN) deep brain stimulation (DBS) is presented. The patient had dominant levodopa resistant bradykinesia, freezing of gait and autonomic disturbances with a good cognitive condition. The patient underwent bilateral deep brain stimulation of the pedunculopontine nucleus which ended with modest benefit. He had a postoperative follow-up period of 2 years, his neurological status remained stable and PPN-DBS provided modest benefits in gait disorder and freezing episodes. This unusual patient suggests that mesencephalic pedunculopontine region may be a target of interest in atypical parkinsonian syndromes with dominant locomotor symptoms.

Key Words: pedunculopontine nucleus, multiple system atrophy, parkinsonism, deep brain stimulation

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A STUDY OF PATIENTS' EXPECTATIONS AND SATISFACTION IN STN DBS FOR PARKINSON'S DISEASE

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Aim: Subthalamic nucleus (STN) deep brain stimulation (DBS) for Parkinson's disease leads to objective improvements in motor symptoms, activities of daily living and quality of life. However, some patients may be dissatisfied with the overall outcome of surgery despite significant improvements in objective outcomes. This may in part be influenced by patients' expectations. The aim of this study was to explore patients' expectations and satisfaction with DBS surgery for Parkinson's disease.

Method: A patient satisfaction questionnaire was posted to 20 consecutive patients who underwent STN DBS for Parkinson's disease at King's College Hospital during 2008 to 2011, 6 months after surgery. Additionally the PDQ-39 questionnaire was administered to the same patients on the eve of surgery and posted to patients with the satisfaction questionnaire 6 months after surgery. The PDQ-39 questionnaires contained an additional instruction to record the expected improvement from surgery on both the preoperative questionnaire and postoperative questionnaires.

Results: The response rate was 90%. For the satisfaction questionnaire, the mean VAS scores for satisfaction with surgery, how the information provided before surgery prepared the patient for surgery, and how much surgery had met patients' expectations were 73%, 82% and 76% respectively. 89% of patients felt they had made the right decision about surgery. 72% of patients said they would recommend the procedure to other patients. Patients who had low satisfaction scores also had low expectation scores (i.e. felt that surgery had not met their expectations). The results for the expected and actual improvements in PDQ-39 scores are analyzed separately.

Conclusion: The majority of patients are satisfied with surgery 6 months postoperatively, felt they had made the right decision about surgery, felt adequately prepared for surgery and that they could recommend the procedure to others. Patients with high expectations tended to have lower satisfaction scores, suggesting that addressing patients' expectations may be an important factor that influences the success of STN DBS surgery for Parkinson's disease.

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COMBINED DBS AND ITB TREATMENT FOR DYSTONIA SECONDARY TO CEREBRAL PALSY

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Introduction: Several medical and surgical therapies have been applied in the treatment of patients with secondary dystonia due to cerebral palsy (CP). We report on the results of a new treatment option in patients with medically refractory dystonia secondary that is the combined use of Deep Brain Stimulation (DBS) and Intrathecal Baclofen (ITB) Therapy.

Methods: From 2007 to 2011, 20 patients with dystonia secondary to CP were implanted a baclofen pump in our department. Patient dystonia was evaluated with the Barry-Albright Dystonia (BAD) scale. At two-year follow–up, two of them were considered as candidates for DBS in order to be offered further clinical benefit. Patient 1 was a 30 year-old non-ambulatory male with disabling dystonic symptoms affecting all body parts. Patient 2 was an ambulatory 24 year-old male with disabling symptoms affecting mainly the neck and the upper extremities. In both patients, dystonia was markedly improved by delivering high daily doses of baclofen intrathecally, 800 and 600μgr, respectively; score in BAD scale was reduced from 32 to 27 (patient 1) and from 29 to 23 (patient 2). Bilateral chronic stimulation of globus pallidum internus (GPi) was offered in both patients via a rechargeable, constant-current, implantable pulse generator (IPG) in an one-stage procedure.

Results: In Patient 1, a further reduction in the BAD scale (from 27 to 23) was achieved by DBS GPi. Patient 2 experienced a more complicated course. During his admittance for the DBS procedure, he was reoperated due to abdominal wound dehiscence at the place where ITB pump was implanted. Postoperatively, meningitis due to Staphylococcus epidermidis was manifested. Following systematic intrathecal administration of vancomycin 8mg/day for 3 months, it was made it possible to preserve the implanted ITB system; however, during this period, it was necessary baclofen daily dosage to be kept to a minimum effective level (80μg). At latest follow-up assessment, one-year after DBS procedure, the BAD scale score was slightly improved (from 23 to 21). However, further clinical improvement may be anticipated because both the baclofen dose and the DBS settings are still at the titration phase. For instance, his daily baclofen concentration is currently only 300μgr compared to the 600μgr daily dose that was proven effective before DBS GPi. Notably, the relatives report a substantial improvement in the patients' activities of daily living and quality of life.

Conclusion: It is generally accepted that ITB therapy is an effective treatment for refractory secondary dystonia. Despite the limited number of patients studied in our series, our preliminary data suggest that, in severe cases of dystonia secondary to CP, DBS of Gpi may offer additional clinical benefit to that already obtained by ITB therapy.

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DBS FOR DYSTONIA, EXPERIENCES OF 40 CASES

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Background: Bilateral pallidal deep brain stimulation (DBS) is an established treatment option for primary generalized and segmental dystonia. In the present study we evaluated the results of our dystonia patients treated by DBS.

Methods: The surgical results of forty consecutive dystonia patients underwent DBS implantation were analyzed (age: 43,7±17,7 years; sex: 22 men; etiology: 24 primary and 16 secondary dystonia; topography: 24 generalized, 12 segmental and 4 hemidystonia; disease duration: 16,1±9,3 years). Severity of dystonia measured by Burke-Fahn-Marsden Dystonia Rating Scale (BFMDRS) and health-related quality of life measured by EQ-5D scale were obtained preoperatively and compared to the scores obtained at postoperative 6 months and subsequent yearly follow-ups. The average follow-up lasted 2.5 years (median, 0.5-8 years). In all cases the BFMDRS scores were re-evaluated by a rater blinded to the treatment. Treatment responsiveness was defined as an at least 25% improvement on the BFMDRS scores. Non-parametric Mann-Whitney, McNemar and Kruskal-Wallis tests were applied to test statistical significance.

Results: Severity of dystonia improved from 31 to 10 points (median, 68% improvement, $p<0.01$) in the primary dystonia group, whereas in secondary dystonia these changes were statistically insignificant (improvement from 40 to 31.5 points, 21.2%, $p>0.05$). However, the health-related quality of life significantly improved in both groups (primary dystonia: 0.378 vs. 0.788 and secondary dystonia: 0.110 vs. 0.388, $p<0.01$). Significantly more patients in the primary dystonia group responded to DBS treatment than those in the secondary dystonia group (83.3% vs. 37.5%, $p<0.01$).

Conclusion: Our results are in accordance with previously published international findings demonstrating that DBS is a highly effective and long-lasting treatment option for primary dystonia. DBS is considerably less efficient in secondary dystonia; however, it still has a high impact on the quality of life presumably due to its pain-relieving effect.

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GPI OR SUBTHALAMIC DEEP BRAIN STIMULATION FOR HOLMES´ TREMOR: HOW TO CHOOSE THE BEST TARGET

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Holmes´ tremor is a rare neurological condition characterized by resting, postural, and intention tremor in the 3 – 5 Hz frequency band, which is not as rhythmical as other tremors. Rest tremor is present as long as the patient is awake and still, and when a voluntary movement is attempted, an intention tremor of the same frequency as the resting component appears. It is therefore a severely disabling disease, since patients no longer find any symptomatic relief, in any position or activity. Moreover, many of these patients have additional neurological comorbidities, secondary to the primary disease (e. G. brainstem stroke), that worsen their quality of life even more.

Tremor is generally is secondary to a lesion in the brainstem, at the junction of the mesencephalon and diencephalon, thalamus or cerebellum, specifically involving cerebellar dentate outflow and the nigrostriatal pathways. The causative lesion might also be located at cortical and other subcortical loci as well. Thus, since regarding lesion location, the terms rubral or midbrain are actually misleading, the term Holmes´ tremor has got wide acceptance.

Tremor control is a difficult challenge, since this disorder might not improve with multiple pharmacological treatments. Surgery is explored in some refractory cases with good outcomes using ablation or Deep Brain Stimulation (DBS) of the Thalamic Vim nucleus as the most common target. Recently, our group has been approaching this disorder by choosing the internal segment of the Internal Globus pallidus (Gpi) or thalamosubthalamic junction area according to preoperative tractography and intraoperative microelectrode recording and stimulation. Relevant anatomy and pathophysiology is reviewed.

A series of nine, with severely disabling symptomatic Holmes´ tremor, refractory to medical therapy is presented, with long term follow up (1 - 9 years). Preoperative and postoperative videos are shown and discussed.

All patients benefited out of DBS, with no complications or definitive adverse effects. Seven were operated in the Gpi and two in the subthalamic area.

Regarding informed consent, it is important to emphasize on expected results and above of all, that this surgery is intended for tremor control. This is particularly true because these patients very often have poor quality of life because of non – remitting tremor and accompanying neurological comorbidities, like paresis, cerebellar or cranial pair syndromes.
DBS for Holmes´ tremor is a safe and efficacious treatment method for refractory cases.

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FUNCTIONAL NEUROSURGERY FOR SECONDARY DYSTONIA: INDICATIONS AND LONG TERM RESULTS

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Dystonia is a movement disorder characterized by patterned, repetitive, phasic, or tonic sustained muscle contractions that produce abnormal, often twisting, postures or repetitive movements. When the disorder is genetic or the cause is unknown and dystonia is the sole feature, the disease is called primary or idiopathic. Secondary dystonia (SD) is an entity with different clinical expression, etiologies and response to treatment.

Primary and SD often show poor response to medical treatment, whereas primary focal dystonias are well controlled by medical treatment. For refractory cases neurosurgical procedures are offered, however SD shows less and more variable results than primary dystonia to neurosurgical procedures: treatments offered to one type may be absolutely not helpful to other cases.

A 36 patient series with secondary dystonia is presented, separating the statistic and clinical analysis in several etiology groups: perinatal insults (generalized early onset dystonia, hemidystonia, cerebral palsy), tardive syndromes, and other syndromes. The importance of separating the SD forms is that treatments are offered to patients with a reasonable degree of success. Treatment response to brain procedures is different if brain circuitry is intact or not, we propose to separate SD in two main types, accordingly: 1. Brain motor circuits intact: the disease process has not damaged the anatomy in a significant way as to be demonstrable in anatomical or functional neuroimaging. Patients with tardive syndromes and some with perinatal insults (non cerebral palsy patients), some genetic syndromes and hemidystonic patients if there is no overt or gross abnormality in the basal ganglia are included. This group should benefit out of DBS as the first alternative. 2. Brain motor circuits not intact: cases are included when significant anatomical alterations are seen in the basal ganglia. Patients with hemidystonia should receive a DBS trial, whereas in the cerebral palsy group an intrathecal baclofen trial should be the first step. Non-responders are managed with DBS trial is offered.

Gpi is our first target when tonic component predominates. In cases with dystonic tremor or not responding to Gpi DBS, we propose Vim (Ventralis Intermedius nucleus), Vop (Ventralis Oralis Posterior nucleus) or subthalamic DBS. For specific cases cortical areas or other deep nuclei and the internal capsule, can be tried.

A classification and grading system is proposed for patients with SD according to preoperative evaluation of semiology, causes and neuroimaging. The importance of separating the SD according to anatomical integrity is that treatments will be offered to patients with a reasonable degree of success. Genetic information will surely add to the prognosis and to the decision making process.

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REFLECTIONS ON PIONEERING SURGICAL TREATMENT OF PARKINSON DISEASE, IN LISBON IN THE SIXTIES

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Although the authors are performing deep brain stimulation for the treatment of Parkinson disease they think that it is important to review the initial thalamotomies done 53 years ago in Lisbon. Between 1959 and 1966, 105 thalamotomies were done at the Hospital dos Capuchos. As the Levodopa therapy became the mainstay treatment, the surgical therapy progressively decreased from 1962 to 1966.

The surgeons Vasconcelos Marques and Pais d'Athaíde, guided by ventriculography, used a Cooper needle to perform the thalamotomy. The results of more than half of the patients were considered good or very good.

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BEHAVIORAL AND ELECTROPHYSIOLOGICAL VALIDATION OF A ROTENONE-INDUCED RAT MODEL OF PARKINSON'S DISEASE

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Introduction: The 6-hydroxydopamine (6-OHDA) Parkinson (PD) rat model is based on specific dopamine depletion in the nigrostriatal pathway, which leads to hyperactivity of the subthalamic nucleus (STN). Chronic rotenone injections similarly lead to loss of dopaminergic neurons in the nigrostriatal pathway but in addition also to loss of cholinergic neurons in the pedunculopontine nucleus (PPN), which has been thought to underly certain components of parkinsonian gait. We here evaluated the motor disability and the extra cellular neuronal firing activity of the STN in the rotenone rat model of PD.

Methods: Male Sprague Dawley rats were treated with chronic rotenone injections (2.5 mg / kg bodyweight, i.p.) for 60 days. Control rats received vehicle injections. After the end of the treatment motor coordination was assessed by using the Rotarod test. Thereafter, single unit activities and local field potentials were recorded in the STN in urethane 1.2 g/kg anesthetized rats.

Results: Rotenone injected rats spent significantly less time on the Rotarod as compared to vehicle treated rats. Further, electrophysiological data showed a higher firing rate and higher beta oscillatory activity in the STN.

Conclusion: Similar as in 6-OHDA injection we found enhanced STN neuronal firing rates as well as increased beta oscillatory activity, key features of PD, in this model. The rotenone-induced rat model of PD should deserve further attention since it covers more aspects than just the dopamine depletion.

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6-OHDA LESIONS OF THE DORSOLATERAL STRIATUM DIFFERENTLY AFFECT NEURONAL DISCHARGE ACTIVITY PATTERNS IN THE MEDIAL AND LATERAL SUBTHALAMIC NUCLEUS

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Retrograde 6-hydroxydopamine-induced lesions of the motor associated dorsolateral striatum differently affect neuronal discharge activity patterns in lateral and medial parts of the rat subthalamic nucleus.

Objective: Lesions of the rat nigrostriatal dopamine (DA) system by injection of 6-hydroxydopamine (6-OHDA) lead to abnormal neuronal activity in the basal ganglia (BG) motor loop similar to that found in Parkinson's disease (PD). In the BG motor loop the subthalamic nucleus (STN) represents an important structure, which, however, also comprises areas of the BG associative and limbic loops. We were interested whether neuronal activity would differ between the STN associative-limbic and motor part, and whether selective 6-OHDA-induced lesions of the dorsolateral striatum, the entrance region of the BG motor loop, would have a different effect on these subregions.

Methods: In male Sprague Dawley rats 6-OHDA or vehicle was bilaterally injected in the dorsolateral striatum for lesions (n = 12) or sham-lesions (n = 10) of the nigrostriatal DA system. Four weeks later neuronal extracellular single-unit activity and local field potentials were recorded in the medial associative-limbic and the lateral motor part of the STN in urethane anaesthetized rats.

Results: In sham-lesioned rats the discharge rate and burst activity was higher in the lateral compared to the medial STN. After 6-OHDA lesions the burst activity was enhanced, while the discharge rate was not affected. Similar effects were found for other neuronal activity measures (coefficient of variation of interspike interval [ISI], skewness, kurtosis, and approximate entropy [ApEn]). In addition, in 6-OHDA-lesioned rats β-band oscillatory activity was enhanced, with no difference between the medial and lateral STN.

Conclusion: We found important differences of neuronal activity between the associative-limbic and the motor part of the STN, indicating functional segregation of this region. However, selective 6-OHDA lesions of the dorsolateral striatum had a pronounced effect on the medial STN subregion, indicating that in the rat manipulation within the BG motor loop is integrated with the other loops either within the STN itself or upstream of this region.

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CLINICALLY SILENT CEREBRAL ISCHEMIA AFTER DBS SURGERY

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Introduction: Early postoperative magnetic resonance imaging (MRI) using diffusion weighted imaging was performed to assess the incidence of cerebral ischemia as a complication of stereotactic functional neurosurgery.

Methods: 25 patients undergoing deep brain stimulation (DBS) for Parkinson's disease, essential tremor, or dystonia were included in the study. Target structures were the subthalamic nucleus in patients with Parkinson's disease, the globus pallidus internus in dystonia patients, and the nucleus ventralis intermedius thalami in tremor patients. Multiple tract microelectrode recording was performed using 3 to 5 trajectories before implantation of DBS electrodes. DBS electrodes were implanted bilaterally in 24 patients after a trial of test stimulation. Unilateral implantation of DBS electrodes into the globus pallidus internus and the nucleus ventralis intermedius thalami was performed in one patient with hemidystonia and action tremor. All patients underwent postoperative computed tomography (CT) on postoperative day one. Early postoperative MRI was performed using T1 weighted, T2 weighted, and diffusion weighted imaging (DWI) on postoperative day 2 to 30.

Results: In all patients postoperative CT was negative for signs of cerebral ischemia. Early postoperative MRI using DWI showed DWI signal alterations consistent with cerebral ischemia along five of fifty implanted electrodes. The patients with ischemia did not show any clinical deficits or conspicuity of their postoperative clinical course. Clinically, the group of five patients with ischemia benefited equally from DBS surgery as the group without ischemia.

Discussion: Early postoperative MRI including DWI sequences is highly sensitive to cerebral ischemia. CT could not detect small areas of cerebral ischemia in the vicinity of the implanted electrodes. Perioperative cerebral ischemia may presently be an underreported complication of DBS surgery, because postoperative MRI using ischemia sensitive DWI is not routinely used in the postoperative follow-up of DBS surgery.

Conclusion: MRI performed postoperatively detects cerebral ischemia more sensitively than CT. However, small infarctions along the electrode tracts seem to remain clinically silent and without consequences for the success of surgery.

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EVALUATION OF THE CONTINGENT NEGATIVE VARIATION POTENTIAL THROUGH VISUAL AND AUDITORY TASKS ON BRADYKINETIC PATIENTS WITH PARKINSON'S DISEASE AFTER UNILATERAL PALLIDOTOMY

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Introduction: According to numerous authors apparently bradykinesia is not only a motor but also a perception symptom. The contingent negative variation (CNV), a slow negative potential shift related to preparation of a response has been studied as non-clinical test regarding motor and perceptual functions in patients with Parkinson's disease (PD) exhibiting bradykinesia. Nevertheless the effect of surgical treatment for PD on CNV is limited.

Methods: Patients, whose predominant symptoms were unilateral bradykinesia and rigidity, were evaluated in OFF periods with the UPDRS III, neuropsychological tests, and CNV go/no-go recordings to visual and auditory tasks, at the preoperative stage and six months after pallidotomy. The later was performed with stereotactic Riechter-Mundinger (Inomed, Germany) at GPi. The radiofrequency lesion was performed using N50 equipment (Inomed, Germany) for 90 seconds at 80 degrees Celsius. Statistical analysis was performed with SPSS V. 17 trough T student tests.

Results: Ten patients (5 male) 57.7 ± 3.16 years, scoring UPDRS III 30.90 + 2.74 underwent unilateral pallidotomy. No statistical difference was found between the early and late components of the CNV elicited with auditory tasks. In contrast, visual CNV showed statistical difference ($p \leq 0.05$) for the early and late components at both, baseline and postoperative evaluations.

Conclusions: Pallidotomy is a safe procedure and still an option to improve PD symptoms. The CNV potential is a reliable tool to investigate sensorial and motor functions. Although, CNV usefulness to investigate motor symptoms in PD patients is questioned, particularly in cases where bradykinesia complaint is the primary motor function impaired.

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DEEP BRAIN STIMULATION FOR THE TREATMENT OF PRIMARY DYSTONIAS AND DYSKINETIC CEREBRAL PALSY

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Introduction: DBS of the globus pallidus internus (GPi) is efficient and safe on primary dystonias, but its benefit on dyskinetic cerebral palsy (DCP) is less clear.

Methods: The objective of this study is to report a series of patients with primary dystonia and DCP with no or mild cognitive and pyramidal deficits, submitted to DBS in our hospital. Dystonia was assessed using Burke-Fahn-Marsden Dystonia Movement and Disability (BFMDMD) scale, before and after surgery. All operated patients with a follow-up of at least 6 months were included in the study.

Results: Twelve patients underwent surgery (6 female; mean age 42 years-old; mean disease duration 29 years): Nine had generalized dystonias, 2 segmental (craniocervical and craniocervical plus trunk) and 1 a cervical dystonia. Six were idiopathic (3 generalized, 2 segmental, 1 cervical), 5 DCP (generalized) and 1 secondary to hypoxia (generalized). No one had positive tests for DYT1 or DYT11 and 2 wait DYT6 tests. One patient with idiopathic dystonia was implanted to treat status dystonicus. All patients were implanted bilaterally, 11 in GPi and 1 in sub-thalamic nucleus due to previous bilateral pallidotomy. No adverse events occurred. Eight had a follow-up 36 months: 4 idiopathic cases (1 generalized, 2 segmental, 1 cervical), 3 DCP and 1 hypoxic. Mean improvement score was 45.1% (primary dystonia 49.3%; secondary dystonia 34.5%) in BFMDMD motor function and 46.3% in disability subscale (primary dystonia 57%; secondary dystonia 27.5%). Two are on DBS monotherapy; in all other patients the medication was reduced.

Conclusions: Although less efficient than in primary dystonias, DBS-GPi is a safe and useful procedure in treatment of DCP (at least in short term follow up) for patients with minimal cognitive and pyramidal involvement.

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PALLIDAL DEEP BRAIN STIMULATION FOR SEGMENTAL DYSTONIA: IMPACT ON GAIT

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Objective: To measure subtle changes of gait parameters induced by bilateral chronic deep brain stimulation (DBS) of the globus pallidus internus (GPi) in patients with segmental dystonia pre- and postoperatively using computerized gait analysis.

Background: GPi DBS has been established as an effective and safe therapy for dystonia. In general, side effects are rare, but there is increasing evidence that GPi DBS in dystonia can induce hypokinetic symptoms like micrographia or freezing of gait, sometimes even the full clinical picture of parkinsonism.

Methods: We prospectively analyzed different parameters of normal gait in 10 consecutive patients (mean age 57.81/-14.3 years) with segmental dystonia but without involvement of lower trunk or legs who were treated with bilateral GPi DBS. Using a computerized gait analysis system with pressure sensitive insoles, walking distance (in 20s), cadence, step length and step duration were measured preoperatively (pre-OP) and at a median of 7 months post DBS surgery. None of the patients had typical capsular side effects, and only one patient reported mild gait disturbances with GPi DBS. Statistical analysis used Students t-test for paired variables.

Results: While walking distances were comparable pre- and post-OP (mean1/-SD 21.21/-2.7 m vs. 20.21/-2.5 m; p 50.14), mean step length significantly decreased from 60.01/-6.9 cm pre-OP to 54.31/-6.4 cm with GPi-DBS ($p<0.01$). In consequence, cadence significantly increased from 105.61/-9.2 steps/min pre-OP to 111.31/-11.4 steps/min with GPi DBS ($p<0.05$), and step duration was slightly reduced post-OP (0.571/-0.05 s pre-OP vs. 0.541/-0.06 s with GPi-DBS; $p<0.05$).

Conclusions: With chronic bilateral GPi DBS, patients with segmental dystonia showed a mild change in gait pattern with reduced step length and increased cadence. We postulate that this phenomenon reflects a disturbance of basal ganglia function in terms of a mild hypokinesia of gait. Given the other recently reported hypokinetic effects of GPi-DBS in dystonia like micrographia or freezing of gait, a general alteration of neuronal activity in striato-pallido-thalamo-cortical pathways following chronic stimulation of the posteroventral lateral GPi leading to hypokinesia of different aspects of motor function can be presumed.

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BODY WEIGHT CHANGES AFTER DEEP BRAIN STIMULATION FOR DYSTONIA

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Objective: To analyse the evolution of body weight following bilateral chronic deep brain stimulation (DBS) of the globus pallidus internus (GPi) or the thalamic ventral intermediate nucleus (VIM) in patients with segmental or generalized dystonia.

Background: In patients with Parkinson's disease (PD) significant weight gain following DBS of the GPi or the subthalamic nucleus (STN) has been reported and attributed to multiple factors like the reduction of motor symptoms, changes in eating behaviour or metabolic alterations. In a recent study, severe body weight gain could be observed in some patients with primary cervical dystonia following STN-DBS, but no systematic analysis of body weight changes following DBS in patients with dystonia has been reported so far.

Methods: The body weight of 17 consecutive patients with segmental or generalized dystonia (mean age 54.6+/-16.1 years) who were treated with bilateral DBS of the GPi (n=14) or the VIM (n=3) was measured preoperatively (pre-OP) and at three follow-up (FU) time points post DBS surgery (post-OP). The median FU1 was 7 months, FU2 17 months and FU3 72 months post-OP. To evaluate outcome of DBS, the Burke-Fahn-Marsden motor (BFM) score was determined pre-OP and at all FU examinations. Statistical analysis used non-parametric Wilcoxon rank test for paired variables and Spearman rank correlation analysis.

Results: Mean body weight pre-OP (SD) was 64.6kg (14.1kg) and increased stepwise to 68.7kg (13.1kg) at FU1, 69.9kg (13.4kg) at FU2 and 70.9kg (12.7kg) at FU3 ($p<0.01$ at all three FU compared to pre-OP). Relative body weight gain in percent at FU3 was correlated with the body mass index (BMI) at baseline ($r=-0.53$; $p=0.035$) and, for trend, with the BFM motor score at baseline ($r=0.45$; $p=0.072$), but not with improvement of BFM motor score at FU3, age, and disease duration at DBS.

Conclusion: Chronic bilateral DBS in patients with segmental or generalized dystonia is associated with significant body weight gain, in particular during the first six months post-OP. This probably is a result of improvement of dystonic involuntary movements and changes of eating behaviour, possibly related to reduced orofacial dyskinesias.

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DEEP BRAIN STIMULATION IN DYSTONIA: DOES AETIOLOGY MAKE THE DIFFERENCE?

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Introduction: In patients with dystonia, response to deep brain stimulation (DBS) of the globus pallidus (GP) is not uniform. Aetiology of dystonia, among other features, has been invocated as a key prognostic factor.

Methods: Retrospective analysis of our DBS treated dystonia patients' database. Demographic and clinical features, aetiology, and adverse events were recorded. Efficacy was measured by the change in the severity of dystonia one year after DBS (Burke Fahn Marsden scale, BFM) and clinical global impression (CGI 1-7). Statistical methods: descriptive statistics and SPSS statistical software.

Results: Thirty patients, 15 male, were treated. Mean age at the onset of dystonia was 18.2 years (1-69), mean duration of the disease before DBS was 32.8 years (9-72). Dystonia was generalised in 87% of the patients. In 52% of the patients dystonia was secondary, in 48% was primary (two of them DYT1 positive). Two patients had been previously treated with lesional surgery. One year after DBS, 80% of the patients had very much or much improved (CGI<2), and significantly improved in the BFM score ($p=0.01$). No significant differences were found between primary and secondary dystonia outcomes (93% and 80% of good or partial response respectively). DYT1 patients had the best responses. One of the patients with previous surgery had a good response to DBS. No worsening after DBS was recorded in any patient. Two patients had infections that made removal or change of the device necessary.

Conclusions: DBS of the GP was equally safe and effective in both primary and secondary dystonia, and may be a therapeutic option in patients with previous surgery.

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UNILATERAL DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS FOR PARKINSON'S DISEASE

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Introduction: The aim of this study was to assess the results of unilateral deep brain stimulation (DBS) of the subthalamic nucleus (STN) for the treatment of idiopathic Parkinson's disease (PD).

Methods: The clinical series consists of 31 consecutive PD patients. The patients underwent unilateral magnetic-resonance imaging-guided STN DBS. All procedures were performed under local anesthesia. The STN was confirmed only by macrostimulation. All patients were assessed according to a modified Core Assessment Program for Intracerebral Transplantation. The patients were assessed preoperatively and at 6, 12 and 18 months after surgery. 25 patients were followed for 18 months.

Results: Medication off/stimulation on total UPDRS motor scores were improved by 29 % when compared to the baseline medication off motor scores. The contralateral motor scores improved by 54 %, ipsilateral motor scores by 14 %, whereas the axial motor scores by 33 % in medication off/stimulation on condition. The duration and severity of levodopa induced dyskinesia were reduced by 78 %. The daily levodopa dose was decreased by only 15 %.

Conclusion: Unilateral STN DBS is a safe and effective procedure for selected patients with medically refractory PD motor symptoms. Unilateral STN DBS may be a sufficient treatment for patients with asymmetry of PD symptoms. Patients with advanced age may gain more benefit from unilateral STN DBS than simultaneous bilateral STN DBS which can be associated with higher chance of postoperative confusion and dysarthria.

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CEREBELLAR STEREOTACTIC STIMULATION - ITS IMMEDIATE CLINICAL AND EEG RESPONSES

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Stereotactic stimulation of anterior lobe of cerebellum has been used in our department for symptomatic treatment of spasticity and dyskinesias in 43 patients suffering from cerebral palsy. Higher current than applied for therapeutic stimulation is accompanied by profound somatomotor and behavioral responses.

The association of this motor and behavioral responses with EEG changes were studied. We examined two patients, 12 years old.

During stimulation, which evoked pleasure feeling, EEG showed significant increase in high frequency i.e. beta range. The changes in the lower frequency ranges were variable but significant. Overstimulation which elicited unpleasant feelings and pronounced pathological postural changes was associated with large increase of the EEG magnitude of the frequencies (delta and theta). The changes in the alpha and beta ranges showed significant increase only in one of the patients.

The finding of this study support idea of the profound neuromodulatory influence of the cerebellum on the brain functions.

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A SINGLE CENTER 12 YEAR EXPERIENCE OF INTRATHECAL BACLOFEN THERAPY

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Introduction: Intrathecal baclofen (ITB) therapy has become an appealing option for the treatment of spasticity of both cerebral and spinal origin. The purpose of this study is to evaluate the effectiveness and safety of this method after 12 years of growing application in several subgroups of patients in our institution.

Methods: We retrospectively reviewed our series of patients treated with ITB between 2000 and May 2012 in our hospital. 240 patients (135 male- 105 female with a mean age of 38.5y) underwent pump implantation for ITB therapy. The underlying cause of spasticity was cerebral palsy (30%), traumatic brain and traumatic spinal injury (28%), multiple sclerosis (22%) and other pathologies (20%) such as hereditary spastic paraplegia. In regard to the complications we have divided them into 3 main groups: 1) surgical procedure related (meningitis/ local infection/ subcutaneous fluid collection/ CSF fistula) 2) hardware related (pump malfunction/ pump rotation/ catheter torsion/ catheter fracture/ catheter dislocation/ catheter kinking) and 3) baclofen related (overdose/ deprivation/ tolerance).

Results: In all subgroups of patients we documented a significant reduction in the Modified Ashworth scale ($p < .05$). The most frequent observed complications were the subcutaneous fluid collection (20 cases, 8.3%) and catheter fracture/dislocation (20 cases, 8.3%). All 20 patients with catheter related complications were re-operated. Of the 20 patients with the subcutaneous collection, 16 were managed conservatively, whereas 4 had to be re-operated due to refractory fluid accumulation necessitating a pump removal in two of them. Two severe complications were noted, both of them being meningitis. There was no case of severe withdrawal or overdose syndrome. Throughout these years 5 patients were not satisfied by the therapy and underwent a pump removal.

Conclusion: Intrathecal baclofen therapy appears to be a safe and efficient treatment option for patients with medically refractory spasticity. We outline, in accordance with the literature, that the main issue of the therapy is the catheter's inherent sensitivity to kinking, migration or fracture.

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MRI-GUIDED DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS: CORRELATION OF POSTOPERATIVE 1.5T MRI WITH POST MORTEM 9.4T MRI AND HISTOPATHOLOGY

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Introduction: Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an established procedure for patients with advanced idiopathic Parkinson's disease (PD). Anatomical location of active stimulation contacts is most accurately determined with postoperative stereotactic MRI., Post-mortem examination of the brain provides additional details. This report uses 9.4T MRI and histopathology to documents electrode location in a single patient who had received bilateral MRI-guided STN DBS without microelectrode recording (MER).

Patient and Methods: A 67-year-old patient with idiopathic PD underwent surgery for DBS of the STN under local anaesthesia using a MRI-guided targeting and macro-electrode stimulation. Postoperatively, the patient experienced transient agitation and increased dyskinesia lasting for a few hours. Postoperative MRI documented lead location within the subthalamic nuclei and high signal consistent with oedema along the length of the DBS leads. Chronic stimulation provided moderate improvement in both motor and quality of life scores. After death at age 74, the brain was examined with MRI at 9.4T, followed by gross and microscopic histological analysis.

Results: On the right the lead trajectory was seen to traverse the centre of the STN; on the left it traversed the medial part of this nucleus. Both electrode tracks were surrounded by a small amount of collagen, gliosis and a mild chronic inflammatory infiltrate that may represent the long term histological correlate of the perioperative MRI changes. There was no evidence of neuroparenchymal tissue damage secondary to high frequency stimulation.

Conclusions: Our findings demonstrate that lead artefact location on postoperative 1.5T MRI corresponds well with anatomical location as determined on subsequent 9.4T MRI and histological examination.

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PREDICTORS OF 5-YEAR FUNCTIONAL OUTCOME IN PARKINSON'S DISEASE AFTER CHRONIC BILATERAL STN STIMULATION

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Although long-term effects of bilateral SubThalamic Nucleus stimulation (STNs) on motor symptoms are currently well-known, a detailed prediction of functional outcome after longstanding chronic STNs in Parkinson's disease (PD) is not yet available.

Objectives: to describe functional outcome predicting factors and disability after five-year chronic STNs in PD subjects.

Methods: Forty-five consecutive PD patients (age at surgery 60.2 ± 6,9 years, disease duration: 12,1 ± 3,3 years) were yearly assessed for 5 years after bilateral STN implant. Motor symptoms were evaluated with (ON) and without (OFF) levodopa treatment, with and without bilateral stimulation. Disease-related ADL disability (UPDRS-II score), neuropsychological and mood evolution were comprehensively studied. A stepwise regression was applied in order to find predictors of changes in both UPDRS III and UPDRS-II scores at the 5th follow-up (T5) with respect to pre-surgical assessment (T0). To this scope, the Delta UPDRS was calculated: [(T0 UPDRS score – T5 UPDRS score)/ T0 UPDRS score]x100. Independent variables were chosen among T0 values of the following: age, response to L-DOPA challenge, UPDRSIII (OFF med), UPDRS-II, a few UPDRS subscores (speech, dysphagia, gait, freezing, falls, tremor, dyskinesia duration), MMSE, FAB, phonological word fluency, attention tasks.

Results: At T5: (i) STNs still exerted therapeutic effects on motor symptoms (UPDRS III) that were improved by 48% in ''OFF'' drug with respect to T0 pre-surgical "off"; (ii) activity of daily living (UPDRS II) improved by 25%; (iii) the severity of levodopa--related motor complications was decreased by 70% and LEDD was reduced by 65%. Cognitive performance slightly declined, with verbal fluency significantly worsening. Dysphagia, drooling, hypophonia and apathy emerged as newly referred symptoms in around 20% subjects. Response to L-DOPA challenge was the only predictor of DELTA UPDRS III score ($F=4.9$, $p=.04$). Pre-surgery UPDRS IV dyskinesia duration score, UPDRS II speech and gait sub-scores, phonological word fluency, attention task and MMSE scores were the variables in the model for DELTA UPDRS II ($F=35.54$; $p<.0001$).

Conclusions: Pre-surgery axial symptoms and cognitive level are the best predictors of 5-year disability progression under chronic STNs; L-DOPA challenge response is the best predictor of STNs effect on motor symptoms in the long-term.

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EFFECTS OF GLOBUS PALLIDUS INTERNUS DBS ON QUIET STANCE IN PRIMARY MULTISEGMENTAL DYSTONIA: PRELIMINARY DATA

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Introduction: Aim of the work is the evaluation of primary standing in a subclass of patients affected by multisegmental dystonia, without prominent clinical involvement of inferior limbs and not significant impact on gait and quiet stance. The efficacy of Globus Pallidus Internus (GPi) DBS for primary generalized dystonia is well described in literature and good long--term follow-up have recently been reported also for multisegmental dystonia [1,2]. However, improvement in posture with decrease of postural sway length of COM was recently described just in a single patient affected by generalized dystonia [3].

Materials and Methods: Four patients affected by multi-segmental dystonia (cranio-cervico-brachial dystonia) and treated with GPi DBS were selected for the first part of this study. All the patients underwent to bilateral GPi DBS implantation under local anesthesia and with intra-operative monitoring, in order to obtain the best neurophysiological and clinical targeting and avoiding post-operative stimulation-related side-effects. The patients were tested in the Gait Analysis laboratory preoperatively and at 12-months after surgery in stimulation-ON condition. All the patients were evaluated with video-BFMDRS. Subjects stood barefoot on a force plate (KISTLER) for three trials of one minute of quiet stance with eyes open. A movement analysis (VICON 460 Oxford Metrics) system with six video cameras recorded the kinematics of body segments. The quiet stance variables extracted from the center of pressure (COP) data included: sway dispersion, calculated as the root mean square distance (RMS) of the COP; and sway frequency, calculated as the centroid frequency of COP. The differences between pre and post DBS were analyzed with Wilcoxon Rank test. Level of significance was set to 0.05.

Results: The mean improvement of total motor-BFMDRS for the four selected patients was 52,6% (SD±11) and the mean improvement of total disability-BFMDRS was 75,6% (SD±10,3). Sway dispersion was significantly reduced after surgery ($p=0.02$) in respect to the pre-operative. Sway frequency was slightly reduced by GPi stimulation. However, this differences didn't result statistically significant.

Conclusions: The results of this preliminary experience show a possible efficacy of GPi stimulation in reducing the amount of postural sway in multisegmental dystonia, supporting also the previously reported evidences [1,2] of clinical improvement at long-term follow-up for all the patients according to the motor- and disability-BFMDRS. These preliminary data seems confirming the positive impact of GPi DBS on quite stance even if more data are needed to confirm and improve these evidences.

References:

1 - Sarubbo S, Latini F, Quatrale R, Sensi M, Granieri E, Cavallo MA. Five-year follow-up of 10 patients treated with globus pallidus internus deep brain stimulation for segmental or multisegmental dystonia. Stereotact Funct Neurosurg. 2012; 90(2): 84-91.
2 - Sensi M, Cavallo MA, Quatrale R, Sarubbo S, Biguzzi S, Lettieri C, Capone JG, Tugnoli V, Tola MR, Eleopra R. Pallidal stimulation for segmental dystonia: long term follow up of 11 consecutive patients. Mov Disord. 2009 Sep 15; 24(12): 1829-35.
3 - Nakao S et al.: Gait and posture assessments of a patient treated with deep brain stimulation in dystonia using three-dimensional motion analysis systems. J Med Invest. 2011 Aug; 58(3-4): 264-72.

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LOCALIZATION OF THE SUBTHALAMIC SENSORIMOTOR REGION BY ANALYSIS OF NEURAL POPULATION SYNCHRONY

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Introduction: Effectiveness of Subthalamic Deep Brain Stimulation (STN-DBS) for Parkinson's Disease (PD) is largely dependent on accurate electrode placement. The dorsolateral sensorimotor region of the STN has been evaluated as the optimal stimulation site. Moreover, increasing evidence suggests that subthalamic oscillatory synchronization in the beta frequency band is a critical pathological feature in PD. We hypothesized that analysis of longitudinal synchronization of the subthalamic oscillatory activity could assist identification of the sensorimotor part of the STN during intraoperative electrophysiological monitoring.

Methods: We analyzed the distribution of synchronization through the assessment of standard and phase coherence between the single-unit activity and the high-frequency background activity at steps ranging from 0.5 to 1 mm in 14 microelectrode recording (MER) trajectories obtained from 7 patients with PD. Background activity reflects the multi-unit spiking activity of the local population in the neuron's immediate vicinity embodying the network's co-activity at a microscopic scale. At macroscopic scale, we stepwise assessed standard and phase coherence between single-unit activities recorded from two parallel trajectories 2mm apart. Additionally, we estimated the spatial correlation of the maximum coherence site with the anatomical target location.

Results: The dorsolateral oscillatory region of the STN was marked by a striking increase in neuronal coherence in the beta band in 10 out of 14 tracks (71%), yet in only 2 of 7 pairs (29%) of parallel MER trajectories. The site of maximum local neuronal coherence in the beta band verged on the anatomical target position by -0.078± 0.5286 mm (mean ±SD). Contrariwise, as the microelectrode descended to the ventral region of the STN, a remarkable decrease in beta-band synchronization or increase in gamma–band synchronization was observed.

Conclusions: Quantitative analysis of local synchronization of the subthalamic oscillatory activity during intraoperative electrophysiological monitoring yields new adjunctive information for the delineation of the sensorimotor region of the STN. Furthermore, the site of maximum beta oscillatory synchronization of the local neuronal populations along the STN seems to adequately point to the final target location during DBS surgery.

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GAMMA KNIFE SUBTHALAMOTOMY FOR PARKINSON'S DISEASE : A PROSPECTIVE STUDY

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Objectives: To assess the tolerance and effecay of Gamma Knife subthalamotomy in disabling Parkinson's disease.

Background: Chronic STN stimulation is an established treatment for complicated PD. Bilateral subthalamotomy may induce significant and long-lasting results when DBS is not available. However, which alternative can be proposed for patients with surgical or medical contraindications for electrodes implantation? Gamma Knife thalamotomy is an effective therapy for treating disabling tremor. This technique encounters very few contraindications as it is done without craniotomy. We report here the preliminary results of two patients with severe PD who were included in the study assessing the tolerance and efficacy of STN Gamma Knife radiosurgery.

Methods: Two PD patients with severe motor complications were assessed before surgery. Although, both had a good motor response to levodopa without emerging axial symptoms or cognitive impairment, STN DBS was contraindicated. Patient 1, a 53-year-old man (disease duration: 7years) had a severe diabetes mellitus with vasculopathy at the MRI. Patient 2, a man aged of 57 years (disease duration 11 years) had severe vasculopathy. A unilateral Gamma Knife subthalamotomy on the most affected side was proposed. Each patient gave his informed consent. MR imaging was performed in stereotactic conditions. STN targeting was achieved with Leksell Gamma unit with a single exposure through a 4 mm collimator helmet. The GKS dose at the maximum was 110 Grays.

Results: Unfortunately, patient 1 died of massive stroke 6 months after the radiosurgical procedure. However, he reported slight motor improvement 3 months after surgery. Patient 2 had mild dyskinesia at 3 months. The 6 months assessment showed an improvement of his UPDRS motor score with no increase of dyskinesia (45% improvement of the "off-dopa" motor score). The dopaminergic treatment was reduced and the continuous Apomorphine infusion could be stopped. The MRI showed typical gamma knife induced ring-enhancing lesion within the STN.

Conclusion: These preliminary results show that Gamma Knife subthalamotomy is feasible in patients with severe Parkinson's disease. It may be an alternative treatment in case of contraindication for STN DBS.

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DEEP BRAIN STIMULATION FOR PKAN- RELATED DYSTONIA

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Objective: Treatment of symptoms related to Neurodegeneration with Brain Iron Accumulation (NBIA) is difficult and frequently ineffective. The authors present a group of patients treated with deep brain stimulation for PKAN-related dystonia.

Methods: 11 patients with confirmed PANK2 mutation (NBIA-PKAN) were treated with deep brain stimulation. Age of the patients varied from 6-31 years. The clinical condition of the patients was Global Dystonia Scale (GDS). At 9 cases the permanent electrodes were implanted to the subthalamic nuclei (STN) and in 2 to the globus pallidus (GPi). The target was identified with direct and indirect method. Intrasurgical macrostimulation and microrecording were used for neurophysiological evaluation of the target. Postsurgical local field potentials were recorded in all cases.

Results: Neither neurological deterioration nor surgical complication were reported among the group. Caregivers of the patients noted subjective improvement of the clinical state of the subjects that was confirmed with tailored scales. There was no significant difference in improvement between STN and GPi group.

Conclusions: STN and GPi deep brain stimulation reduces dystonic movements among PKAN patients. The technique carries minimal surgical risk, and improves quality of life of the patients.

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MANAGEMENT OF HARDWARE-RELATED INFECTIONS IN DEEP BRAIN STIMULATION: WHAT TO DO?

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Introduction: One of the most distressing hardware-related complications of deep brain stimulation (DBS) is infection of the device. The incidence of infection related to DBS reported in the literature ranges from 0.4 to 22.2%. There is currently no consensus about the best treatment, removal or should first antibiotic treatment be applied with approximately 50% success rate. One important factor for decision-making from the perspective of the health care provider is the cost of each choice. Here, we calculated the costs of each choice using a bottom-up costing procedure.

Methods: Through a bottom-up costing procedure, costs of both different strategies are established. A decision analytic model is used to establish average cost per patient representative for a clinical setting where both strategies are employed. Subsequently, a sensitivity analysis is performed that mimics various clinical scenarios. Each scenario represents a set of clinical assumptions regarding the relative number of patients eligible for each treatment strategy and the effectiveness of antibiotics treatment.

Results: Although treatment with antibiotics alone is significantly less expensive than surgical intervention, under base-case conditions, average cost per patient is comparable to the cost of a single treatment with surgical intervention. Only when relatively high proportions of patients with DBS hardware infections can be appointed to and effectively treated with antibiotics alone can substantial cost savings be realized.

Conclusion: Treatment with antibiotics alone is an equally valuable strategy in addition to surgical intervention in the clinical management of certain cases of DBS hardware infections.

MOVEMENT DISORDERS - TRANSPLANTATION:

TRANS-EURO CONSORTIUM

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INCLUSION AND ASSESSMENT CRITERIA FOR THE OBSERVATIONAL AND TRANSPLANTATION STUDY IN PARKINSON PATIENTS

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Introduction: In order to provide a control group for intracerebral interventions without a sham surgical procedure, a larger control group than group undergoing intervention, has been recruited. This cohort is followed longer than the intervention group. Candidates for an investigation study are randomly enrolled from the larger cohort, of which 50% will undergo transplantation surgery and 50% further detailed evaluation. Careful clinical characterization of the clinical course of this cohort is thought to provide a large reference group, to which the course of a smaller interventional group may divert and provide statistical more powerful comparison.

Methods: Inclusion criteria in brief are disease duration less than 10 years, no L-dopa induced dyskinesias and age less than 65, and Parkinson's disease according to disease criteria including medication effects. Exclusion criteria are atypical forms of parkinsonism, prior neurosurgery and significant L-dopa induced dyskinesias. Evaluation included determination in defined off, ie at least 12 hours after last anti-parkinsonism medication, and after a drug challenge of 150% of the regular morning dose of L-dopa. Videotapes are made for subsequent rating by independent and to treatment blinded evaluators. A battery of ratings scales and neuropsychological tests are administered, along with fMR and MR. A larger test battery is administered at inclusion, +12, +24 and 36, and a smaller battery at +6, 18, 30 months. Treatment is according to "best medical practice" but limited to regular medication, and is closely monitored.

Results: The observational cohort is recruited at 7 centers in the UK, Sweden and Germany, and aim for 160 cases; at present more than 120 are recruited, with a follow-up period of 12 months in about 40 patients.

Conclusion: The observational cohort is a partly new concept for functional neurosurgical interventional studies, to provide a cohort that will reflect the course of disease. The group is recruited with the general inclusion criteria for the surgery, and will provide a statically larger sample for comparison with a smaller group. The degree of placebo effect can be observed by comparing the observation group, the non-operated transplant group and the grafted patients. The study design will provide more detailed information of the impact of interventions than previously.

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CRITICAL PRE-CLINICAL STUDIES TOWARDS ESTABLISHING THE FINAL PROTOCOL FOR THE TRANSEURO CLINICAL TRIAL OF NEURAL TRANSPLANTATION IN THE TREATMENT OF PD

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Introduction: The TransEuro project is an EU funded, 5-year, multicenter clinical trial using human fetal dopaminergic (DA) neuronal cell treatment for Parkinson's disease (PD). The consortium's objectives are to show that optimized protocols can positively impact on the consistency and efficacy of the current DA cell therapy, including the reduction/elimination of off-state graft-associated dyskinesia, as well as leading the way to future clinical trials in neurodegenerative diseases including stem cell-based therapies. To this end, significant parts of the pre-clinical work were consecrated on improving the procedures leading up to the transplantation of the cells into the patient.

Methods: Work Packages 1 and 3 set out to establish and validate the donor age window of using human fetal ventral mesencephalon (hVM) tissue from both medical and surgical terminations of pregnancy (MTOP/ STOP), and to develop hibernation protocols for transportation, storage, preparation and transplantation of tissue. Dissection parameters for hVM tissue were looked at in view of identifying inclusive and exclusive regional specific markers, as well as to study the impact of non-DA cells in 6-OHDA rodent models of graft induced dyskinesia (GID). Risk factors for developing GID, such as prior exposure to L-DOPA or the age of the recipient, were also investigated. Importantly, we have developed a novel protocol based on serial tissue washing steps – intervening at different stages of the cell preparation procedure - that results in microbiological decontamination of hVM, or of rat VM when tested in a model system with high concentrations of defined microbe solutions containing representative bacteria and fungus species.

Results: Relying on specific examples from members of the consortium, the presentation will demonstrate how various experimental studies have contributed to the final TransEuro protocol concerning optimal tissue source and treatment, including hibernation, washing, and dissection, as well as in aspects relating to patient selection.

Conclusions: As set out in the original application, the TransEuro consortium adapted and validated all aspects of the tissue harvesting, treatment and preparation protocols so that they comply with the GMP requirements without compromising the scientific standards.

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PET- AND MRI-BASED EVALUATION OF THE NATURAL COURSE OF PD AND FOLLOWING TRANSPLANTATION OF FETAL DOPAMINERGIC NEURONS

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In vivo functional imaging has provided to be an objective measure to assess rate of loss of dopaminergic nigro-striatal terminals which strongly correlated with clinical impairment in Parkinson's disease (PD). Moreover, it also can provide objective evidence of the effects of restorative therapies. Clinical trials with the use of positron emission tomography (PET) have shown that human dopamine-rich foetal ventral mesencephalic tissue grafted in the striatum of PD patients can survive, grow and release dopamine producing motor symptom relief, and also that they can restore brain activation related to movement. PET studies have aided in the elucidation of the pathophysiology of serious adverse effects, so called graft-induced dyskinesias. With the use of newly established radioligands, PET techniques could help to improve PD patient selection in future clinical trials by selecting those with better predicted outcomes. Moreover, PET could help monitoring post-operational inflammatory processes around the grafted tissue and the effect of immunosuppression. Functional and structural MRI techniques could help to better assess the integration of nigral graft with the host brain by assessing the restoration of brain activation during movement, and of functional and structural connectivity. This knowledge should lead to the development of new, optimised in vivo imaging protocols that could help to better schedule, monitor and modify the clinical outcomes of future human trials assessing the efficacy of foetal or stem cell therapy in Parkinson's disease.

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NEW APPROACHES WITHIN THE ETHICS OF CLINICAL TRIALS: THE ETHICAL GOVERNANCE OF TRANSEURO FROM FOCUS GROUPS

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In democratic societies, science cannot succeed without strong societal and political support, social understanding and the resulting social legitimacy. This is especially true for the potentially contentious use of fetal tissue for research, and therapeutic approaches related to it. The ethical governance strategy of TRANSEURO is based on systematic literature research and active social scientific research following the empirical turn in bioethics.

In qualitative social scientific research focus groups are defined as carefully planned series of discussions, in which 5-10 people discuss a topic led by a skilled moderator, who is not pressuring participants to reach consensus. In this sense we rigorously investigate not only what patients and their relatives know and think about the treatment options in Parkinson's disease (PD) and especially the transplantation of fetal dopaminergic cells, but also why they do so and what kind of emotions and fears are expressed. We have conducted and recorded seven 1,5/3-hours-long focus groups in Freiburg/Germany with in total 48 participants (26 female, 22 male, aged 41-84) in February 2012 that generated 500 pages of text.

Based on our first hermeneutic analysis we draw the following preliminary conclusions: patients are extremely competent ("PD-experts"), and they do have a clear and realistic perspective of their condition and treatment options. Their relationship with caretakers and relatives is close and "symbiotic" and also patients in age groups over 70 and 80 seem to be very well informed, deliberate and clear in their argumentation. In general the Freiburg patients are highly active and self-organized. Furthermore the trust in the physician plays a fundamental role and the patients and patient group members are very well informed about TRANSEURO. Participants of the focus groups expressed their ethical objections concerning the origin of the fetuses and personal risks; however, there is a desperate search for any treatment that works, almost under all conditions. Finally the treatment expectation seems to create a natural barrier to the idea of control groups and sham surgery is strongly rejected.

At this point it seems that the TRANSEURO clinical protocol corresponds with patients' expectations and preferences concerning a PD trial. In order to contextualize the results and to generalize them further we will compare the empirical data with additional focus groups that are currently conducted in Lund/Sweden and Cambridge/UK.

MOVDIS – T / O / 316

TRANSPLANTATION STRATEGIES IN PD PATIENTS

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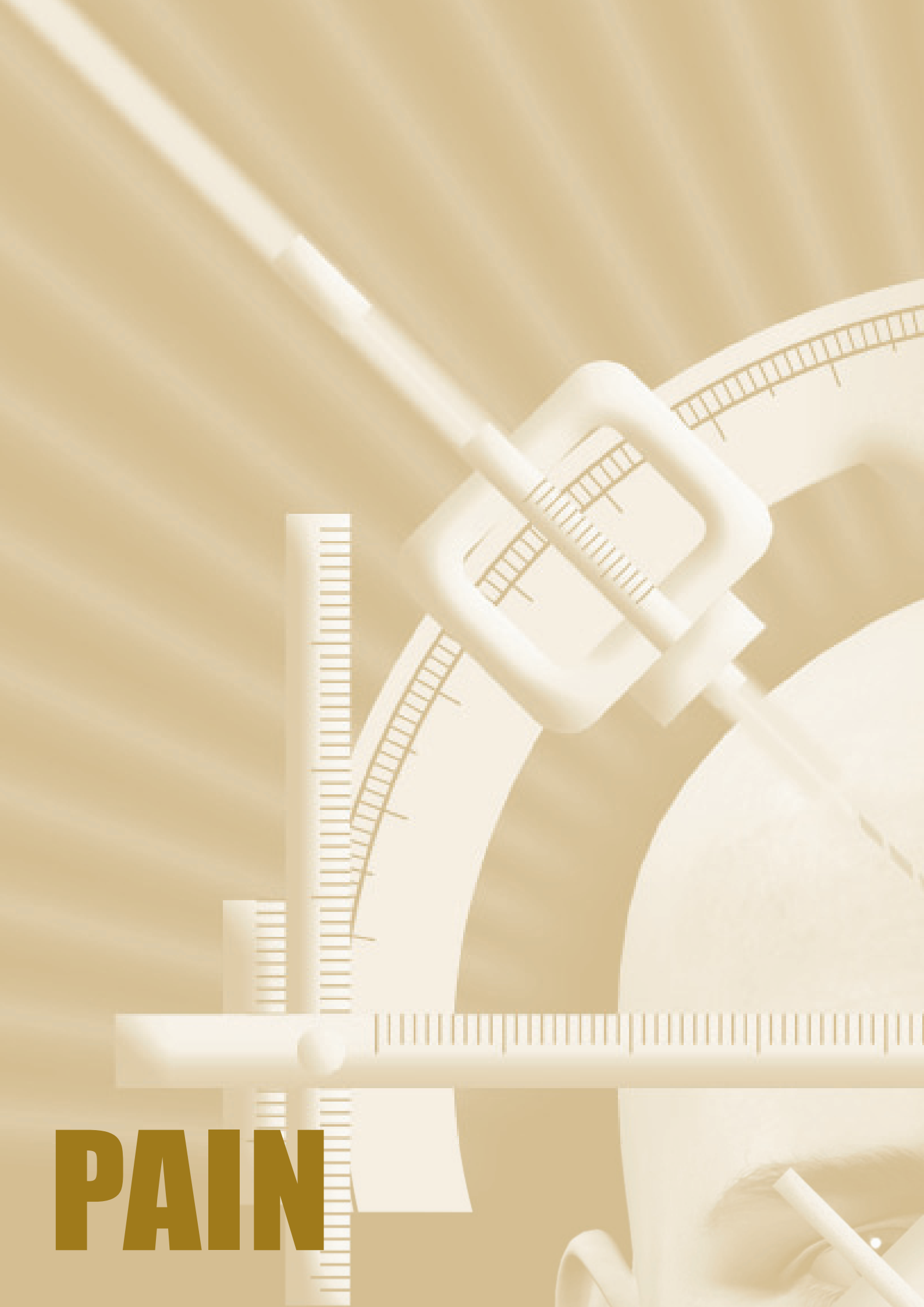
Parkinson's disease is a degenerative disease with severe motor symptoms provoked by the death and disappearance of the dopaminergic cells of the substantia nigra, which results in loss of dopaminergic innervation of the striatum. Pharmacologic therapy with Levodopa and agonists for replenishing the lack of transmitter is, at least, in the beginning efficient to reduce the symptoms, but after some years medication often becomes inefficient and triggers undesired side effects. Therefore, neurosurgical interventions are highly warranted.

Lesional surgery including stereotactic heat lesions like pallidotomy, thalamotomy and subthalamotomy has now been replaced by Deep Brain Stimulation (DBS) as routine procedures to give symptomatic relief while more curative directed treatment principles are under assessment. These include the possibilities for replacement of the lost dopaminergic cells and reinnervation of the striatum by cell transplantation. One principle is to transplant cells that produce and release dopamine diffusing into the tissue in close vicinity acting as a kind of local internal pharmacologic factories. The Transeuro project is based on our earlier experiences with grafting of human fetal cells. The aim is to re-establish a physiologic reinnervation with cell to cell communications by synaptic transmission. Since animal experiments indicated that outgrowths from cells transplanted to the substantia nigra did not reach striatum, the putamen is chosen as the main target for grafting. The surgery is performed using an MRI-guided stereotactic technique with the Rehncrona-Legradi transplantation instrument for the delivery of cells to the putamen. Five separate tracks for each putamen will be used to ensure as homogeneous reinnervation as possible. The neurosurgical technique was earlier used for fetal cell grafting in 18 patients in 32 procedures with a total of 195 tracks without any haemorrhages, infections or other surgical complications. A detailed description of the neurosurgical technique will be given. A similar technique may also be useful in possible future clinical transplantation trials of stem cells or genetically engineered cells.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NEW INSIGHTS IN THE ROLE OF DESCENDING INHIBITION IN EFFECTS OF SPINAL CORD STIMULATION ON NEUROPATHIC PAIN

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Introduction: In the last decades, research on the mechanisms of spinal cord stimulation (SCS) has mainly focused on spinal segmental mechanisms activated antidromically by current applied to the dorsal columns. Several segmental inhibitory circuits have been described: GABAergic, cholinergic, adenosinergic, etc. Lately, however, studies of supraspinal circuitries activated by SCS have progressed considerably.

Methods: The studies were carried out on rodent models of neuropathic pain. The suppression of signs of neuropathy by SCS applied via chronically implanted miniature electrodes have been studied in animals some of which had dual stimulation systems located at the dorsal column (DC) nuclei level (rostral) and on the lumbar cord (caudal), in rats with DC lesions or intact. Microelectrode recordings from different brain stem areas have been performed and different receptor active drugs have been administered i.t., i.p. or via indwelling chronic brain stem cannulas in order to further explore the biochemical mode of SCS action.

Results: The studies indicate that in SCS responding animals there is a neuronal activation of the so-called OFF cells in the rostroventral medulla and the decending serotonergic axons projecting to the spinal dorsal horn where they act via 5-HT2, 5-HT3 and 5-HT4 receptors. The activation of 5-HT3 receptors appears to operate via spinal GABAergic interneurons. SCS also produces an activation of the principal noradrenergic brain stem nucleus, locus coeruleus. The suppressive effects of both rostral and caudal SCS is retained, though attenuated, in animals with chronic lesions of the DCs, and receptor antagonists may differently counteract the SCS effects.

Conclusions: SCS partially operates via a spinal-brain stem-spinal loop involving a direct activation of suprasegmental mechanisms, which interact with spinal segmental interneuron circuitries.

Key words: neuropathic pain; spinal cord stimulation; brain stem: rostroventral medulla; dorsal columns; serotonin; rat.

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PREVIOUS MICROVASCULAR DECOMPRESSION DECREASE THE CHANCES OF PAIN FREE IN PATIENTS TREATED WITH GAMMA KNIFE RADIOSURGERY FOR TIC

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Object: The authors sought to establish whether the safety-efficacy of Gamma Knife radiosurgery (GKRS) as a second treatment for intractable trigeminal neuralgia (ITN) are influenced by prior microvascular decompression (MVD) which remains, for some of the authors, the reference technique.

Methods: Between July 1992 and November 2010, 737 patients have been operated with GKRS for ITN and prospectively evaluated in Timone University Hospital in Marseille, France. Among these, 54 patients had a previous MVD history. Radiosurgery using a Gamma Knife (model B or C or Perfexion) was performed relying on both MR and CT targeting. A single 4 mm isocenter was positioned in the cisternal portion of the trigeminal nerve at a median distance of 7.6 mm (range 3.9-11.9) anteriorly to the emergence of the nerve (retrogasserian target). A median maximum dose of 85 Gy (range 70-90) was delivered. Are further analyzed only 45 patients with previous MVD and a follow-up longer than one year (the patients with megadolichobasilar artery compression and multiple sclerosis were excluded).

Results: The median age in this series was 56.75 years (range 28.09-82.39). The median follow-up period was 39.48 months (range 14.10-144.65). All the patients had a past history of surgery, with at least one previous failed MVD, but also a radiofrequency lesion (RFL) in 16 (35.6%) patients, balloon microcompression in 7 (15.6%) patients and glycerol rhizotomy in 1 case (2.2%). Thirty-five patients (77.8%) were initially pain free in a median time of 14 days (range 0, 180). Patients from this group had less probability of being pain free compared to our global population of essential trigeminal neuralgia without previous MVD history (p=0.010, hazard ratio of 0.64). Their probability of remaining pain free at 3, 5, 7 and 10 years was 66.5%, 59.1%, 59.1% and 44.3%, respectively. Twelve patients (34.3%) initially pain free experienced a recurrence with a median delay of 31.21 months (range 3.40-89.93). The hypoesthesia actuarial rate at 1 year was 9.1% and remained stable till 12 years with a median delay of onset of 8 months (range 8-8).

Conclusions: Retrogasserian GKRS proofed to be safe and effective on the long-term basis even after failed previous MVD. Even if the initial result of pain free was of only 77.8%, the toxicity was low with only 9.1% hypoesthesia. No patient reported a bothersome hypoesthesia. The probability of maintaining pain relief in long-term was of 44.3% at 10 years.

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GAMMA KNIFE IRRADIATION OF THE SPHENOPALATINE GANGLION IN THE SELECTED PAIN SYNDROMES

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Introduction: Various facial pain syndromes with the maximum in the orbital and retroorbital region are accompanied by vegetative symptomatology. The neurosurgical interventions in the trigeminal nerve have not been successful in these pain syndromes. Therefore we have focused on the sphenopalatine ganglion (SG) and targeted it for Gamma knife surgery (GKS).

Material and Methods: Between 1999 and 2012 we irradiated SG in 20 patients. Here we present 18 of them with a sufficient follow-up. Patients have suffered from: atypical /AN/ (7 patients) and postherpetic trigeminal neuralgia /PHN/ (1 patient) in the 1st trigeminal branch, migraine (2 patient) and trigeminal autonomic cephalalgia /TAC/ (8 patients). For GKS we applied Dmax 80 – 90 Gy. A pain decrease under 50 % of the original intensity was considered as a successful treatment.

Results: Initial successful rates of pain relief were reached as follows: AN – 4 patients (57%) after 2 months (mean, SD±1.2), PHN – 1 patient during 1 month, migraine – 2 patient during 1 month, TAC - 7 patients (87%) after 3 months (mean, SD±2). A recurrence of pain has appeared in 2 AN patients (50 %) after 6 months, in 1 PHN patient after 25 months, in 1 TAC patients (14%) after 9 months.

Conclusion: SG proved to be an effective target for GKS of selected cranial neuralgias. Especially, the results of TAC with a high successful rate and a low number of recurrences emerged as very promising. Unfortunately a small number of cases does not allow the statistical evaluation.

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MOTOR CORTEX STIMULATION IN THE TREATMENT OF NEUROGENIC PAIN SYNDROMES

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Objectives: We aim to present the outcomes of MCS for the treatment of severe deafferentation pain in our institution.

Material and methods: Totally 22 patients were undergone to implantation of epidural electrodes over the central sulcus region from 2005 until 2011. There were 12 males and 10 females, aged 29 – 56 years. In case of positive trial stimulation in 20 of them the neurostimulator was subcutaneously implanted. Of the 22 patients 5 had facial anesthesia dolorosa related to different destructive procedures on the trigeminal nerve branches, in 2 of these 5 patients, trigeminal neuralgia had previously occurred within the multiple sclerosis. 7 patients had severe deafferentation pain in the arm due to traumatic brachial plexus injury with development of total (2 cases) or medium paralysis (5 cases). In one patient (female) pain occured after neurinoma excision at the level C6-Th2 and increased 1 month after DREZtomy. 3 patients suffered from poststroke pain syndrome (PSP). Another 3 patients had phantom limb pain: in the arm only (2 cases) and in the right arm and leg (1 case). Finally one patient (female) suffered from reffered pain due to traumatic spinal cord injury (C6 vertebra fracture complicated by tetraparesis). Pain intensity was evaluated with Pain and Quality of Life Card (PQLC) based on 10-point Visual Analog Scale (VAS). In all patients repetitive transcranial magnetic stimulation (rTMS) of central cortex contralateral to the pain territory was performed as a trial preoperative test. 15 patients achieved more than 50% pain relief, that lasted for 30 min to 36 h.

Results: In 17 patients good outcomes were achieved both in immediate postoperative period and in long-term (up to 48 month) follow-up. Pain had improved by 35 to 70% in comparison with baseline. All 17 patients have stopped to use opiates. Loss of MSC effect was observed several months later in 3 cases: one patient with traumatic spinal cord injury and two patients with complete avulsion of brachial plexus. In general our results agree with the data from the leading clinics, using MCS technique.

Conclusions: Chronic epidural motor cortex stimulation is effective technique for the treatment of severe neurogenic pain. Expression of psychogenic aspect of pain syndrome and deafferentation significantly influence on efficacy of MCS. When expression of these factors is insignificant, clinical outcomes seem to be better and longer. MCS efficacy less depends on sensory deficits, but correlate directly with degree of motor deficit. The less motor deficit presents in the painful zone, the more beneficial effect is achieved with MCS. Preoperative rTMS outcomes in general correspond to ones of chronic MCS. However, direct correlation is not always noted.

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MANAGEMENT OF MEDICALLY INTRACTABLE GENITOFEMORAL AND ILIOINGUNAL NEURALGIA

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Objective: This is a prospective study of 20 patients with genitofemoral and ilioinguinal neuralgias who were treated at our medical center between 2007 and 2011. Procedures in these neuralgias and postoperative pain outcomes were evaluated.

Methods: Patient histories, physical examinations, visual analogue scale scores before and after treatment were analyzed prospectively.

Results: This study includes 9 cases with genitofemoral, 8 cases with ilioinguinal, and 2 cases with combined genitofemoral and ilioinguinal neuralgias. All patients were under medical treatment. Genitofemoral and ilioinguinal nerve blocks were performed in all cases after medical treatment had failed to alleviate the patients' pain. In eight patients one nerve block application, in four patients two and in two patients three nerve block sessions were applied. Six of the patients whose pain did not improve with nerve block application underwent neurectomy surgery resulted in pain relief. Mean follow-up time was 11 months (range 6 to 18 months).

Conclusions: For patients with medically intractable genitofemoral and ilioinguinal neuralgias, nerve blocks and neurectomies provided favorable early postoperative pain control.

Key words: neuralgia, neural block, neurectomy, genitofemoral, ilioinguinal

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SPINAL CORD STIMULATION PLACEMENT GUIDED BY INTRA-OPERATIVE CENTRAL H-REFLEX

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Objectives: Demonstrate that spinal cord stimulators (SCSs) could be placed under general anesthesia (GA) and to demonstrate that the proposed evaluation method activated structures in the dorsal columns which is the structure that SCS initially activates.

Materials and Methods: Data was retrospectively analyzed from 172 electrodes implanted with spinal cord SCSs at the Lahey clinic between September 2008 and July 2011. All patients had their SCS placed under GA. EMG was recorded from upper or lower limb muscle groups related to the placement of the stimulator electrode. Lateralization was performed based on EMG responses and electrode pairs stimulated. In a select group of patients standard neurophysiologic tests, paired pulse and collisions studies, were performed to demonstrate the test stimuli was activating the dorsal columns.

Results: 155 patients had standard thoracic or cervical SCS placement. Pre-operatively this cohort of patient had a VAS of 7.51+/-1.93 while postoperatively the VAS was 3.63+/- 2.43 (a reduction of 52.11%). Based on the EMG recording technique the electrodes were repositioned in 15.9% of patients. The recovery time (initial around 70 mSec and complete at around 150 to 300 mSec) in both the paired pulse tests and the collision studies showed that the stimulation used to elicit the CMAPs came from antidromic activation of the dorsal columns and not the cortico-spinal tract.

Conclusion: GA SCS is safe and appears at least as accurate and efficacious as using the awake SCS placement technique based on a 50% improvement in the VAS. In addition the technique presented herein demonstrates that the test stimuli activate the same fiber tracts as that of the therapeutic stimulation.

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LONG-TERM OUTCOME OF RADIOSURGERY FOR ESSENTIAL TRIGEMINAL NEURALGIA: A PROSPECTIVE SERIES OF 130 CONSECUTIVE PATIENTS WITH MORE THAN 7 YEARS OF FOLL

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Background: Radiosurgery (RS) is one of the surgical alternatives for trigeminal neuralgia (TN). Although acceptable short/mid-term outcomes have been reported, long-term outcomes have not been well-documented.

Methods: We report the long-term results in 130 consecutive patients who underwent RS for drug-resistant essential TN between 1992 and 2001, and that were evaluated prospectively by means of clinical testing and a survey for at least 7 years after the procedure (up to 15 years). Pain attack frequency and severity, trigeminal nerve functions were evaluated before radiosurgery and regularly after. RS using a Gamma Knife was performed relying on both MR and CT targeting. A single 4 mm isocenter was positioned at the cisternal portion of the trigeminal nerve with a median distance of 8 mm (range 4.9 -14) anteriorly to the emergence of the nerve (retrogasserian target). A median maximum dose of 85 Gy (range 70-90) was delivered.

Results: The median age was 66.5 years (range 28.76-88.98). At the time of radiosurgery, 68 of the patients were presenting with side effects of drug therapy, 48 were previously treated by other surgical techniques and 29 were presenting hypesthesia due to a previous surgery. The median follow-up period was 118.4 months (range 84.16-174.1). The median time between onset of the symptoms and radiosurgery was 72.25 months (range 1-387.5). One hundred and twenty-two patients (93.84%) were initially pain free in a median time of 15 days (range 0-180) after the procedure. Their probability of remaining pain free at 3, 5, 7 and 10 years was 77.9%, 73.8%, 68% and 51.5%, respectively. Fifty-six patients (45.9%) that were initially pain free experienced at least one recurrence with a median delay of 73.06 months (range 0.91-150.06). However, the rate of patient free for any recurrence requiring a new surgery was 67.7% at 10 years. The hypoesthesia actuarial rate at 7 years was 20.8% and remained stable untill 14 years, with a median delay of onset of 12 months (range 0.5-65). A very bothersome facial hypoesthesia was reported in 1 patient (0,8%).

Conclusions: RS is a safe and effective treatment for TN, on a long-term basis and in a large population of patients. Although microvascular decompression remains the reference treatment in drug-resistant essential TN, the high probability of a long-lasting pain relief and the rarity of complications of RS suggest that this approach can be proposed as a first and/or second intention alternative.

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MECHANISM OF THERAPEUTIC BENEFIT WITH DORSAL COLUMN STIMULATION USING A COMPUTATIONAL MODEL OF THE SPINAL CORD WITH CLINICAL CORRELATION

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Introduction: Stimulation of axons within dorsal columns of the human spinal cord has become widely used therapy to treat refractory neuropathic trunk and limb neuropathic pain as well as other conditions. The mechanisms by which such stimulation achieves pain relief, have yet to be fully elucidated and better understanding may lead to more effective use of the therapy.

Methods: A computational model of three levels of the lumbar enlargement region in the human spinal cord involving over 300,000 individual neurons and over 42 million synapses was developed. The overall parameter space of the model circuitry was validated by reproducing well known reflex arcs (eg. H-reflex). In addition both a simulated 'pain' signal with topographically activated isolated c-fiber regions and a ' SC stimulation' field with topographically activated Ia fibers in the dorsal columns were modeled.

Results: The 'pain' signal drives analogous regions of laminae II and V wide-dynamic range (WDR) neurons while the 'stimulation' signal generated spatially select inhibition that ameliorated the pain-induced activity in the WDR cells. This effect was both amplitude and spatially selective.

Discussion: The subject model, the most sophisticated human spinal cord model yet created, allowed hypotheses regarding pain relief mechanisms to be tested and compared to clinical SCS therapies. Specific dynamic activity of spinal cord neurons is typically impossible to study by other means.

Conclusion: Future use of this complex dynamic computational model of the human spinal cord will allow further complex stimulation paradigms to be evaluated and understood prior to testing in patients.

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GAMMA KNIFE SURGERY FOR GLOSSOPHARYNGEAL NEURALGIA

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Introduction: Although Gamma Knife surgery (GKS) is widely recognized as an effective and minimally invasive treatment for intractable trigeminal neuralgia, it's role in glossopharyngeal neuralgia (GPN) has not been determined.

Methods: Between january 2002 and february 2011, nine patients with medically intractable GPN were treated using GKS. Indication for GKS was the presence of medically intractable GPN and patient refusal or contre-indication to microvascular decompression. Patients underwent preoperative investigation and were evaluated postoperatively with periodical assesment of pain relief and neurological function.

Results: The average age of the patient population was 64 years (range 49-83) and they presented with symptoms for an average of 49 months (19-104). Five patients had a vasculo-nervous conflict. Patients were treated with a dose ranging from 60 to 85 Gy targeted on the cisternal segment (n=2) or GlossoPharyngeal Meatus (GPM; n=7). Outcome was favorable with cure of glossopharyngeal neuralgia in 5 of 9 patients (66%) in the short-term (3 months) and a 55% long term cure rate. There were no neurological complications.

Conclusion: All patients, except one, that received a dose Superior to 75 Gy were cured at long-term follow-up using the GPM as a target. The only 2 patients that received GKS targeted on the cisternal segment were not cured of their GPN, however the dose was significantly lower at 70Gy. There were no neurological déficits of the lower cranial nerves. It will be necessary to investigate the optimal radiation dose and target of GKS in order to achieve long-term pain relief in GPN.

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PERCUTANEOUS BALLOON COMPRESSION FOR THE TREATMENT OF TRIGEMINAL NEURALGIA: CLINICAL EXPERIENCE WITH 80 PATIENTS

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Introduction: The aim of this study is to assess the surgical results and outcomes of a series of patients that presented with carbamazepine resistant trigeminal neuralgia and underwent percutaneous balloon compression regardless of etiology or previous surgery.

Methods: Eighty patients with symptoms of typical TGN were operated from January 2005 until December 2011. The operations were performed under general anethesia. The foramen ovale was entered with a Kirschner wire, over which a 14 G cannula was advanced. The Kirschner wire was then removed to allow the introduction of a no 4. Fogarty catheter to the Meckel's cave. The baloon was inflated for 3 minutes. Postoperatively, outcome was assessed as being satisfactory when the patient was pain free and medication free. Patients were offered microvascular decompression if at the end of the second postoperative week this outcome had not been obtained.

Results: The mean duration of the symptoms was 7,5 years and the mean age was 58 (range 18 to 85). The mean follow-up period was 43,7 months (range 4 to 88 months). 26 % of patients had a history of previous surgical interventions, including radiofrequency lesioning, microvascular decompression, and radiosurgery. In 37 patients (46 %) a single trigeminal division was affected, whereas in the other 43 patients (54 %) multiple divisions were affected. The ophthalmic division was involved in 30 %. Magnetic resonance imaging showed vascular compression in eight cases and a small tumor in one. Six patients had multiple sclerosis. A pear shaped balloon was obtained in 90 % of the cases. The rate of immediate pain relief was 93,7 %. All patients with multiple sclerosis were pain free. There was one case of abducens nerve palsy, and two cases of diminished corneal reflex all of which had resolved by the sixth postoperative month. Transient hypoesthesia and masseter weakness occurred in 80 and 8 % of the cases. After one year follow-up the recurrence rate was 22,5 %. Recurrence rates for the second, third and fourth year were 28,7%, 33,7% and 37,5 % respectively. Persistent but asymptomatic mild hypoesthesia was apperent in 14 patients (18 %) and mild masseter muscle dysfunction in two patients (2,6 %) by the end of the follow-up period. 24 of 30 recurrences underwent repeat surgeries. 15 patients were successfully treated with microvascular decompression, and nine patients preferred percutaneous techniques or gamma knife surgery.

Conclusions: Our results suggest that percutaneous balloon compression is a safe and efficacious procedure. As such, it is an attractive first line choice in the treatment of trigeminal neuralgia.

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FEASIBILITY, SAFETY AND PRELIMINARY RESULTS OF DBS OF THE THIRD VENTRICLE USING A FLOATING ELECTRODE TO TREAT CLUSTER HEADACHES

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The third ventricle (V3) is surrounded by various centers related to satiety, global homeostasis, hormones, sleep, memory and pain. However, accessing the V3 to stimulate its wall has not been studied and could have potential advantage to treat disorders related to dysfunction of the hypothalamus. Here we present our preliminary experience of V3 electrical stimulation using a floating DBS lead layed on the floor of the V3 to treat refractory cluster headaches (CH). We enrolled 5 patients suffering from CH in this prospective pilot study. Targetting was based on MRI that was fused with ventriculography. The target was as follow; AP: -1/4 of AC-PC length, laterality: midline; high: floor of the V3. Under general anesthesia, a stereotactic frame was placed and one electrode was inserted trough a right frontal entry point and was lowered into the lateral horn of the ventricle up to the anterior V3. Then, under tele-Xray ventriculoscopy guidance, the lead was oriented posteriorly and laid on the floor of the V3.

Results: insertion of the lead into the V3 required some technical adjustment but was feasible and safe. No complications occurred during surgery and during follow up. Acute stimulation induced transient blurring vision. Chronic, bipolar stimulation was set between1-1.5 v, 130 Hz, 90 µs. At one year follow up, 3/5 patients were pain free, 1/5 had 75% improvement and 1/5 was improved by 25 %. This proof of concept demonstrates the feasibility, safety and potential efficacy of V3-DBS using a transventricular road that could be applied for various diseases.

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PERCUTANEOUS BALLOON COMPRESSION VERSUS PERCUTANEOUS GLYCEROL RHIZOTOMY FOR THE TREATMENT OF TRIGEMINAL NEURALGIA

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Introduction: Percutaneous balloon compression (PBC) and percutaneous retrogasserian glycerol rhizotomy (PRGR) are two minimally invasive techniques for treating trigeminal neuralgia (TN). Both were described over thirty years ago and are now routine procedures around the world. However, no study has yet compared these methods on equal terms.

Method: Data from 129 PRGRs and 72 PBCs performed in Umeå between 1986 – 1999, and 2000 – 2010, respectively, on patients without previous history of surgery for their TN were analyzed. The indication for surgery did not differ between the two techniques. The patients were elderly, usually above 70 years old, or suffering from secondary TN due to multiple sclerosis. All patients were followed using the same protocol. At follow-up, a pain-free state was defined as pain free without medication for TN. Data from clinical examinations and electrical transcutaneous stimulation collected preoperatively and at two time points, early postoperatively and more than three months postoperatively, was analyzed to objectify changes in sensory function. A very late follow-up to assess the pain reliving effect was performed at up to 180 months. Side effects associated with each procedure were also reviewed.

Results: Duration of complete pain relief was not significantly different between the two techniques (median 24 months for PBC and 21 months for PRGR). Eight of the patients undergoing PRGR had undergone previous attempts where no glycerol had been injected due to technical complications. Increased sensory and pain threshold levels were observed postoperatively at electrical stimulation and standard clinical testing. Differences were less prominent at late follow up but still significant ($p<0.01$) for everything but pain threshold after PBC. Corneal sensibility was significantly affected by PRGR but not by PBC. Complication rates were generally low, except for dysestesia after PRGR, which occurred in 25% of the cases compared to 4% after PBC. However, the dysethesia was usually mild.

Conclusions: PBC and PRGR are both effective treatments for TN, and generally safe. PBC do however result in less cases of postoperative dysestesia and decreased corneal sensitivity, and we found no cases of technical failures associated with PBC in this series.

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CHRONIC PRECENTRAL STIMULATION FOR THE TREATMENT OF NEUROPATHIC PAIN. LONG-TERM RESULTS IN 50 PATIENTS

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Introduction: Stimulation of the precentral cortex in order to relieve chronic neuropathic pain is a valuable tool. Unfortunately no randomized controlled study has been performed yet. However, the ability to carry out a "patient-blinded" stimulation allows intraindividual testing during a stimulation trial or limited cross-over studies after implantation.

Methods: A prospective single-center observational study with a double-blinded testing trial. 52 patients were enrolled. A follow-up of more than 6 months is yielded in 50 patients with a maxiumum of 18 years (mean 8 years).

Results: Good or excellent results were seen in patients with circumscribed pain (trigeminal neuropathy 15/21 and plexus avulsion 6/9) more often than in patients with wide-spread pain as in post-stroke-pain (6/17).

Conclusions: Chronic precentral stimulation is an accepted neuromodulation technique among functional neurosurgeons. In order to become more generally and widespread known and reimbursed, a prospective multi-center trial is urgegently desired.

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NEW NEUROSTIMULATOR FOR PERIPHERAL NERVE STIMULATION

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Introduction: The peripheral nerve stimulation has been reported as a technique with numerous complications due to electrocatheter and implantable pulse generator. To evaluate the results of a new neurostimulation system intended to reduce the incidence of electrode fracture, and the implantation in the same painful segment of the limb.

Patients and methods: fourteen patients (8 females, 6 males) suffering from neuropathic pain due to damage of a limb nerve were implanted by neurostimulator Lightpulse 100 with quadripolar cylindrical electrocatheter (Neurimpulse, Rubano, Italy). The disease was in two patients a median damage on the carpal tunnel, in three patients a median nerve trauma, in four a ulnar trauma, in two a sural disease, in two a trauma of the tibial nerve, in one a surgical trauma of the mandibular nerve. The VAS scale was scored before and after the implantation.

Results: twelwe patients but two had improvement on VAS scale. The mean current output was 0.8 mAmph. The IPG implant in the same segment of the limb was reported by patients as confortable.

Conclusions: The generator could help solving the main problems described in literature by offering small size, light weight, minimum thickness. The output current appears to be lower than spinal cord stimulation with improvement on battery life.

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CUSTOM MADE ELECTRODE FOR INTRACTABLE TRIGEMINAL NEURALGIA

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Introduction: After 30 year involvement with trigeminal neuralgia (TN) and experience with multiple techniques from neurexhaeresis to tractotomy and every step in between, with most experience with Micro Vascular Decompression (MVD) and Gamma Knife radiosurgery (GK), we have a considerable group of intractable cases that were candidates for surgical partial rhizotomy (Dandy procedure) in the recent past. Transfacial electrode placement has proved effective, but is technical challenging. The possible advantage of direct placement of a new electrode around the trigeminal root through a standard suboccipital approach with standard Deep brain stimulation fixation techniques are investigated.

Methods: Patients with recurrent classical TN after multiple treatments, MVD and GK and/or percutaneous thermal rhizotomy, which failed to respond favorably to all medical regimens, were offered an experimental treatment before considering open surgical rhizotomy. After reopening the MVD craniotomy a new model circular electrode with 4 contacts inside (Custom made Medtronic 09037) was placed around the root. The elastic strength of the silicone material applies a gentle pressure on the nerve and keeps it in place. Through a small defect in the tightly closed and sealed dura mater the electrode is led through a small groove in the bone and here fixed with a metal plate covered with silicon tubing used for hydrocephalus shunts. A subgaleal pocket towards the vertex is made and the electrode connected to the external stimulation connecting cable that is pulled towards the top of the head. A temporary lumbar spinal drainage for three days prevents CSF leakage from the cranial wound. After an external trial period the pocket is opened, the external cable disconnected and an extension cable subcutaneously processed towards the opposite direction, where it is connected to a Prime Advanced pulse generator (Medtronic) in a subpectoral pocket just below the clavicle. The setting of the stimulation is then optimized using the standard external programmer Nvision.

Results: The two cases treated so far resulted in a good reduction of the pain in the first case without side effects and complete reduction of all medication. The second case was also relieved of the TN, but is still on medication for a new complaint after the removal of the surgical pad Ivalon during the introduction of the electrode. Hypesthesia and parethesia developed in the first division shortly after surgery that did not respond to the electrode stimulation.

Conclusions: Intractable TN can be successfully treated with direct neurostimulation of the root of the trigeminus with complete relieve of symptoms in patients with classical type TN that failed all other medical and surgical procedures with a lasting effect.

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TRIGEMINAL NEURALGIA - MICROVASCULAR DECOMPRESSION. SURGICAL EXPERIENCE OF 19 YEARS (1993-2012) FROM THE NEUROSURGICAL DEPARTMENT OF HUC-CHUC,PORTUGAL

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Introduction: Trigeminal neuralgia is a syndrome of neuropathic pain characterized by severe paroxysmal lancinating pain in one or more distributions of the trigeminal nerve. Microvascular Decompression (MVD) surgery for this cranial nerve compression syndrome offers a relatively low risk treatment oportunity generally with imediate relief and good results.

Methods: We presente a retrospective analysis of the surgical results and outcome of the 79 patients with typical and atypical trigeminal neuralgia submitted to microvascular decompression surgery between the years of 1993 and 2012 at a single institution and a review of the literature.

Results: The patients' ages were between 29 and 84 years; 43 (54,4%) women and 36 (45,6%) men, with mean duration of symptons of 7,1 years, predominance of both V2 and V3 territory of pain distribution (27 patientes, 33,8%) and 56 (70,9%) of the cases envolving compression of the trigeminal nerve by the superior cerebellar artery. 72 (91,1%) patients had significant relief of pain and only 5 (6,3%) patients requiered reintervention, (2 prosthesis dislocation, 3 "de novo" vascular contact). The early overall morbility was 10,1% and the late morbility was 2,5%.

Conclusions: MVD is still one of the most effective surgical procedures for trigeminal neuralgia with imediate partial or total pain relief in the great majority of patients and with low morbility.

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OCCIPITAL NERVE STIMULATION (ONS) FOR THE TREATMENT OF CHRONIC HEADACHE SYNDROMES

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Introduction: Migraine is highly prevalent along with the high percentage of treatment-refractory cases. ONS may provide pain relief for patients with otherwise refractory primary headache disorders. It is more generally applicable than other invasive methods. We investigated ONS in a series of patients to determine efficacy, complications and outcome.

Methods: We included a case series of 20 patients who had chronic headaches for a duration of 5.3 y who underwent ONS lead implantation (SJM, Octrode). Prior to surgery patients had received conservative and surgical therapies including antidepressants, occipital nerve blocks, opioids, cervical posterior fusion (one patient), without success. 9 patients suffered from chronic migraine, 1 had a history of thalamic infarction, 1 patient suffered from cluster headache, 4 patients complained tension headache and 5 patients with recurrent cervicozephalgia after spine surgery. Using a midline approach two octrodes were placed subcutaneously and positioned across the level of C1 using fluoroscopy. Leads were placed under general anesthesia and externalized for three days.

Results: Device dislocation was found in 3 cases. 16 patients mentioned significant relief of pain, so that they all underwent insertion of the generator (eon MINI, SJM), in 3 patients 30% pain reduction was achieved, one patient did not benefit. Decreases in pain led to an improvement in functional capacity during the 3 months follow-up after implantation. The mean VAS score changed from 8.2 ± 1.5 to 3.5 ± 1.3 at the 6 months follow-up. No complica occurred.

Conclusion: The exact mechanism of neuromodulation in the tratment of different headache syndromes remains unclear. ONS is safe and efficacious in the treatment of medically intractable headaches conditions. Further investigations are required to evaluate predictor for patient selection and sstimulation setting among this crucial pain conditions.

PSYCHO-SURGERY

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DEEP BRAIN STIMULATION (DBS) FOR THERAPY-RESISTANT MENTAL DISORDERS IN ITALY

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Introduction: DBS is an established treatment option for movement disorders and is currently being investigated for highly resistant psycho-affective disorders that are a significant source of worldwide disability. Deep brain stimulation has inherent advantages over previous psychiatric lesioning procedures. It is fully reversible, and stimulation can be adjusted according to a patient's changing symptoms and disease progression. Two Centers in Italy, the Neurosurgical Department - University "Magna Graecia" of Catanzaro and the 3th Neurosurgical Department – Neurological Istitute "Carlo Besta" of Milan, employed DBS to treat refractory behaviour disorders.

Materials and Methods: Treated patients were affected from Mayor Depression (2 cases), Obsessive Compulsive Disorders (4 cases), Somatophorm Disease (1 case) and Aggressive Behaviour associated with subeverage IQ (7 cases). Most of patients underwent DBS as "compassionate treatment" lacking a national protocol on this topic. The targeted anatomic structures were the Brodman area 25 within the cingulated cortex for depression, the accumbens nucleus for obsessive compulsive disorder, the cingulate cortex Brodman area 24 for somatophorm disease and the posterior hypothalamus for disruptive behaviour. All patients have been selected for surgery by two indipendent psychiatrists and all the procedures underwent approval from the ethical committee.

Results: Responders at long term follow-up (2-6 years) have been more than 80%. Results will be detailed and discussed in view of the recent advances in neuroimaging and in view of the need to suggest European programs and guidelines to develop this topic for the future.

Conclusions: DBS is an unique, very promising and "ultima ratio" therapy for the treatment of disabling behaviour disorders refractory to other treatment modalities. Nevertheless, the resistance toward this procedure still remain even though recent studies have shown significant improvement. DBS must be embedded in a treatment plan including pharmacological, psychological, sociotherapeutics and rehabilitative procedures.

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DEEP BRAIN STIMULATION FOR THE TREATMENT OF REFRACTORY COCAINE DEPENDENCE

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Introduction: Drug dependence involves motivational and behavioral disturbances such as compulsive drug intake and episodes of intense craving often refractory to all kinds of therapy. The neuronal basis of addiction comprehend the limbic system and the brain rewarding circuits, namely the ventral striatum nucleus accumbens (Acc), the bed nucleus of stria terminalis (NST) and the middle forebrain bundle (MFB). Preliminary data from other groups point to some degree of clinical efficacy of Acc DBS in alcohol and heroin dependence, but it has never been shown an effect in cocaine. Also doubts have been raised about the best target to use and the exact localization of Acc. Our group has shown the precise Acc localization and its intimate neighborhood with the NST and MFB. The main objective of this study is therefore to evaluate the clinical efficacy of DBS on Acc/NST/MFB in the treatment of cocaine refractory dependence.

Methods: One male 36 year old man with a 16 years history of refractory cocaine dependence (DSM IV 304.20) was the first patient admitted for surgery of a larger study approved by the local Ethics Committee. This refractoriness was confirmed and the surgical indication approved by two independent psychiatrists nominated by the National Council for Mental Health, after an appropriate informed consent was signed. Bilateral electrodes (one 3387 Medtronic® DBS electrode on each side) were implanted under local anesthesia. To reach all the intended targets with the same intraparenchimous trajectories, these were almost vertical to the axial plane (right: 85.8°; left: 82.5°) with 21.8°(left) to 29.1°(right) angles to the sagittal plane. Contact points n° 1 were bilaterally targeted to the antero-lateral limit of NST at the level of the anterior commissure (AC) (posterior edge), 6.5mm apart from the midline; contact points n° 0 were 3mm underneath the AC, 5.5mm apart from the midline, in the posterior Acc according to our anatomical data; contact points n° 2 were 3 mm above the AC, in the anterior internal capsule (IC) genu and MFB; contact points n° 3 were 6mm above the AC, in the IC anterior limb. The cortical entry points were in the posterior F2 gyrus. Intraoperative monopolar stimulation was performed at each contact with 130hz, 150µs pulse width and 1-6 volts amplitude. The electrodes were finally connected subcutaneously to an Activa PC® pulse generator. No operative morbidity was registered. The post-operative DBS started 5 days after the operation.

Results and Conclusions: A 3-month period for adjusting DBS parameters was started after surgery to optimize the effect on cocaine consumption and craving. The patient is now in a period of 3 months of continuous (adjusted) stimulation. Afterwards a randomized period will follow, as scheduled in the study protocol. At the end of the present period the first conclusions will be drawn about the treatment efficacy.

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CHANGES OF CEREBRAL PERFUSION DUE TO DEEP BRAIN STIMULATION IN MEDICALLY-REFRACTORY TOURETTE SYNDROME

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Objective: We evaluated changes of regional cerebral blood flow (rCBF) in patients with severe Tourette syndrome (TS) as a result of bilaterally deep brain stimulation (DBS) of the globus pallidus internus (GPi) and the centromedian-parafascicular/ventralis oralis internus of the thalamus (CM/Voi).

Background: Nothing is known about changes of regional blood flow under pallidal and thalamic deep brain stimulation in patient with TS.

Methods: We enrolled 5 severely affected TS patients (age 31±10 ys, YGTS-Scale 81±8) with DBS electrodes in the GPi and CM/Voi and 6 age-matched, healthy controls for Tc-99m ECD SPECT. Patients were scanned during anaesthesia: 1. before DBS implantation (preOP) and after 3 months of 2. GPi-DBS, 3. CM/Voi-DBS or 4. sham stimulation (OFF), respectively. Data were analysed by voxelwise and volumes-of-interest (VOI) analysis (e.g. frontal lobe and Brodmann areas (BA)) (SPM2 and SPSS statistics, significance thresholds: $p<0.01$ and 0.05, respectively).

Results: In patients preOP compared to controls, rCBF was significantly decreased in the central region, frontal and parietal lobe, as well as in BAs 1, 4-9, 30, 31 and 40. Cerebellar perfusion was increased. DBS significantly decreased rCBF compared to OFF condition: (1.) for GPi-DBS in striatum, pallidum, cerebellum and BA21; (2.) for CM/Voi-DBS in cerebellum and BA19. A significant increase of rCBF was found during both DBS conditions in the frontal cortex.

Conclusions: We demonstrated reduced frontal cortex perfusion in non-stimulated TS patients particularly in parts involved in planning and controlling of movements. Perfusion changes due to DBS might be correlates of clinically beneficial effects i.e. reduced perfusion in basal ganglia / cerebellum during GPi- or CM/Voi-DBS reflecting reduced presence of motor-tics and increased perfusion during CM/Voi-DBS in frontal cortex (BA10) reflecting improved motor control.

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LONG TERM RESULTS OF POSTEROMEDIAL HYPOTHALAMIC DEEP BRAIN STIMULATION FOR ERETIC PATIENTS WITH RESISTANT AGGRESSIVENESS

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Introduction: Erethism defines severe cases of aggressiveness associated with mental retardation, usually owing to perinatal brain damage. When erethism is resistant to pharmacological therapy, seriously impairs the affected individual's ability to interact, causing a significant individual, social and economical impact. Deep brain stimulation (DBS) at the posteromedial hypothalamus (PHN) has been proposed as a treatment for resistant aggressiveness (Franzini et al; Hernando, et al) although experience around the world is very scarce. The objective of this study is to examine the long term outcomes of DBS at the PHN, in 6 patients with severe erethism treated in our institution.

Material and methods: Medical records of 6 patients treated with DBS at the PHN, for intractable aggressiveness, were reviewed. The therapeutic effect on behavior was assessed by the "Inventory for Client and Agency Planning (ICAP)", at baseline, and at the last follow-up.

Results: Two patients died due to causes unrelated to the neurosurgical treatment, 6 months and 2 years after the DBS implantation. Five out to six patients experienced a significant reduction in aggressiveness (mean general aggressiveness ICAP score was -47 at baseline, and -25 at the last follow-up, mean 3 years and 6 months). Similar response was obtained with low and high frequency stimulation. Four patients´ sleep pattern became more regular, and one patient stopped previous binge eating and potomania. One out to three epileptic patients noticed a 30% seizure frequency reduction. None experienced relevant side effects.

Conclusions: DBS at the PHN successfully controlled refractory aggressiveness in our series of erethic patients. Respect to hypothalamotomy, DBS at the PHN has additional advantages such as reversibility and titrability, and did not cause any serious adverse effects. Prospective controlled studies with a larger number of patients are needed to confirm these results.

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DEEP BRAIN STIMULATION OF THE NUCLEUS BASALIS MEYNERT TO TREAT COGNITIVE DEFICITS IN LIGHT TO MODERATE ALZHEIMER'S DISEASE

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Introduction: Alzheimer dementia is the most common disease leading to dementia and will become more and more important in the near future.Present therapeutical concepts aim to support the cholinergic transmitter function and shall on the other hand interfere with the amyloid cascade and inhibit the cell damaging amyloid deposition. The hypothesis was to support cholinergic transmission by deep brain stimulation of the nucleus basalis Meynert and at the best generate neuroprotective effects.

Methods: In a prospectively randomized study, 6 patients with Alzheimer dementia, underwent bilateral deep brain stimulation of the nucleus basalis Meynert. The aim of the study was to treat cognitive deficits and achieve stabilization or even improvement of cognitive functioning, psychological wellbeeing and quality of life by means of deep brain stimulation of the nucleus basalis Meynert.

Results: Deep brain stimulation of the nucleus basalis Meynert in 6 patients seems to stabilize cognitive function and prohibit further decline in memory deficits during a follow-up of average 1 year.

Conclusion: Deep brain stimulation of the nucleus basalis Meynert seems to be worth of further research as a method for treatment of cognitive and memory deficits in light to moderate Alzheimer's disease.

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BEHAVIOR ANALYSIS OF A RAT MODEL OF OBSESSIVE-COMPULSIVE DISORDER TREATED WITH ELECTRICAL STIMULATION IN THE BED NUCLEUS OF STRIA TERMINALIS

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Introduction: In schedule-induced polydipsia (SIP) model, test subjects receive food pellets under a fixed-time schedule each day, and gradually develop compulsive drinking behavior. The objective of our research is to investigate the effect of high frequency electrical stimulation in the bed nucleus of stria terminalis (BNST) in SIP rats.

Method: 32 Wistar rats were randomly allocated into three different groups: SIP BNST (N=12), SIP RND (N=12) and CON BNST (N=8). Electrodes were implanted in BNST bilaterally in SIP BNST rats, in control groups (CON BNST), and in random targets in rats of SIP RND group. On the first three days of conditioning every rat from all three different groups was individually placed in a conditioning cage for one hour, in which it received 60 food pellets at once (CON conditioning). After three days of baseline measurement, rats in SIP BNST and SIP RND underwent SIP conditioning (1 pellet delivered every minute for one hour) while rats in CON BNST continued undergoing CON conditioning. These conditionings continued for 25 consecutive days, but in the last six days, every rat received 3 days (in random order) of electrical stimulation in the implanted brain region (0.5mA of 50uSec at 100 Hz, bipolar stimulation). Water intake during conditioning was recorded daily, and a webcam was fixed on top of each conditioning cage to record rat behavior. Videos were analyzed by custom Matlab script.

Results: Preliminary analysis showed that high frequency electrical stimulation significantly decreased water intake in SIP BNST group. Moreover, changes in total number of water-reaching behaviors, travelling distance and travelling pattern were also observed. Water intake in CON BNST group showed no significant difference between stimulation on/off conditions. However, electrical stimulation in some random targets adjacent to the posterior part of the BNST also decreased water intake significantly and showed similar changes in behavior.

Conclusion: High frequency electrical stimulation in the BNST is effective in reducing compulsive drinking and changing behavior pattern in SIP rat.

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TRACTOGRAPHY-BASED TARGET PLANNING FOR DEEP BRAIN STIMULATION IN PATIENTS WITH OCD AND TOURETTE-SYNDROME

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Introduction: A significant number of patients with Tourette-syndrome (TS) and obsessive-compulsive disorder (OCD) are not improved from psychotherapy or drug treatment. Deep brain stimulation (DBS), as a reversible and controllable procedure may offer further opportunities for these selected psychiatric cases. So far not so many cases were reported in the literature, especially with the involvement of tractography during surgical planning.

Methods: 7 patients underwent DBS for psychiatric disorders in our department. 5 patients with TS and 2 cases with OCD were selected for surgery by our research group. The patient selection is based on published inclusion end exclusion criteria. Prior to the surgery an extensive MR imaging has been performed in all cases, for 2 patients general anaesthesia was needed during the investigation. All patients underwent diffusion MRI protocol with subsequent deterministic tractography which has been used for optimal target selection during surgical planning. In OCD patients the nucleus accumbens and anterior limb of internal capsule (NA-ALIC), and in TS the Voi-centromedian-parafascicular complex have been used bilaterally as targets. Intraoperatively 5-channel microelectrode recording has been applied. The quality control of proper electrode placement has been performed with postoperative CT to preoperative MRI and to tractography co-registration. Along with the clinical scales in TS perioperatively the motor tics were recorded with a home-developed wireless 3-D accelerometry system.

Results: Two of the three OCD patients showed significant improvement, the third patient has a relatively short, 4-months follow-up. All the patients with TS showed significant improvement. No surgical and device-related complications, and only slight stimulation-related complications were observed, but successfully were eliminated after refinement of the stimulation parameters.

Conclusions: DBS is an effective and well tolerated treatment option for severe drug resistant TS and OCD cases. Tractography is a promising tool in individual target determination for treatment of psychiatric disorders with DBS.

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FUNCTIONAL NEUROSURGERY FOR IMPULSIVE AGGRESSION: LONG TERM FOLLOW UP

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Impulsive Aggression can be defined as a destructive behavior in which a psychiatric patient involuntarily intends to harm oneself, friends, family members, and objetcs involuntarily. Neuropsychiatric Disorders such as epilepsy, central nervous system infections, traumatic brain injuries, dementia and developmental abnormalities disrupt neurochemical balance, and changes in neuronal signaling in the aggression circuit over time. Severe impulsive aggression associated to mental retardation is highly prevalent and a therapeutic challenge in patients whose potential dangerous aggressive behavior has become a threat for both the patient and the society. In the last decade there has been new interest in the posterior medial nucleus of the hypothalamus as a therapeutic target for epilepsy pain and psychiatric symptoms.

Even though ablative procedures on the hypothalamus have been tried with varying degrees of success in refractory cases of aggression, posteromedial hypothalamic deep brain stimulation (PMHDBS) has been recently reported at least as safe and efficacious as hypothalamotomy, with the advantage of being a reversible intervention without permanent lesions on the hypothalamus.

In this presentation, the authors summarize the most recent advances in the neurobiology of aggression. A 11 patient series is presented with long term follow up (1 - 7 years) and the results compared to posteromedial hypothalamotomies performed by the same group.

The main conclusions are:
1. PMHDBS improves aggression on mentally retarded patients, with moderate to severe aggression, when they have been refractory to medical treatment. Mean improvement on aggression scales is 85%, averaging reduction on frequency and intensity of aggressive outbursts.
2. Radiofrequency lesions although more economic and practical, have as major drawbacks, recurrence and irreversibility.
3. After individual benefit – risk ratio and cost analysis, PMHDBS is the recommended method for the vast majority of patients with mental retardation and aggression (with or without epilepsy).
4. Based on our preliminary results PMHDBS offers a new possible treatment for epilepsy in some patients with or without aggression.
5. Close and interdisciplinary follow up is a prerequisite for substained clinical efficacy.

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ANTERIOR CAPSULOTOMY VERSUS DBS FOR OBSESSIVE COMPULSIVE DISORDER; A REVIEW OF THE LITERATURE

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Introduction: Obsessive compulsive disorder (OCD) is a chronic and debilitating psychiatric condition that affects 2% of the population. Traditionally, anterior capsulotomy has been an established procedure for treatment refractory OCD patients. Over recent decades deep brain stimulation (DBS) has gained popularity over ablative surgery because of its adaptability and reversibility. The "optimal" brain target for DBS in OCD is still a matter of debate. Here we evaluate the published literature on surgery for OCD to compare the outcomes of patients treated with anterior capsulotomy versus patients who had DBS in the ventral striatum /ventral capsule (VS/VC) or nucleus accumbens (Nacc).

Methods: Publications on capsulotomy or DBS for OCD were obtained from the PubMed database, from proceedings of neurosurgical meetings, and references from relevant papers. Duplicate patients were removed. To be included, the studies needed to report on baseline characteristics (age at surgery; duration of OCD; Yale-Brown Obsessive Compulsive Score (YBOCS) at presentation), and outcome (length to follow up; YBOCS and clinical state at follow up). Patients were grouped according to whether they received DBS or capsulotomy. Patients were deemed to have a clinically relevant response to surgery if the YBOCS improved by at least 33%, and an excellent response if there was a more than 50% decrease in YBOCS.

Results: In total 18 studies were identified reporting on 149 patients. Sixty-four patients underwent DBS implantation of the VS/VC or the Nacc (mean age 39 years, mean follow up 17 months, mean baseline YBOCS score 33) and eighty-five patients underwent anterior capsulotomy (mean age 35 years, mean follow up 58 months, mean baseline YBOCS score 29). In patients who had DBS, there was a 39% decrease in YBOCS compared to a 57% decrease for those undergoing capsulotomy. In addition, patients undergoing capsulotomy where 24% more likely to have a clinically relevant response ($p=0.002$) and 36% more likely to have an excellent response when compared to DBS ($p<0.0001$). However, patients undergoing capsulotomy reported more persisting side effects including disinhibition and apathy.

Conclusion: Anterior capsulotomy is an efficient procedure for refractory OCD. DBS is an emerging and probably promising method for OCD. The current popularity of DBS over ablative surgery for OCD is not due to non-efficacy of capsulotomy, but rather to DBS being more acceptable by clinicians and patients.

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ANATOMICAL LOCATION OF CLINICALLY EFFECTIVE DEEP BRAIN STIMULATION ELECTRODES IN OBSESSIVE-COMPULSIVE DISORDER

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Introduction: Obsessive-compulsive disorder is a chronic psychiatric disorder characterized by persistent thoughts and repetitive ritualistic behaviours. Despite optimal cognitive-behavioral and pharmacological therapy, approximately 10% of patients remain treatment resistant. Deep brain stimulation is being investigated as an experimental therapy for treatment-refractory obsessive-compulsive disorder, but reported clinical improvements are highly variable.

Methods: In the current study, we determined the relationship between the precise anatomical location of active electrode contacts and long term clinical outcome in obsessive-compulsive patients undergoing bilateral deep brain stimulation targeted at the nucleus accumbens.

Results: Remarkably, we found that most patients actually do not receive active stimulation within the nucleus accumbens but in the more laterally, anteriorly and dorsally located ventral part of the anterior limb of the internal capsule. Patients receiving bilateral deep brain stimulation in the ventral part of the anterior limb of the internal capsule improved on average 75% on their Yale-Brown Obsessive-Compulsive Scale scores, whereas patients with their centers of stimulation located otherwise improved on average only 30%.

Conclusion: We propose the ventral part of the anterior limb of the internal capsule as a promising and clinically effective deep brain stimulation target for patients with treatment-refractory obsessive-compulsive disorder.

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CELL THERAPY WITH NERVE GROWTH FACTOR (NGF) TARGETING CHOLINERGIC NEURONS IN THE BASAL FOREBRAIN IN PATIENTS WITH ALZHEIMER´S DISEASE

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Background: Degeneration of cholinergic neurons in the basal forebrain correlates with cognitive decline in patients with Alzheimer´s disease (AD). These neurons depend on nerve growth factor (NGF) for survival. Targeted delivery of exogenous NGF has emerged as a potential therapy due to its regenerative effects on basal forebrain cholinergic neurons in AD animal models. We have developed a cell therapy technique where encapsulated cells release NGF to the basal forebrain with the objective to improve cognitive functions and to halt the degeneration of cholinergic neurons in AD patients.

Aims: To demonstrate that NGF cell therapy to the basal forebrain in Alzheimer patients is safe and well-tolerated.

Methods/Study design: The catheter-like cell therapy implant consists of an NGF producing, genetically engineered human cell line encapsulated within a semipermeable hollow fiber membrane that allows for the influx of nutrients and the efflux of NGF. A total of 10 patients with mild to moderate AD were stereotactically implanted bilaterally with NGF implants targeting cholinergic neurons in the basal forebrain. Patients were monitored regarding safety, tolerability, cognitive functions and biomarkers.

Results: All patients were implanted safely and accurately with bilateral single (2) or double implants (4). The first 3 patients received implants in the nucleus basalis (Ch4), and the following 7 patients were implanted in Ch4 and in the vertical limb of the diagonal band (Ch2). The first six patients were studied for 12 months. Two of these patients showed improved cognitive scores, EEG parameters, and increased cortical 11C-nicotine binding, as assessed by PET-imaging at 3 and 12 months. No device- or procedure-related serious adverse events were recorded. Due to low levels of NGF being released from retrieved devices at 12 months, a second generation implant was developed in order to increase NGF release and improve long-term function. Four AD patients have been implanted with these improved devices, and have been studied for 6 months. Clinical data and device performance are being evaluated.

Conclusions: A new strategy for cell-based treatment of AD by local delivery of NGF to cholinergic neurons in the basal forebrain is being tested in an open-label dose escalation Phase 1b clinical study. Safety, tolerability and device functionality will be presented.

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DEEP BRAIN STIMULATION OF THE HUMAN MEDIAL FOREBRAIN BUNDLE (SLMFB-DBS) FOR REFRACTORY DEPRESSION - RESULTS FROM THE FORESEE STUDY

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Introduction: The main focus of studies on the underlying neurobiology of major depression concentrated for a long time on alterations on monoaminergic or endocrine systems. A more complete and appropriate treatment might arise from conceptualizing depression as a dysfunction of specific brain networks that mediate mood and reward signals. DBS is currently being researched actively for its putative application in treatment resistant major depression (TR-MDD). While first studies on three different targets in TR-MDD (cg25, anterior limb of the capsula interna, Nucleus Accumbens) showed promising effects in comparable patient populations, only 50-60% of patients responded at a clinically significant level. Furthermore, stimulation intensities ranging from 4-10V and large electrodes geometries were used; somewhat undermining target specificity.

Methods: Seven Patients suffering from TR-MDD underwent bilateral DBS electrode implantation in the supero-lateral medial forebrain bundle (slMFB, target description @ http://tinyurl.com/slmfb) utilizing a NexFrame(R) neuronavigated system (Medtronic, USA) after Diffusion Tensor Imaging (DTI) based individualized target site definition. Intraoperative microelectrode recording was used to identify the implantation environment.

Results: All patients showed strikingly similar intraoperative effects of increased appetitive motivation. Six of the seven patients attained the response criterion, response was rapid, mean MADRS of the whole sample was reduced by more than 50% at day seven after onset of stimulation and decreased from 29.9 (SD 8) at baseline to 14.6 (SD10.1) after 12 weeks of stimulation. At last observation (12 to 33 weeks), six patients were responders; three out of these six were remitters (MADRS<11). Social functioning (GAF) improved in the sample as a whole from serious to mild impairment. Mean stimulation current was 2.86 mA in responders; no major side effects were observed.

Conclusions: These preliminary findings suggest that bilateral stimulation of the slMFB may significantly reduce symptoms in TR-MDD. Onset of antidepressant efficacy was rapid (days) and a higher proportion of the population responded at lower stimulation intensities than observed in previous studies.

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DEEP BRAIN STIMULATION OF THE FORNIX, VENTRAL AND DORSAL HIPPOCAMPUS AND ENTORHINAL CORTEX IN AN EXPERIMENTAL MODEL OF MEMORY IMPAIRMENT

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Introduction: Deep brain stimulation (DBS) is a surgical treatment involving the implantation of electrodes which give electrical impulses to specific parts of the brain. Recently, DBS in the region of the fornix has been applied in Alzheimer's disease with the purpose of improving or reducing the progression of memory loss. When structures of the memory circuitry are stimulated, DBS is thought to enhance neural activity and thus improves performance on memory tasks. In the following study, we implanted bilateral electrodes at the site of the fornix, dorsal and ventral hippocampus, and entorhinal cortex in order to detect which stimulation parameters provide beneficial effects in spatial memory.

Methods: Rats were then tested in the Object Location Task with the following conditions: (i) with attachment of stimulation cable (off stimulation), and (ii) with DBS at various amplitudes (50 µA, 100 µA and 200 µA), 100 µs pulse width and 100 Hz or 10 Hz stimulation frequency. Intraperitoneal scopolamine injections 30 min before the first trial were given to imitate memory impairment.

Results: DBS of the forniceal region and entorhinal cortex reversed the scopolamine effects in high current densities and showed superior memory performance when compared to hippocampal stimulated and sham rats. Hippocampal stimulation showed no beneficial effect on memory impairments. DBS of the the forniceal region and entorhinal cortex, with the most efficient stimulation parameter, had no effect on anxiety-like behaviour in the Open Field and Elevated Zero Maze, suggesting no potential side effects regarding anxiety levels or general motor activity. Finally, immunohistochemical analysis revealed elevated expression of c-Fos levels in DBS treated rats in regions of interest.

Conclusion: DBS of the forniceal region and the entorhinal cortex with specific stimulation parameters enhances the memory circuit and improves memory impairment in an experimental model.

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REFRACTORY OBSESSIVE-COMPULSIVE DISORDER AND MULTI TARGETS FOR DEEP BRAIN STIMULATION

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Background: Deep brain stimulation (DBS) is a promising treatment for medication refractory obsessive-compulsive disorder (OCD). Putative targets are involved in the pathophysiology of the condition, however the selection of a specific target location is not standardized and remains to be clarified. The authors address the question of the rational, feasibility, safety of implanting multiple targets in intractable OCD. Criteria for patient selection, surgical technique and clinical outcome are presented.

Methods: Six patients with refractory OCD were enrolled in this study. Simultaneous bilateral implantation of two different targets was performed in all patients under general anesthesia during the same surgical procedure: subthalamic nucleus, accumbens nucleus, limbic antero-ventral internal pallidum, bed nucleus of stria terminalis, subcallosal cingulate gyrus. Symptoms severity was preoperatively and postoperatively evaluated by the Yale-Brown Obsessive Compulsive Scale (Y-BOCS).

Results: Mean follow-up with DBS was of 5 years (range, 2 to 8). Mean Y-BOCS scores decreased from 30.8 (27-33) at baseline assessment to 9.7 (0-25) at last assesment after DBS. Surgery related adverse events included wound infection on one DBS system in 2 patients. Adverse effects included dramatic mood disturbance and suicidal ideation/suicide attempt in one patient when the STN DBS was "on". Interestingly, for two of these patients, only the residual target was used and still permitted to reduce symptom severity.

Conclusions: This strategy could allow the use of one target instead of another whether suboptimal clinical response occurs by stimulating one target and to decrease/avoid side effects related to one specific target. Further research should focus on optimizing this therapy.

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BILATERAL CINGULOTOMY AND ANTERIOR CAPSULOTOMY APPLIED TO PATIENTS WITH AGGRESSIVENESS

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Objective: To perform a preliminary study on the effects and safety of bilateral cingulotomy and anterior capsulotomy in patients with aggressive behavior.

Patients and methods: Twenty-three psychiatric patients showing aggressive behavior refractory to conventional treatment were initially evaluated. The subjects were clinically selected using the Overt Aggression Scale (OAS) and the Global Assessment of Functioning Scale (GAF). Each case was carefully reviewed by the Ethics Committee of Mexico's General Hospital. Once selection criteria were met, stereotactic lesions were made using radiofrequency on the anterior limb of the internal capsule and supragenual cingulum. Statistical differences were evaluated with a Wilcoxon test at 6 months and at 4 years.

Results: Ten patients underwent surgery. Their OAS and GAF scores decreased after the procedure at 6 month follow-up ($p<0.05$) and at four years ($p=0.068$) Four patients showed mild and transitory post-surgical complications (hyperphagia and somnolence).

Conclusions: Bilateral anterior capsulotomy in combination with cingulotomy may reduce aggressive behavior and improve clinical evaluations. Very strict clinical and ethical evaluations were applied prior to considering patients for this treatment.

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GRADING REFRACTORY ANOREXIA NERVOSA FOR SURGICAL TREATMENT

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Introduction: To grade anorexia nervosa as a reference of patient and surgical procedure selection for surgical treatment based on the surgical results and clinical characteristics of anorexia nervosa.

Methods: 104 patients with refractory anorexia nervosa underwent bilateral deep brain stimulation of nucleus accumbens or/and bilateral anterior capsulotomy. 61 patients were followed up over 12 months. Body mass index (BMI) and menstrual status, Yale-Brown obsessive-compulsive rating scales, Hamilton Anxiety rating scales and Hamilton depression rating scales were employed to evaluate the efficacy pre and 1 year postoperatively. Based on the clinical characteristics and surgical results of anorexia nervosa, patients were graded from I to IV.

Results: 12 cases of grade II patients were cured, 4 of them were treated by bilateral NAcc DBS only, the other 8 cases by bilateral capsulotomy. 18 cases of grade III were significantly improved or cured, 5 of them underwent bilateral capsulotomy after failed DBS, the others were treated by capsulotomy only. In 31 cases of grade IV, 25 cases were significantly improved or cured; 5 cases with mild improvement or no change, 3 of these 5 cases were treated by DBS plus capsulotomy; 1 case suicided 9 months after capsulotomy due to severe depression even though her BMI recovered.

Discussion: For grade II refractory anorexia nervosa patients, both DBS and anterior capsulotomy are effective, grade III patients are mildly responsive to DBS and should be treated by bilateral capsulotomy. The surgical efficacy of Grade IV patients was not as good as grade II and III.

Conclusion: Grading of anorexia nervosa is very important for patient and surgical procedure selection.

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DEEP BRAIN STIMULATION IN THE INFERIOR THALAMIC PEDUNCLE (ITP) AS TREATMENT OF OBSESSIVE COMPULSIVE DISORDER

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Introduction: A patient with major depression disorder was successful treated with DBS into ITP. Non-alternative or perseverative behavior is produced by 8OH-DPAT during T-maze OCD model in Wistar rats, the lesion of thalamic reticular nucleus has shown decrease of perseverative behavior similarly to chlorimipramine's effect. Low frequency (2 Hz) electrical stimulation of the same nucleus has preventive effect over perseverative responses originated by 8OH-DPAT. Similar results were obtained with low frequency stimulation into orbitofrontal cortex. Low frequency DBS either TRN or OFC proved to be the most effective way to prevent non-alternative behavior (37, 38). Additionally, lesioning in TRN had similar effect (39). These results drive to conceptualize the orbitofrontal thalamic system as a unit.

Objective of Clinical Trial: To evaluate the efficacy and the security of DBS in ITP in OCD difficult to treat.

Patients and Methods: Six patients (1:1 male/female) with OCD (from 9 to 34 years) were bilaterally implanted in ITP. According to Yale-Brown Obsessive Compulsive scale (Y-BOCS) score in base line 3 patients had severe and 3 extreme OCD. They were setting at 5.0 V, 130 Hz and 450 microseconds in bipolar mode during 12 to 48 months. Y-BOCS,

Results: Median of Y-BOCS score decreased more than 50% of base line record; GAF score increased from 30 to 70. Changes were evaluated trough Wilcoxon test ($p<0.05$).

CASES	BL	M1	M3	M6	M9	M12	M24	M36
SP	25	22	18	14	15	14	18	15
RR	36	38	15	14	17	15	NA	NA
JJ	40	38	19	24	22	22	NA	NA
PI	40	40	30	29	30	22	19	18
CH	34	25	20	18	18	16	NA	NA
LM	40	34	26	22	20	16	5	7
Median	35.8	32.8	21.3	20.2	20.3	17.5	14.0	13.3
SD	5.9	7.5	5.6	5.9	5.3	3.6	7.8	5.7

Table1. Follow up of Yale Brown Obsessive Compulsive Scale scores during 36 months in six patients underwent to high frequency DBS into ITP. BL(base line), M1 – M36 (Month-1 to Month-36), NA (Non applicable). Decrease of scores between BL and M12 were observed in every case. In M24 two cases were dropped out of study because death by overdoses to drugs (RR) and tuberculosis infection (JJ). CH was lost by this time. Other three cases showed stable scores by M24 and M36; SP and PI are patients with OCD and co-morbidity (schizoid personality and drug abuse respectively). LM has the best result probably because she suffers of OCD exclusively.

Conclusion: DBS in ITP can decrease of OCD symptoms. Best results could be getting in patients without co-morbidity. Low frequency could be better parameter instead high frequency. A controlled, blinded, randomized clinical trial must be performed.

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IMPRESSIONS OF DBS FOR INTRACTABLE DEPRESSION

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Personal Impressions of DBS for intractable depression

Introduction: In 2001 the first ideas about combining our experience in Deep Brain Stimulation (DBS) for movement disorders with our patients with psychiatric diseases proved premature. After Mayberg and Lozano published in 2005 (Neuron 2005 vol. 45 (5) pp. 651-60) their results of DBS of the area 25 of the cingulum (CG25) this changed. A new cooperation in the country started and because of the experience of the Amsterdam team with Obsessive Compulsive Disorder (OCD) and the accumbens nucleus target (NA) we discussed the details of a multicenter trial with this target for intractable monopolar depression. The effects in their OCD patients on depression proved to be instantaneous and weeks before the OCD complaints resolved. The fact that after implantation best results were obtained using the two proximal electrode positions (2 and 3), that are actually outside the NA and located in the lower part of the anterior internal capsula (CI), made us decide to use only one position inside the NA and to use a track with the proximal three electrodes in the CI.

Methods: The technique of DBS implantation is executed in slightly different ways in both centers, but the same equipment is used; supplied by Medtronic as used in DBS for movement disorders: Activa PC implantable pulse-generator (IP) and the 3389 DBS leads with 4 positions at the last 8 mm. The Activa RC rechargeable IP is used, if the first drains within a year. The target is defined in the same way with stereotactic frame (model G Elekta) and approached using Elekta's Surgiplan software. The recipe is related to the AC-PC line and the same in both centers (7 mm lateral, 3 mm anterior from the anterior limit of the anterior commissure and 4 mm inferior). The patients are mostly awake and rarely under general anesthesia during implantation and IP change. The subject of this presentation is the comment of the awake cases during implantation, during IP change and in the office six weeks later. The scientific results of the study will be presented later with detailed account of validated measuring systems and the proper statistics. The goal of this presentation is to describe subjective information about the quality of the mood change in a number of successful cases. We find this is relevant and helpful in the ethical discussion whether the effect of this treatment is a cure of the depression and not an artificial self-stimulation effect. Since overdose generates mania and over activity that impression might occur. On the other hand, the fine balance of "normalcy" could elude the measuring instruments and the statistics.

Results: Successful cases of DBS for severe depression report improvement of memory function due to the discontinuation of Electro Convulsive Treatment (ECT), which has a usually strong anti-depressive effect. Obviously our target group of patients responded insufficiently to ECT. Some report of postponed mourning after years after the loss of loved ones. One patient complained that although the depression was adequately controlled, she failed to become the center of each party through a personality change to a more exuberant one. Several mention the positive effect of feeling negative emotions again. But most of the patients report the surprising effect of restoration of relations with spouses, relatives and friends who recognize the "old" person again, that was absent due to the disconnection of emotion and/or ECT side effects.

Conclusion: This presentation consists of a number of anecdotal comments of our patients that illustrate the cure of the depression, meaning the restoration of access to emotions, either happy or sad. This justifies the procedure and leaves us the task to identify the patients that will respond favorably to it.

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INCREASED 6-10 HZ ACTIVITY RECORDED FROM THE BASAL GANGLIA AND THE THALAMUS IN PATIENTS WITH TOURETTE-SYNDROME

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Objective: To gather further understanding about the underlying mechanisms of deep brain stmulation (DBS) therapy in Tourette Syndrome (TS), we aimed to explore the disease specific pattern of oscillatory local field potential (LFP) activity of the centromedian-parafascicular nucleus (CMPf), the ventral and dorsolateral globus pallidus internus (GPi) and the subthalamic nucleus (STN).

Background: TS is a disabling disease associated with motor tics, obsessive-compulsive behaviour and attention deficit hyperactivity disorder. Deep brain stimulation of the CMPf, GPi and the STN has been described to be effective to reduce tics in refractory TS. However, little is known about the functional significance of these targets in the pathophysiology of TS.

Methods: In five patients with severe TS DBS-electrodes were implanted in the dorsolateral GPi and CMPf and in one patient electrodes were implanted in the ventral GPi and STN. Bipolar LFP from four adjacent contacts (0:1/1:2/2:3) at rest were recorded. Additionally an electromyography of motor tics was recorded in parallel to the LFPs in one patient.

Reults: A distinct peak in the 6–10 Hz frequency band occurred in all DBS targets with a mean peak frequency of about 7.2 Hz in the GPi, 8.3 Hz in the CMPf, 6.2 Hz in the STN and 6.7 Hz in the ventral GPi. 22 out of 23 individual recordings showed a distinct peak at 6-10 Hz with on average 20.1% in the GPi and 24.8% in the CMPf difference in max peak power compared to the remaining contact pairs. Additional power peaks were detected in the beta frequency band (13 -30 Hz) and high gamma frequency band (78-86 Hz). Significant coherence between GPi-CMPf and GPi-STN occurred in the 6-10 Hz frequency band in all patients. Tic-related EMG activity was associated with an increase in 6-10 Hz LFP activity.

Conclusions: Our data extend previous findings of ~7 Hz activity in CMPf in TS suggesting that enhanced low frequency LFP activity is not restricted to thalamic nuclei but might be present in the cortex-basal ganglia-thalamic network in patients with TS. Furthermore, coherent low frequency activity was found between GPi and CMPf and the tic-related increase of 6-10 Hz activity may point to a potential pathophysiological role of enhanced low frequency activity in TS.

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DBS FOR DEPRESSION AND OCD – A CRITICAL REVIEW OF THE LITERATURE

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Introduction: Deep brain stimulation (DBS) has emerged as a treatment for therapy refractory obsessive compulsive disorder (OCD) and major depressive disorder (MDD). Promising results have been reported, but the literature might be somewhat confusing, considering the different brain targets used, and due to recycling of individual patients in multiple publications. The aim of the present study was to critically analyse the literature on DBS for OCD and MDD.

Method: Modern literature concerning clinical studies on DBS for OCD and MDD was scrutinized.

Results: The results of DBS in OCD have been presented in 25 papers with 130 patients, of which only 90 constituted of individual patients. Five of these papers included at least five individual patients not published elsewhere. Sixty-eight of these patients were implanted in the region of the internal capsule /ventral striatum, including the nucleus Accumbens. The target in this region has varied between groups and over time, but the latest results from bilateral procedures in this area have demonstrated a 50 % reduction of OCD-scores, depression and anxiety. The Subthalamic nucleus has been suggested as an alternative target. Even if beneficial effects have been demonstrated, the efficacy of this procedure cannot be decided yet, since only results after 3 months of active stimulation have been presented so far. The results of DBS in MDD have been published in 2 case-reports and 3 studies totalising 47 patients operated on in 5 different target areas. Positive effects have been presented in all studies and side-effects have been minor. DBS in the Accumbens resulted in a mean reduction of Hamilton depression rating scale (HDRS) of 36% after one year and 30% of the 10 patients achieved remission. DBS in the internal capsule/ventral striatum resulted in a reduction of 44 % after one year, and at the last evaluation, after a mean of 2 years, 40% of the 15 patients were in remission. The 20 patients with subcallosal cingulate gyrus DBS had a reduction of HDRS of 52% after one year and 35% were within 1 point from remission or in remission.

Conclusions: DBS is a promising treatment for therapy-refractory OCD and MDD, but the published experience is limited and the method remains investigational.

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PATIENT-SPECIFIC VISUALIZATION OF THE DBS-ELECTRIC FIELD IN TOURETTE SYNDROME

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Introduction: Several different target areas have been suggested for deep brain stimulation (DBS) implantation in patients with Tourette syndrome (TS). The aim of this study was to simulate and visualize the electric field surrounding TS-DBS in the anteromedial part of the internal globus pallidus (GPi).

Methods: Based on pre- and post-operative stereotactic 1.5T MRI (T1, T2 and proton density) 3D patient-specific finite element models of bilateral DBS-electrodes (Medtronic Model 3389) in the GPi were set up for three patients. To provide the best conditions for the electrical classification, the T1 and proton density weighted image volumes were fused into a single image volume for each patient. Simulation of the electric field distribution around the DBS electrodes positioned in the respective brain models was performed for each individual DBS-settings. Simulated fields were visualized in 2D and 3D with an electric field isolevel at 0.2 V/mm. Anatomical targets were superimposed onto the MRI slices using the Morel brain atlases.

Results: The simulations showed inter-patient differences regarding field distribution and clinical outcome. These were significant with respect to the image quality. The visualized field confirm that the anteromedial pallidum was the main stimulation target for all three patients. However, best effect on the tics was obtained in the patient where the electric field covered the very anterior part of the external Globus Pallidus (GPe).

Conclusion: An existing method for patient-specific DBS simulations has been further developed and adapted to a new anatomical target in order to investigate and visualize the spatial extent of stimulation in relation to the effect of DBS on tics.

RADIO-SURGERY

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RADIOSURGERY FOR BRAIN AVMS: OUTCOME ANALYSIS

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Purpose: Radiosurgery has made a great impact in the treatment of small and medium AVMs. We were aimed to review the outcome of patients with brain AVMs treated by stereotactic radiosurgery taking into account not only the localization and volume of the AVM but also the prescribe dose and normal tissue receiving 10-12Gy. Furthermore we want to understand better their strict relation with temporary and permanent neurological sequelae, as well with the treatment outcome.

Methods: A retrospective review of 60 patients treated between 2004 and 2009 was performed. The patients age ranged from 20 to 60 years old, and were irradiated with a single dose fraction from 12-20Gy, using 6MV photon beam. The treatments were undertaken in a Linear Accelerator 2300CD_Trilogy® (Varian Medical Systems, Inc., Palo Alto, CA), with the HD120 Micromultileaf incorporated, at Centro Oncológico Drª Natália Chaves, Carnaxide. All patients were submitted to an Angio-TC, Angio-MRI and a Stereotactic Digital Angiography in the day of the treatment. To assess the outcome, all patients had a follow--up time of at least 2 years and up to 4 years. Clinical evaluation and Angio-TC/MRI were made after 6, 12 and 24 months post radiosurgery, and every year from then on.

Results and Conclusions: The total obliteration rate after 2 years was 54% (mean time: 1.9 years); further 46% had a major reduction of the AVM nidus. After 3 years of follow-up, 22% more of these patients showed a complete obliteration, and after 4 years, plus 3.4% of the patients were cured. The complete obliteration of the AVMs seems to be dependent of the volume of the lesion (<5cc) as well as the Pollock-Flickinger score (<1.50). Most patients had no complications. The main temporary and permanent neurological sequelae were related to the prescribe dose (≥ 18Gy) and the amount (≥16cc) of normal tissue receiving ≥12Gy, as well as the location of the irradiated brain: occipital lobe, cerebellum and corpus calosum, followed by temporal lobe and brainstem.

Key Words: Radiosurgery, AVM, Brain, Post-radiosurgery AVM complications, AVM Outcome

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STEREOTACTIC LINAC-RADIOSURGERY FOR THE TREATMENT OF PATIENTS WITH GLOMUS-JUGULARE TUMORS

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Introduction: The optimal management of glomus jugulare tumors (GJTs) remains controversial. Surgical resection and fractionated external beam irradiation have been the most accomplished options but with a relatively high morbidity rate. We evaluate the long-term efficacy of single-fraction stereotactic LINAC-Radiosurgery (LINAC-RS) for the treatment of GJTs.

Material and Methods: Between May 1991 and September 2011, 30 consecutive patients (f:m = 21:8, median age: 60 years, range: 28.7 to 80 years) suffering from GJTs underwent LINAC-RS at our institution. Twelve patients underwent surgical resection at different institutions and eight of them underwent embolization prior to surgery. One patient received fractionated irradiation with a total dose of 64Gy before LINAC-RS. The most common symptoms were pulsatile tinnitus (n=16), hyp-/anacusis (n=18), vertigo/dizziness (n=6) and weakness of cranial nerves V, VII, IX-XIII (n=21). A median therapeutic dose of 15Gy (range: 11 to 20Gy) was applied to the tumor surface. The median isodose was 70% (range 44 to 80%) and the median number of isocenters was 4 (range 1 to 7). Since 2002 16 patients underwent LINAC-RS with the Micro-Multi-Leaf Collimator. The tumor volume ranged from 4.4 to 51ml (median: 10.8ml).

Results: After a median follow up of 106 months (range: 4.6 to 248.6 months, 14 patients with a follow up greater than 10 years) 20 patients improved in their neurological status, 8 remained stable. One patient developed a permanent paresis of the facial nerve (House & Brackmann grade II) and in one patient the hypacusis deteriorated. Four patients died, 3 due to old age and one due to sepsis after hip surgery. Follow up MR images show a regression in tumor size in 16 patients and a stable disease in 14 patients. No tumor progression was observed.

Conclusion: Our results show, that stereotactic LINAC-Radiosurgery yield a long-term tumor control with low risk morbidity for GJTs. It should be used as an alternative therapy regime to surgical resection or fractionated external beam radiation.

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OPTIMAL MULTISESSION RADIOSURGERY FOR LARGE BRAIN METASTASES IN CRITICAL AREAS

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Introduction: Radiosurgery has become a useful tool for treatment of brain metastases. However, single session radiosurgery is not adequate for metastases in critical areas, especially for large tumors because of dose limitation to avoid adverse effects on surrounding structures. Surgical removal has risks to cause neurological deficits after dissection of functional areas. Surgery also requires hospitalization at least one week and higher medical expense than radiosurgery. Multisession radiosurgery seems to be beneficial for these metastases. However, optimal dose and session number are not yet established for these tumors. The efficacy and toxicity were analyzed from patients treated with multisession radiosurgery and the optimal treatment was proposed.

Methods: Since 2005, 3585 metastatic tumors were treated with CyberKnife. Metastatic tumors located in and around critical areas, such as the motor cortex, thalamus, and brainstem, were intended to treat with the marginal doses of 30-35Gy in 3-5 sessions depending on the size of tumor. Marginal doses of 27-35Gy in 3-8 sessions were intended to use for large tumor to decrease adverse effects on surrounding brain. Neurological deterioration such as paresis visual and sensory disturbances was examined after treatment in patients with tumors in critical areas as well as local tumor control. The incidence of brain edema and necrosis was evaluated in patients with large tumors in relation with surrounding brain volumes included in single dose equivalent of 14Gy (SDE-14).

Results: Four hundred and twenty-one lesions of 3585 brain metastases were treated with multisession treatment. These were tumors in and around critical areas, such as the frontal lobe (close to the optic pathway, motor cortex and Broca's area), parietal lobe (sensory cortex and dominant angular cortex), temporal lobe (close to the optic pathway and Wernicke's area), occipital lobe (visual cortex), basal ganglia, thalamus, brain stem and cerebellum close to the brainstem. There were 176 large tumors more than 10ml including 35 lesions more than 30ml up to 115ml. Symptoms such as paresis, aphasia, ataxia and visual disturbances found prior treatment were improved in most patients, though patients with large tumors directly involved functional areas did not improved. No new neurological deficits were observed in patients with lesions in and around critical areas. Most tumors decreased in size and high rate of local tumor control was obtained. Twenty two (5.2%) patients developed brain edema required medical treatment for clinical symptoms and six (1.4%) patients were operated on because of mass effects even after osmo-steroid therapy. The surrounding brain volume circumscribed with SDE-14 (V14) of operated patients was more than 7ml. No patients with V14 less than 7ml were required operation for adverse effects.

Conclusions: Multisession radiosurgery is beneficial for treatment of large tumors in critical areas. The V14 seems to be helpful to determine the optimal dose and session number of multisession treatment. How to select the optimal treatment is presented for large brain metastases in critical areas.

Reference:

1 - Inoue HK. Characteristics of radiosurgery. In: Inoue HK, editor. Textbook of Radiosurgery. Osaka: MedicaPress; 2012. pp. 14-15. (Jpn)
2 - Barker FG, Butler WE, Lyons S, et al. Dose-volume prediction of radiation-related complications after proton beam radiosurgery for cerebral arteriovenous malformations. J Neurosurg 2003; 99: 254-263.
3 - Timmerman RD. An overview of hypofractionation and introduction to this issue of seminars in radiation oncology. Semin Radiat Oncol 2008; 18: 215-222.

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WHAT RATIONAL FOR ON DEMAND RADIOSURGERY IN BRAIN METASTASES ?

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Radiosurgical (RS) series with sufficient marginal dose without WBRT are reporting local control rates equal or superior to resection plus WBRT (Muacevic08). The association of WBRT to radiosurgery is reducing slightly but significantly the probability of new brain metastases (from 66% to 42% in Ayoama07). This benefit is clearly shown only for Lung origin. The selection of the therapeutic strategy must take into account the origin of the primary cancer (Golden08). Thus, we are not proposing WBRT when the primary is a melanoma or a kidney cancer (Powel08). Best indications of RS are small nodular metastases (Shiau97). Many of the neurosurgical teams with availability of human and technical resources for good quality radiosurgery are moving toward a « on demand » radiosurgical strategy consisting in the RS treatment of the BM without WBRT, a cautious MR follow up (every 3months), the repeatition of RS as frequently as necessary and a salvage WBRT only in cases of very numerous lesions or carcinomatous meningitis (Linskey09). This approache is supported by the absence of chances loss in thoses receiving salvage WBRT only compared to those exposed to upfront WBRT (Sneed99). The advantage is to reduce the use of WBRT and then the neurocognitive toxicity, the risk of radionecroses (Xu07), the cost (Aoyama07) and the requirement for chemo stop (Larson10). The toxicity of radiosurgery is very lo even in highly functional areas (Dea10).

The level of evidence for neurotoxicity specialy neurocognitive and mnesic toxicity of WBRT even on the short term is growing steadly (Welzel07, Slotman07, Chang09, Douw09). The dramatic improvement of the safety efficacy of treatments in oncology in general are providing us with much more long survival and must lead us to be more concerned about iatrogenic long term toxicity and quality of life worsening. If the number of lesion operated by radiosurgery is increase the risk of appearance of new BM (Sawrie08) it does not per se reduce the survival (Larson03, Chang10). As a matter of fact, the activity of RS for BM is increasing dramaticaly nowadays (roughly 600 operated by Gamma Knife versus 100 resected in Timone in 1 year). However, several questions related to the indications of this approach, the remaining role for associated treatments (WBRT) and the limit of application in cases of multiple lesions and or as a complement to a resection (Tumor Bed Radiosurgery) are also still a matter of debate.

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LONGITUDINAL HEARING ANALYSIS IN VESTIBULAR SCHWANNOMAS BEFORE AND AFTER RADIOSURGERY

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Objective: The aim of this study was to perform an accurate analysis of changes in hearing in patients with vestibular schwannomas (VS) who have undergone Gamma Knife surgery (GKS).

Methods: This study was a retrospective review of prospectively collected patient data. A total of 938 patients with unilateral non-surgically treated VS were treated by GKS over an 8-year period. Patients with complete ipsilateral hearing loss were excluded from the study. 217 patients had pre-GKS hearing assessment more than 6 months before GKS, of whom 154 patients (70.9 %) have been followed up with serial clinical examination, MRI scans and audiometry. The annual hearing decrease rate (AHDR) was measured before and after radiosurgery and the possible prognostic factors for hearing preservation were investigated.

Results: The mean dose prescribed to the tumor margins was 12.1 Gy. The mean radiological follow-up period after GKS was 60 months. Tumor control rate was 94.8 % and 8 patients underwent subsequent intervention due to tumor progression. Moderate facial palsy and trigeminal dysfunction were observed in one (0.6%) and two patients (1.3%), respectively. The mean audiological follow-up times before and after GKS were 22 and 52 months, respectively. The mean AHDRs before and after GKS were 5.39 dB/year (95%CI: 3.31~7.47) and 3.77 dB/year (95%CI: 3.13~4.40), respectively (P>0.05). The mean AHDRs in patients who were initially Gardner-Robertson (GR) class I pre- and post-GKS were -0.57 dB/year (95%CI: -2.95~1.81) and 3.59 dB/year (95%CI: 2.52-4.65) respectively (P =0.007). The mean AHDRs in GR class II patients pre- and post-GKS were 5.09 dB/year (95%CI: 1.36~8.82) and 4.98 dB/year (95%CI: 3.86~6.10) respectively (P >0.05). A subgroup of 80 patients had both early and late post-intervention AHDR assessment (where divided with the audiometry result recorded at closest to two years from intervention) and the AHDRs were 5.86 dB/year (95%CI: 4.25~7.50) and 1.86 dB/year (95%CI: 0.77~2.96) respectively (P<0.001). A maximum cochlear dose of less than 4 Gy was found to be the sole prognostic factor for hearing preservation.

Conclusions: GKS can be performed with acceptable risk of worsening hearing loss in patients with VS. The AHDR will accelerate in the first year after GKS but decelerate and stabilize thereafter.

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MULTISESSION RADIOSURGERY FOR OPTIC NERVE SHEATH MENINGIOMAS. A NEW PROMISING TREATMENT PARADIGM

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Background: Traditional treatment options for optic nerve sheath meningiomas (ONSMs) include observation, surgery and radiotherapy, but to date none of these has become the clear treatment of choice.

Objective: The aim of this study is to evaluate the effectiveness and safety of multisession radiosurgery for ONSM.

Methods: From May 2004 to date, 35 patients affected by ONSMs underwent a radiosurgical treatment by using the frameless CyberKnife system. Patient age ranged from 16-73 years (mean, 51 years; median 52 years). All patients were treated using multisession radiosurgery, with 5 fractions of 5 Gy each to a total dose of 25 Gy prescribed to the 75-85% isodose line. Patients were evaluated both for tumor growth control and visual function.

Results: The median pre-treatment tumor volume was 3.7 cc (range, 0.2 – 23 cc). The mean follow-up was 26 months (range, 5-68 months). Thirteen patients had a follow-up period longer than 36 months. No patients showed ONSM progression on follow-up MRI. Two patients (10%) had a partial response. visual function was stable in 65% and improved in 35% of patients. At the moment of the present analysis the visual function was stable in the 74 % of the patients, improved in the 20 % and worsened in the 6 %. Unexpectedly, in this experience the optic neuropathy always occurred during the first 6 months after the treatment. Moreover, the analysis of these two cases revealed that the dose to the chiasm, optic nerve, retina, ocular bulb and lacrimal gland as well as the involved volumes were not at the higher level of the present series.

Conclusions: Multisession radiosurgery for ONSMs was found to be safe and effective. The preliminary results from the present study, in terms of both growth control and visual function improvement are at least promising. Further studies are required not only to define the long term results, but also to better understand the real mechanism underlying the treatment related optic neuropathy.

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PRELIMINARY RESULTS AFTER MULTISESSION GAMMA KNIFE RADIOSURGERY FOR PERIOPTIC MENINGIOMAS

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Introduction: To evaluate the effectiveness and safety of a Gamma Knife treatment in three consecutive days (multisession) in patients with parasellar meningioma in close contact to the optic nerve and chiasm.

Methods: Between January 2006 and September 2010 49 patients (41 females, 8 males, mean age 57 years) underwent multisession gamma knife treatment at San Raffaele Hospital for a meningioma in close contact to the optic nerve and chiasm. Five patients have been treated for optic nerve meningioma, 44 for a parasellar meningioma. Preoperative decreased visual acuity or visual fields defect was found in 28 patients. Gamma Knife radiosurgery was delivered in three sessions with a mean prescription isodose of 6.8 Gy per session (range 6.5-7 Gy) and a mean total prescription dose of 20.7 Gy (range 19.5-21 Gy). Mean tumor volume was 8.8 ml (median 7.6, range 0.33-34.2). Maximum dose to the optic apparatus was always below 7 Gy for each session (mean 5 Gy).

Results: Median follow-up was 29.5 months (range 6-57). Overall tumor control rate was 100%. Tumor volumetric reduction was observed in 33 patients (67%), whereas in 16 patients (33%) no volumetric change was recorded. No patient experienced worsening of visual function, in 5 patients (10%) visual acuity improved after treatment; visual field improvement occurred in 4 patients (8%). Cranial nerve function improvement was recorded in 2 patients (4%); one patient experienced VI cranial nerve paresis (2%).

Conclusion: This preliminary experience suggests that multisession radiosurgery with Gamma Knife can be a safe and effective treatment for tumors immediately adjacent to segments of the optic apparatus.

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GPA PROGNOSTIC INDEX IN THE EVALUATION OF GAMMA KNIFE SURGERY TREATMENT FOR BRAIN METASTASES

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Objective: The population of patients with brain metastasis is very heterogeneous. We try to show the usefulness of the vital prognostic index for metastatic brain disease Primary Diagnosis Specific Graded Prognostic Assesment Score - DS-GPA and correlated its validity with the serie of patients treated for brain metastases with Gamma Knife Surgery (GKS) at our institution.

Material and Methods: Between October 2007 and May 2012, 110 patients were treated with GKS. The primitive tumors originated from the SCLC and NSCLC lung (42%), breast (32%), melanoma (6%), kidney (3%), IM (4%) and others (13%). The best prognosis is determined by a GPA of 4.0 and 0.0 for the worst. GPA includes several prognostic factors which vary from the primary tumor, and include: age, KPS, number of brain metastases and the presence of extracranial disease. The GPA was calculated for each patient and each primary tumor and correlated with their expected survival. Survival time was calculated since the date of GKS, and included patients with previous surgery, and with or without whole brain radiotherapy.

Results: The mean survival time observed in the series presented, coincides with the expectations marked in DS-GPA. We found a median survival time for breast-11.9, NSCLC-7.0, SCLC-4.9, melanoma-6.7, kidney-9.6 and gastro-intestinal-5.4.

Conclusions: It´s increasingly common the use of the DS-GPA in radiosurgery centers, to establish the survival prognosis for oncologic patients. It´s an excellent prognosis index as far as the traditional classification RPA, being less subjective and more quantitative and easy to use. For this reason, the DS-GPA is usually used in the Gamma Knife Center in Lisbon, as a guide for therapeutic decision in each oncologic case.

RESEARCH FROM INDUSTRY

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CONTOURING STIMULATION FIELDS TO OPTIMIZE TARGET COVERAGE USING INTERLEAVED PULSES IN DEEP BRAIN STIMULATION

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Introduction: Deep brain stimulation (DBS) of the subthalamic nucleus has been successfully used for the treatment of Parkinson's disease. Conventional stimulation programming involves the selection of stimulation parameters including an electrode configuration (electrode polarities), amplitude, pulse width, and frequency in order to provide the therapeutic effect. Recent advances in DBS technology allow for more complex field shaping capabilities in the form of interleaved pulses. This technology allows the use of two different programs or stimulation parameter sets in a sequential or alternating manner to "contour" the field shape around the lead axis to better deliver effective therapies while also avoiding brain areas that may induce side effects.

Methods: A finite element model was used to compute the electric fields generated by monopolar stimulation using various electrode configurations, including a single cathode, two adjacent cathodes, and two non-adjacent cathodes, on a DBS lead. Using detailed, multi-compartment models of nerve fibers we modeled the axonal responses to the applied stimulation. The volume of tissue activated (VTA) with a lead in the subthalamic nucleus was visualized for each modeled configuration using conventional stimulation. These VTAs were compared to those generated by interleaved stimulation on two adjacent and two non-adjacent electrodes using different amplitude and pulse widths on each program.

Results: The modeling results show the ability of interleaved pulses to contour the stimulation fields to match the target anatomy. The use of two different stimulation parameter sets including amplitudes and pulse widths may be used to selectively control the shape and size of each individual VTA on the lead when interleaved stimulation pulses are used.

Conclusions: Computer modeling predicts that interleaved pulses may be used to contour stimulation fields to optimize target coverage in deep brain stimulation. This capability of fine-tuning the stimulation fields allows for increased programming options of DBS devices.

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LONG-TERM RECORDINGS OF LOCAL FIELD POTENTIALS FROM DBS ELECTRODES IMPLANTED IN THE STN

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Introduction: Deep brain stimulating (DBS) of the subthalamic nucleus (STN) is effective for treating Parkinson's disease (PD). However, it is not patient-responsive, and programming parameters, once established, do not change to reflect the disease state in individual patients. The β-frequency band (13-30Hz) of STN local field potentials (LFP) shows promise as a potential biomarker for PD motor symptoms, but no data from patients exist regarding β-LFP characteristics over years. We have tested the potential use of β-frequency activity as a chronic biomarker.

Methods: Bipolar STN LFP activity was recorded using DBS extension cables at the time of surgical replacement of implanted neurostimulators, 2-7 years (median: 3.5) following initial DBS implantation, in 7 subjects (10 electrodes) who had STN DBS placed for PD. LFP power-frequency spectrum was calculated for each of 3 pairs of bipolar contacts over multiple rest (patient awake), and hand-movement periods. The pair of contacts with highest β-band activity was chosen for further analysis.

Results: β-band peak frequency was 20.1±2.6Hz (mean±SD), with a root mean square (RMS) of 0.66±0.3V. Overall we observed similar LFP β-band peaks after extended durations following DBS implant compared with results from shorter durations following implant. In 2 subjects LFPs were also recorded at initial DBS implantation. In one patient, β-band activity was similar in amplitude and had the same association of the signal to movement as during initial recordings. For the other subject RMS at peak frequency β-band decreased from 0.81V to 0.4V over a 3-year period. However, the association between recorded LFP and movement was preserved.

Conclusion: Post-operative LFP activity can be recorded years after initial electrode implantation, and demonstrates a similar association to movement as during acute recordings. These results support the feasibility of using β-band LFPs as a long-term biomarker in PD.

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INTRAOPERATIVE AND LONG TERM LFP PROFILES IN PD: ANATOMICAL AND TEMPORAL DIMENSIONS OF STN PHYSIOMARKERS

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Introduction: Increased power in the low frequency bands of the local field potentials (LFPs) recorded from STN is considered as a potential physiomarker of the symptomatic state in Parkinson's disease (PD). The LFP signals are often recorded during the surgical lead-implant procedure using microelectrodes or DBS macroelectrodes. Recent studies have demonstrated that the electrode contact with the maximum recorded power in the beta band (13-30 Hz) is often the same as the one chosen for the delivery of clinical stimulation therapy in the STN (Yoshida et al 2010; Ince et al 2010). This suggests that the power in the beta frequency band of the STN LFPs could be used as a marker to guide the placement of the DBS lead intra-operatively.

Methods: LFP data were collected intra-operatively using DBS macroelectrodes from 31 patients (61 brain hemispheres) at rest during lead implantation surgery for STN DBS for PD. Data were collected for ~1 minute durations at multiple depths (2mm apart) as the lead was positioned towards the target. Power spectra of the LFP were computed to analyze different frequency bands with specific focus on comparing beta (13-30 Hz) and gamma (60-90 Hz) signals. Some results from these data have been published earlier (Yoshida et al 2010).

Results: Consistent with previous reports, we found at least one beta band peak in each hemisphere. The mean RMS amplitude of the peak power was found to be 2.33 uV +/- 1.8uV. We could also identify a specific recording site that exhibited significantly higher beta band power than adjacent sites. A bimodal distribution was observed for the frequencies of the peak beta power, indicating a potential sub-division of the beta band into a "low-beta" and a "high-beta" band. Finally, we observed diverse shapes of the beta spectral profile (unimodal, bimodal, narrow, broad). We also identified two other frequency bands in a subset of the patients. First, a peak was observed in the gamma band (60-90 Hz) in 21 patients (29 hemispheres). The contacts that exhibited the highest gamma band power were often (n= 16/23) co-localized with the contacts that had the highest beta band power. In addition, preliminary results indicate negative correlations between instantaneous power in beta and gamma bands (r= -0.6; n=61). Second, in the data from 7 patients where higher frequencies were recorded, focal or broad peaks were observed (180-400 Hz; all 7 patients; 12/14 hemispheres).

Conclusions: These results provide support for the potential usefulness of the beta band power as a marker for guiding DBS lead placement intra-operatively. In addition, our results suggest that increased power in the gamma band and the higher frequencies often coexist with the beta band.

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SHORT-TERM IMPEDANCE VARIABILITY DURING PROGRAMMING SESSIONS IN A PRE-CLINICAL MODEL OF DEEP BRAIN STIMULATION

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Introduction: In DBS programming, the clinical standard of care is often to perform a monopolar review (MPR) upon activation of the stimulator, in order to determine efficacy and side-effect thresholds for all contacts on all leads of a DBS system (Volkmann et al, 2002). The MPR informs the selection of first clinical program, with which the patient is sent home in the ON condition. We hypothesized that impedances change over the course of the MPR and initial programming session. Existing work (see Lempka et al, 2010) has demonstrated that DBS electrode impedance changes as a function of time and stimulation. For a voltage-controlled DBS system, such impedance changes may result in variability of measured efficacy and side effect thresholds during a monopolar review.

Methods: Two (2) pigs were implanted with bilateral active DBS leads. A Boston Scientific Vercise DBS lead with standard DBS contact sizes was placed in either the left or right frontal lobe of each animal, and a prototype lead with a smaller contact size was implanted in the contralateral side. A monopolar review was performed 23-24 days post-implant for both animals. During this MPR the animals were exposed to a series of stimulation settings intended to simulate the measurement of efficacy and side effect thresholds in a clinical setting. Impedances on all contacts were measured throughout this procedure every 45 seconds.

Results: Impedances varied over a time scale of minutes, and could decrease and increase during the programming session. The maximum increase observed on a standard-size contact was 29% above the baseline at the beginning of the monopolar review, with the entire increase occurring over a 10 minute period while the amplitude on the contact was being adjusted. The same contact then rapidly decreased in impedance while other contacts were being stimulated later in the monopolar review, settling to a level 15% below baseline. Similar behavior was observed across all contacts. Differences between contacts in the magnitude, direction, speed, timing, and duration of impedance changes were correlated with several variables, including whether the electrode was active or passive, whether it neighbored an active or passive electrode, the amplitude of stimulation delivered through the electrode, and the size of the electrode.

Conclusions: Previous researchers (Lempka et al 2010) have proposed that instability in impedances could be partially responsible for the frequent need to reprogram stimulators in DBS patients postoperatively. The impedance changes observed in this animal model suggest a plausible scenario by which this could occur. Changes in impedances would suggest there are changes in current at the electrode for a voltage-controlled DBS system. If this occurs, any thresholds for efficacy or side effects measured during the monopolar review would be different than thresholds after the programming session is complete. Impedance changes over a brief programming session might therefore compromise the selection of stimulation parameters for long-term DBS. Further studies should explore whether the same short-term impedance changes can be observed during a monopolar review in a clinical setting.

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DEVELOPMENT OF PATIENT-SPECIFIC TOOLS FOR DBS ELECTRODE VISUALIZATION

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Introduction: Deep brain stimulation (DBS) has been successfully used to treat various movement disorders including Parkinson's disease. This therapy involves the delivery of electrical stimulation via implanted electrodes to targeted areas of the brain. Visualization of the target structures using conventional imaging is poor. Due to variability in patient anatomy, any visual tool for assisting in lead targeting or postoperative programming must be able to adapt to the individual patient's anatomy. Previous work has shown how patient-specific tools and methodologies may help guide DBS lead placement during surgical planning. Here we show how such tools may be used postoperatively for electrode localization and stimulation parameter selection.

Methods: A preoperative MRI and postoperative CT of the same patient implanted with DBS leads were merged using a rigid registration algorithm based on mutual information. Next, a nonrigid registration algorithm was used to align a 3D brain atlas to the patient's MRI. The brain atlas is a digital version of a histologically reconstructed atlas that contains 3D volumes of brain structures that helps visualize structures and substructures that may be poorly visible or invisible on MRI. Finally, an automatic lead extraction algorithm was used to extract each electrode on a lead from the postoperative CT. The electrode locations were compared when using both rigid and nonrigid registration and using only rigid registration.

Results: The results of the nonrigid registration algorithm were verified visually by examination of the deformation field by means of a deformed grid overlaid over the patient's MRI. The field was smooth and regular over homogeneous regions and showed asymmetry between hemispheres. Distances of electrode locations to landmark structures were determined by relative measures to the midcommissural point. Differences in electrode location on the order of the electrode dimensions (up to several millimeters), and thus likely to be clinically relevant, may be introduced if only rigid registration is used.

Conclusions: Visualization tools that are customizable to each patient can be used to localize DBS electrodes relative to target structures. Such information may be used to aid in the selection of electrodes for stimulation. In the future, these tools may be combined with visualization of the effects of stimulation parameters and used for guiding postoperative programming of DBS systems.

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BIOINFORMATICS APPROACH TO DEEP BRAIN STIMULATION

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Introduction: Deep brain stimulation (DBS) therapy involves the delivery of targeted electrical stimulation to specific structures in the brain. The stimulation parameters are programmed postoperatively to provide a therapeutic effect. Often, these parameters are selected on a trial-and-error basis. However, a good clinical outcome requires appropriately programmed devices. We present a visual, patient-specific workflow and data management tools that may be used to guide the programming of DBS systems.

Methods: A patient's preoperative MRI was registered to a postoperative CT via a rigid registration algorithm. Next, a 3D brain atlas with relevant structures and sub-structures was registered to the patient's MRI using nonrigid registration. An automatic lead extraction algorithm was used to localize the electrodes from the postoperative CT. Efficacy maps based on data collected from a population (>200 patients) were overlaid on the images to visualize as a heat map locations likely to yield efficacious stimulation. Finally, the effects of stimulation parameters were visualized as the volume of tissue activated (VTA). Various VTAs were developed based on the directional sensitivity of nerve fibers relative to the computationally modeled electric field; the VTA of individual parameters or simultaneously delivered sets of parameters (interleaved stimulation) may be comparatively evaluated and selected based on the observed clinical effects of each individual patient. A sample patient's information including stimulation settings and observed clinical effects was saved, and data management tools were used for tracking this patient information over time.

Results: The total workflow from image import to VTA generation took approximately 8 minutes. This workflow combines information on anatomy (patient-specific image sets), physiology (population-level efficacy maps), DBS lead (patient-specific electrode location), DBS parameters (patient-specific settings, multiple VTA types), and stimulation effects (patient-specific clinical effects). In one example, a VTA is selected such that the overlap between the VTA and the region of highest efficacy based on the efficacy map is maximized. Data management tools provide a snapshot of the device settings over time for an individual patient and for a population of patients.

Conclusions: This bioinformatics approach to DBS includes (1) a visual, patient-specific workflow combining anatomical, physiological, and stimulation information, and (2) data management tools for trending, tracking and analyzing data from a large population of patients. This information may be used on a patient-by patient basis and on a population level to better understand DBS and the effects of stimulation. In the future, these tools may be used during the entire treatment continuum including preoperative surgical planning, intraoperative targeting, and postoperative programming and troubleshooting of DBS systems.

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OUTCOME OF ACADEMIC COLLABORATION GAUGED BY PUBLICATIONS OF INVESTIGATOR INITIATED TRIALS SUPPORTED BY MEDTRONIC NEUROMODULATION EUROPE

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Introduction: The Medtronic R&D team has been supportive of investigator initiated (or sponsored) trials (IITs) since the late 1990s. By this means, Medtronic supports trials that otherwise may not have been conducted due to lack of funding in academic institutions. The Medtronic internal multi-functional research board reviews submitted research proposals based on strategic fit, scientific interest, quality in methodology, highest ethical standards and unmet medical need. One output of these supported programs is the general increase in scientific and medical knowledge in the form of doctoral theses, posters and talks at congresses, as well as articles in peer-reviewed journals. The purpose of this work is to measure the peer-reviewed publication output of research supported with financial or device contributions from Medtronic.

Methods: As required per research agreements, publications generated by IITs were submitted by investigators to the Medtronic team, and to ensure thoroughness, a PubMed search was performed using principal investigator names and identifying which publications were related to funded research projects. Full publications were downloaded and individually checked for relevance to the project. Publication dates ranged from 1999 to 2011. Journal impact factors retained were the latest available values, either through direct disclosure by the journal or online databases.

Results: These IITs generated more than 120 peer-reviewed publications. The pace has been steadily increasing, with 30 publications in 2011 alone. Impact factors reflected both general audience medical (*New England Journal of Medicine, The Lancet*) or basic science (*Neuron*) journals and more focused journals (e. g. *Stereotactic and Functional Neurosurgery*). While several therapies were represented, deep brain stimulation (DBS) projects were the most numerous and generated the publications with the most impact, followed by spinal cord stimulation and others. Indications were first and foremost movement disorders, followed by pain, psychiatric disorders and epilepsy. They also included lesser-known investigational areas like DBS for hypertension.

Conclusions: The number of publications in peer-reviewed journals is an important indicator for the value of academic collaboration between European physicians and scientists and Medtronic to alleviate pain, restore health and extend life. DBS therapy innovation represents a major part in these research programs.

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CHRONIC VALIDATION OF A FULLY IMPLANTED BIDIRECTIONAL NEURAL INTERFACE WITH AUTOMATED FEATURE DETECTION IN A NON-HUMAN PRIMATE

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Objective: To demonstrate chronic in vivo performance of an automated biopotential feature detection algorithm embedded within a fully implantable bidirectional neural interface.

Background: Chronic measurement of biopotential signals, including those found in brain and muscle tissue provides an avenue to investigate neurological diseases and potentially improve associated treatment through quantitative diagnostics and algorithm-enabled adaptive neuromodulation. Realizing this opportunity requires overcoming practical issues such as poorly validated methods for real-time estimation of physiologic state and demonstrating reliable signal detection in a chronically implanted system. We developed a bidirectional neural interface capable of both stimulation and biopotential recording, including feature detection with an embedded algorithm. The system application was previously reported in an ovine epilepsy model. In this study, the neural interface explored motor function, which has more stringent detection requirements.

Methods: The system was fully implanted in a non-human primate to capture local field potentials (LFPs) from the primary motor cortex, and electromyogram (EMG) patterns from the contralateral infraspinatus muscle, an external rotator of the arm. Data were collected at regular intervals for one year. Iterative adjustments using wireless telemetry enabled the machine learning algorithm to be optimized to detect features of interest in the biopotential signals. The algorithm used frequency domain features of measured EMG signals to trigger and store 8-second segments of data at spontaneous transitions between arm rest and arm movement in the awake behaving state in real-time. To validate the movement detection algorithm, the movement-triggered cortical LFP was analyzed in the frequency domain.

Results: The neural interface showed safety and signal integrity for over 12 months in the non-human primate, with signals resolved to 1μV rms. Auto-detected transitions between arm rest and arm movement in the EMG signal were qualitatively similar to those detected by visual inspection of long (14-minute) non-triggered data segments. Analysis of auto-detected rest-to-move transitions demonstrated a movement-related beta band power decrease and broadband gamma power increase, consistent with previous literature.

Conclusions: Results demonstrate the chronic, in vivo feasibility of automated biopotential feature detection in the brain and muscles using an implanted neural interface. The detection floor required for applications like brain-machine interface (BMI) systems and Parkinson's disease was found to be stable. The sensing integrity and algorithm capability enable potential clinical translation of this brain-machine interface technology to a broad range of neurological applications.

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THE PRELIMINARY EVALUATION OF MACHINE LEARNING AND CLOUD-BASED DATA MANAGEMENT PROTOTYPES FOR PATIENT-SPECIFIC ALGORITHMS IN IMPLANTABLE SYSTEMS

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Introduction: Recent advancements in ambulatory, chronic, neural recording systems provide a unique opportunity for measuring properties of the nervous system and exploring how we might optimize algorithms for patient-specific needs. To achieve this goal, we also need to develop technology to process large amounts of data collected and facilitate the creation of detectors/classifiers that can optimize sensitivity and specificity based on the emerging understanding of physiological biomarkers. A distributed data management and computational architecture, applied to a supervised machine learning flow, lends itself to addressing these issues.

Methods: For the management of data, we developed a cloud computing-based system that allows a user to upload recorded data from a device using a web application, and store these data securely on the cloud. Users can visualize and annotate segments of the data based on observations through an interactive graphical interface. Once data are annotated, the system facilitates the creation of "optimal" classifiers using automated statistical algorithms that define the boundary that maximally separates the annotated states. Interactive statistics and cross-validation are included for confirmation. Once an acceptable classifier is generated, parameters can be downloaded to the implantable device for chronic testing.

Results: The system was tested by end-user researchers for both data storage and classifier generation in animal protocols and previously recorded data libraries. Data uploads of the maximum size of the implantable device memory for neural recordings (42Mb) were limited by the prototype database structure, but could still occur in less than 40 seconds. Annotations were made by the researcher based on observations and markers of interest. The classifier automated machine learning flow was validated on epileptic seizures, motor control signals from brain-machine interface, and acute data from recordings taken from the STN of Parkinson's patients. The classifier generated true positive values >95% and false positive values <5% for each of these trials when multiple dimensions of data were used. For the epilepsy and motor control protocols, the classifier parameter set was downloaded to the implanted device and validated in-vivo for several months.

Conclusions: A web-based application linked to cloud computing and storage is an attractive solution for the analysis and maintenance of large amounts of brain signal data. The software prototype provides a fully-integrated system for storage, sharing, visualization and processing of brain data. Leveraging the cloud-computing infrastructure enables robustness, global accessibility and scalability in both data storage and computing speed with acceptable security. This paradigm aims to facilitate the translation of patient-specific algorithms into the next generation of devices.

POSTERS

BASIC SCIENCE, IMAGING AND DEVELOPMENT TECHNIQUES

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A VASCULAR SAFETY INDEX FOR STEROTACTIC TARGETING OF DEEP BRAIN STRUCTURES

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Background: One major problem in the stereotactic placement of electrodes in deep brain structures is the avoidance of major blood vessels present along the trajectory.

Objective: To define a trajectory safety index (SI), based on a maximum intensity projection (MIP) algorithm, that would represent an objective measure of the proximity of the blood vessels.

Methods: Contrast-enhanced MRI's were filtered using 3D Frangi vesselness filter and co-registered with the other scans (CT, MRI) in the surgical planning software (Waypoint Navigator, Neurotargeting, Nashville, US). Using Matlab (Mathworks, Natick, MA, USA), a 3D model of the vasculature was generated by thresholding the Frangi-filtered MRI. Initial trajectories were planned and the information, including co-registration matrices, was exported to Matlab. The thresholded volume was normalized and smoothed using a 3D Gaussian. SI was defined as the maximum intensity value along the trajectory intersecting this volume. Alternate trajectories were suggested by calculating the trajectory safety index for a grid of entry points surrounding the original one.

Results: We have applied the calculation of the safety index to the targeting of subthalamic nucleus (STN) for deep brain stimulation (DBS) of Parkinsonian patients and to the implantation of depth electrodes for stereoencephalographic (SEEG) monitoring of epileptical patients. A retrospective analysis on n=18 STN targets, resulted in a SI = 0.95±0.07 (mean±sd). The method was prospectively used for 7 SEEG electrodes implantation (SI = 0.83±0.22), suggesting alternate trajectories having a higher safety index.

Conclusions: The trajectory safety index we have defined may represent a useful tool for minimizing risks of brain haemorrhage when targeting deep brain structures. Supported by PN-II-ID-PCE-2011-3-0240.

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ACCURACY OF AN INNOVATIVE DEVICE FOR STEREOTACTIC AND FUNCTIONAL NEUROSURGERY: A CADAVER STUDY

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Introduction: Classic stereoactic frames have been used for decades and have shown to be accurate for stereotactic procedures. However, they may show some limitations concerning their use with intraoperative MRI or to perform simultaneous bilateral procedures. We present a new device fulfilling these criteria (StereoPod, StereoTools, Neuchâtel, Switzerland). The objective of this study is to test the accuracy of the Stereopod on cadaver heads.

Methods: The procedure was performed on 5 cadaver heads. A pre-op 3D CT-Scan (voxel size: 0.488x0.488x0.625 mm3) was performed with the image localizer of the device. A deep seated target (generally thalamus) was defined on the dedicated software. After calibration of the system, the tripod was installed on the cadaver's skull. A biopsy needle was inserted into the brain to the target. An intraoperative CT-Scan was acquired. Several rigid registration algorithms were used to measure the 3D distance between the planned target and the extremity of the biopsy needle.

Results: 5 procedures were performed with the device fixed to the skull on the right frontal area (coronal region). The mean 3D calculated distances were 0.63 +/- 0.10mm (x: 0.39+/-0.25mm; y: 0.14+/-0.32mm; z: 0.21+/-0.25mm). The measurements were performed by 3 different persons and 3 different algorithms. The results were not influenced by the measuring person and/or the used algorithm.

Conclusions: This cadaver study using intraoperative imaging shows a submillimetric accuracy of the Stereopod, which is (at least) comparable to the classic frames. Further clinical studies are planned for stereotactic biopies and DBS electrode implantation, in order to confirm these results.

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A TECHNICAL TRICK TO HELP THE TUNNELLING OF DEEP BRAIN STIMULATION ELECTRODES

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Introduction: Connection of deep brain stimulation (DBS) electrodes to the pectoral generator need to tunnelize them through the retro-auricular region which sometimes need to de done by brute force. We describe a technical trick allowing to avoid potential traumatic haemorrhage and damage of neighbouring structures related to this tunnelling.

Technical description: We performed a cadaver dissection of the retro-auricular cranio-cervical region to identify the causes of the resistance to the up to down tunnelling, imposed by the hardware. The area of resistance was the horizontal line of neck muscles insertions (Sternocléidomastoïdien, Splénius Capitis et Splénius Colli). Crossing these insertion from the subgalleal cranial plane force to change randomly to a more or less superficial sub-aponeurotic cervical plane, leading to potential traumatic damage of neighbouring structures (recurrent branch of the accessory nerve, superficial jugular vein, sub-clavicular vessels). To solve this difficulty, we propose a surgical trick consisting in doing a supplementary short retro-mastoid "bridging" incision over this line of muscles insertion, allowing to control the tunnelling planes in up and down directions. More than one hundred operations have been performed using this technique, without hemorrhagic, neurological or infectious complication.

Conclusion: Several surgical complication of DBS may be related to the traumatic tunnelling of the electrodes, including infection which is facilitated by local haematoma. Performing a supplementary retro-mastoid incision decrease the trauma due to tunnelling without increasing the risk of infection.

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CYTOARCHITECTONIC-BASED THALAMIC RECONSTRUCTION AS GROUNDWORK FOR A THREE-DIMENSIONAL STEREOTACTIC ATLAS OF THE HUMAN BRAIN

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Introduction: Stereotactic procedures are based on precise spatial localization of targets within the human brain. Despite the great advance in neuroimaging in the last thirty years, it is still not possible to delineate or to identify reliably subcortical structures borders using high-resolution computed tomography (CT) or magnetic resonance image (MRI). Although several cytoarchitecture or immunostaining- based maps have been proposed as parameters for correlating imaging results with anatomical location of these structures, technical limitations prevent a point-to-point correlation between imaging and anatomy. The main shortcoming of these maps is the lack of precise correction of post-mortem tissue deformations caused by fixing and processing. To date, even complex algorithms failed to completely correct these distortions.

Methods: Here we present a 3D reconstruction of the human thalamic nuclei of a 56 year-old male subject, based on cytoarchitectonic criteria. To this purpose a simple and reliable method to process the tissue was used and a new tissue warping technique was developed, allowing good three-dimensional coherence.

Results and Conclusions: The one-to-one correlation of the histology with the 3T MRI of the same subject warrants a better interpretation of MRI images. Our results render feasible the construction of an improved three-dimensional stereotactic atlas of the human brain.

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POINT-TO-POINT CORRELATION OF THREE-DIMENSIONAL CYTOARCHITECTURE WITH 3.0T MAGNETIC RESONANCE AND DIFFUSE TENSOR IMAGING

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Introduction: The precise spatial localization of targets within the human brain is a main concern in functional and stereotactic neurosurgery. High-resolution magnetic resonance imaging (MRI) and computed tomography (CT) allow the identification of subcortical structures based on the tissue's physical properties. Despite the great improvements in imaging resolution, this is still an indirect method for locating brain targets and not suitable yet to permit reliable delineation of some subcortical nuclei. Several cytoarchitectural or immunostaining- based maps have been proposed as parameters to locate anatomical structures in imaging, however, technical limitations still prevent a point-to-point correlation between imaging and anatomy. The main shortcoming of these maps was the inability even after application of highly complex algorithms to precisely correct post-mortem tissue deformations caused by fixation and histological processing.

Methods: Here we present a simple and reliable method of tissue processing and a warping technique that allowed the point-to-point correlation of thalamic and subthalamic structures identified in histological sections to the 3.0T MRI and diffuse tensor imaging(DTI) of the same subject.

Results and Conclusions: The correlation of cytoarchitecture/myeloarchitecture with MRI and DTI warrants a better interpretation of neuroimaging and will help to support preoperative planning in functional neurosurgery.

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COGNITIVE ELECTROPHYSIOLOGICAL RESPONSES OF NON-RESPONSIVE PATIENTS BEFORE AND AFTER TRANSCRANIAL ALTERNATING CURRENT STIMULATION

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Objectives: Transcranial alternating current stimulation (tACS) has been shown to affect electroencephalographic (EEG) activity, and to improve implicit motor learning. The present study aimed to assess the effects of tACS in the cognitive electrophysiological responses of patients who are in persistent vegetative state (PVS) or minimally conscious state (MCS).

Methods: EEG cognitive event-related potentials (ERPs) for a semantic oddball paradigm were recorded from six healthy volunteers once, and from ten patients (6 in PVS, 4 in MCS) before and immediately after (a) 20 minutes of 1 mA tACS at 15 Hz (real stimulation), and (b) 30 seconds of 1 mA tACS at 15 Hz (sham). The two conditions (real vs. sham stimulation) were counterbalanced across participants and set one week apart.

Results: Healthy volunteers showed significantly different N400 and P600 ERPs for the rare word category, more evident over central and posterior electrodes. Some patients showed similar findings, but there were no clear effects of tACS.

Conclusions: Some non-responsive patients show electrophysiological reactions to semantic stimuli. However, there is no clear evidence that one session of tACS affects cognition in these patients, as measured by cognitive ERPs.

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COMMON PLATFORM FOR EVALUATING FRAME-BASED AND FRAMELESS IMAGE-GUIDED STEREOTACTIC SURGERY

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Introduction: The main motivation of this work is to develop a common IGS (image guided surgical) platform which is suitable for sharing surgical planning data in frame-based stereotaxy and frameless, navigated brain surgery. The comparison until now has been based on planning with different platforms and review of associated variables of both techniques. In biopsy the final outcomes are compared by pathology diagnostic accuracy and (in electrode placement as well) immediate post-operative CT imaging. The eligibility of frameless technique depends on target size, anatomical location, with an ongoing debate on un-quantifiable variables which ultimately influence technique selection (anesthesia, size of craniostomy, diagnostic yield, etc).

Methods: In our approach, the common IGS platform integrates fusioned CT and MR imaging and standard 3D planning tools for target trajectory. The electrode placement or biopsy technique include Riechert-Mundinger or MHT (Freiburg, Germany) stereotactic frames. The IGS platform is able to calculate parameter settings for these frames with a newly developed algorithm providing for 3D transforms between diagnostic space, marker space and patient local reference (AC-PC). Moreover, the platform communicates with Polaris Spectra and Vicra optical tracking devices (Northern Digital, Inc.) and registers surgical space to diagnostic data.

Results: The polar settings of navigated device (with attached passive sensor) is continuously updated during movement and compared to target trajectory settings. Simultaneously, the actual position of device can be visually inspected and tested with a special targeting graphics on computer screen. The main advantage of this approach is, that it directly compares the frame-based and the frameless techniques for the same patient in one surgical intervention, maintaining identical target dimension and diagnostic yields.

Conclusions: The initial results, accepting frame-based technique as gold-standard, show that the frameless navigation has less accuracy (with more sensitivity to surgical environment), confirming others' data. We expect reliable comparison of stereotactic techniques from the newly developed IGS system.

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USE OF A NOVEL TRIPOD SKULL CLAMP FOR PREOPERATIVE LOCALISATION OF CAVERNOMAS OR SMALL DEEP SEATED LESIONS

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Introduction: In cavernoma surgery, accuracy in localisation is of uppermost importance. In eloquent areas, a mimimal cortical incision and trajectory are mandatory. IR-referenced neuronavigation systems provide an insufficient accuracy caused by an imprecise registration, with surface matching or with skin fiducials and mobility of the underlying skin. Only a referencing based on markers fixed directly or indirectly to the skull is fully reliable, as used in stereotactic registration.

Material and Methods: A tripod skull clamp system was designed and realized in polyamid; it consists of 3 arms, carrying at the top a sterile skull pin used in stereotactic frame fixation, and on the side 7 cone-shaped holes used as fiducials. These are spatially distributed in X, Y and Z directions. The 2 posterior arms are solidary, and the anterior sagittal arm is clamped in the forehead skull by a screwing mechanism, under local anesthesia. A CT scan is realized, and the 7 reference points indicated and registrated.

Results: 8 cases of cavernoma or metastasis deep-seated and/or located in eloquent brain areas are presented, in which the tripod clamp has been used; in each case optimal accuracy was obtained, confirmed by introperative ultrasound and operative verification.

Conclusion: A newly designed tripod skull clamp is presented, providing accurate fiducial registration with 7 rigid markers; stereotactic precision is obtained, with important improvement in navigational accuracy; the clamp appears to be useful in resection of small subcortical lesions in highly eloquent areas or posterior fossa surgery, when classical registration bears an unacceptable error in accuracy.

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USE OF A NOVEL DEVICE FOR MONITORING OF VISUAL FIELDS DURING AWAKE CRANIOTOMIES

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Introduction: During awake craniotomies for lesion resection in temporal, parietal and/or occipital areas, monitoring of visual fields in the vicinity of optic radiation, remains a challenge to the neurosurgeon; this is mainly caused by the lack of assessment by intraoperative testing.

Method: A novel device was realised, consisting of an oval shaped open frame, and bearing twelve LED's with 6 different colours, allowing control of visual fields; simultaneous visibility of the laptop behind the campimeter is mandatory, since most visual testing with object naming, reading, etc. are presented on a monitor in front of the awake patient. The laptop screen is usually located at a distance of 40-60 cm from the patient's face, so can't be used for testing of visual fields: the concept of an open ring, located between the patient and the laptop, was obvious. The choice of different colours was preferred to monocolour spots, since the accuracy of the answer can be easily and instantly verified without need of description of localisation in the visual field. Moreover, visual extinction can be tested with simultaneous lighting up of two spots in both hemifields. The LED's are located as the hours of a clock, offering easy control of localisation if needed. The basic rainbow colours and white, were chosen, with avoidance of similar appearance and confusion of colours(white at 0 & 6 h, blue at 1 & 7 h, orange at 2 & 8 h, green at 3 & 9 h, red at 4 & 10 h, yellow at 5 & 11 h).The speech therapist activates the different LED's by pression on switches, displayed in the same clock-like orientation as the campimeter. Illustrations are presented.The patient is asked to fix a central point on the laptop screen, and to mention the colour of the lighting spot or spots; there is no loss of time, the testing can be afforded at any time needed, continuously or not.

Results: The intraoperative campimeter was used in 5 patients, presenting temporal and/or parietal tumours, resected in awake condition; it revealed to be fast in use, reliable, accurate, with a good reproducibility and without harming access to the patient or use of the classical laptop.

Conclusion: A novel campimeter, with the shape of an oval ring and bearing twelve coloured LED's, was realised and tested for monitoring of visual fields during awake craniotomies for lesion resection in temporal, parietal and/or occipital areas; it reveals to be simple, cheap and reliable in use.

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VALIDATING DIFFUSION TENSOR IMAGING OF THE THALAMUS WITH INTRAOPERATIVE MIRCROELECTRODE RECORDING

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Introduction: Identification of the anteroposterior borders of the ventral thalamic nuclei is important in thalamic stimulation surgery. We have reviewed magnetic resonance imaging data in three patients with tremor who underwent thalamic stimulation.

Methods: We have analyzed the radiographical boundaries of the thalamic ventral nuclei using a deterministic and a probabilistic tractography algorithms with 3-Tesla diffusion imaging data. These tractography results are reviewed with structural magnetic resonance images and intraoperative microelectrode recording data of the thalamic ventral nuclei.

Results: The length of the motor-somatosensory boundaries was 5.5 to 8.5 mm. The highest connectivity of hand motor area was located at 12 to 16 mm lateral from the midline and 6 to 10mm anterior to the posterior commissure on the anterior and posterior commissural plane. The distance from the pyramidal tract to the implanted electrode was 1.8 to 3.3 mm.

Conclusion Diffusion tensor imaging is useful for preoperative estimation of anteroposterior border of the thalamic ventral nuclei, which support safe and effective surgical planning of the thalamic stimulation.

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QUALITY OF LIFE OF FAILED BACK SURGERY SYNDROME PATIENTS WITH SPINAL CORD STIMULATION: RESULTS OF A SINGLE CENTER STUDY

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Introduction: SCS is an evidence based method to treat intractable lower extremity and back pain and also Failed Back Surgery Syndrome. Although several studies investigate the pain reduction, only a few focus on the quality of life (QOL) measures after implantation of SCS. The purpose of our study was to evaluate patient satisfaction after SCS in our center. Health-related QOL as well as depression and anxiety were assessed.

Methods: A total of 27 patients were implanted with SCS between 2005 and 2009. Of this group 23 patients participated voluntarily in the study. All patient follow up consisted of neurosurgical and psychological examination including: physical examination, evaluation of pain relief on the visual analogue scale (VAS), semi-structured clinical interview, projective personality assessment and follow-up test battery.

Results: Postoperative pain intensity on VAS was significantly lower than preoperatively (pre: 9.39 vs. post: 3.17; p0.001), 91.3% of patients would choose SCS again. Despite significant pain relief however, QOL has not improved significantly. 78.3% assessed pain related disability as severe; 82.6% took analgesics, 43.5% used antidepressants; 59.1% had bad sleep quality; levels of anxiety were close to levels of psychosomatic patients.

Conclusion: Our results in terms of pain relief exceeds those reported in the literature. However the quality of life of our patient did not change as expected. This study should draw attention to the very complex psycho-social handicap of the chronic non-malignant pain patient population to provide complex analgesic treatment to be able to impact their daily life even more.

BSIDT / P / 250

RECEPTORS 5HT1A AND D2 IN THE ORBITOFRONTAL CORTEX AND NUCLEUS ACCUMBENS AFTER INJURY OF RETHICULAR THALAMIC NUCLEUS IN T-MAZE MODEL WITH WISTAR RATS

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Obsessive-compulsive disorder (OCD) is a psychiatric illness that can lead to chronic functional impairment. Some patients with refractory OCD have been treated with ablative neurosurgical techniques and recently, deep brain stimulation (DBS). However, is uncertain the neurobiochemistry mechanisms by which it operates. The aim of this study was to determine the thalamic-orbitofrontal system receptor dynamic after bilateral lesion of reticular thalamic nucleus.

Methods: Through [3H]-ligand binding assay were quantified the serotonin (5HT1A) and dopamine receptor (D2) of the orbitofrontal cortex (OFC) and nucleus accumbens (NAc), subsequent of reticular thalamic nucleus lesion (RTN), on 8-OH-DPAT induced persistent behavior model in rat. Results. The binding [3H]-8-OH-DPAT in the NAc decreased, according to the left and right hemispheres, in the sham group (132.47, 101.60 fmol / mg, SD 40.56, 39.77, p = 0.024, p = 0.006), RTN lesion (137.83, 114.04 fmol / mg, SD 28.52, 25.14, p = 0.039, p = 0.006) compared with control (139.99 170.06, 149.99 fmol / mg, SD 33.83, 43.39), while there is similarity between the control, 8 -OH-DPAT (142.67, 138.93 fmol / mg, SD 27.62, 33.64) and the group RTN lesion + 8-OH-DPAT (189.08, 139.99 fmol / mg, SD 39.50, 18.15, p = 0.24, p = 0.55). The event was repeated only in the left OFC, sham (264 fmol / mg, DE 63.80, p = 0.001) NLRA (227 667 fmol / mg, DE 25.10, p = 0.0005) and RTN lesion + 8-OH-DPAT (213.48 fmol / mg, DE 28.06, p = 0.0003) compared with control (365.74 fmol / mg, 88.24). The binding [3H]-spiperone in the different groups was similar compared to control in both structures.

Conclusions: The application of a single dose of 8-OH-DPAT (1mg/kg, sc) produced no changes in binding [3H]-8-OH-DPAT in the NAc and OFC, while the application after the RTN lesion appears to restore binding in the NAc. The binding [3H]-spiperone NAc and OFC is not altered after pharmacological or surgical intervention.

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INTRAOPERATIVE CT IN VERIFICATION OF ACCURACY OF ELECTRODES LOCALISATION IN DBS PROCEDURES

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Introduction: Correct and accurate placement of electrodes in DBS procedures is essential in achievement of proper therapeutical effect in movement disorders and spascity.

Materials and methods: 32 patients with movement disorders (PD, dystonia, cerebral palsy) were operated in 2010-2012 in Military Clinical Hospital in Bydgoszcz, Poland. Standard procedure of electrode implantation was verified by intraoperative CT in operating room. CT scans were fused with preoperative MRI plan of target (STN, GPi, cereberal pedunculi) and trajectory and accuracy were assessed.

Results: In 2 cases the accuracy was not satisfying and required replacement of electrodes.

Conclusions: Intraoperative CT is helpful tool in DBS procedures and enables comparison of preoperative plans with the final trajectory and localistaion of the tip of electrode visualized in CT in appropriate target and eliminates neccesity of post-op verification outside the operating room. All changes can be done during the procedure.

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LONG-TERM ELECTROSTIMULATION IN INJURY OF PERIPHERAL NERVES OF THE UPPER EXTREMITIES

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Problem of restoration of nerve function after close traumatic injury is a difficult question for surgeons during a selection of effective method of treatment.

Materials and Methods: We performed an analyze of a results of surgical treatment with using a long-term postoperative electrostimulation of 151 patients in age from 4 to 60 (26.4 on average) years old with injury of peripheral nerves of upper extremities. Among them 27 patients were operated in term after injury more than 12 months. Electrostimulation was made using ukrainian electrostimulative systems NeuC-3M, with platinum electrodes (4 square mm). This method was used according with long posttraumatic period. In 4 cases were made a suturing of radial nerve and in 2 cases – nervus medianus. In other cases method of long-term electrostimulation was used after neurolysis of upper limb nerves. Also in 89 cases with brachial plexus close injury (including 16 cases with intranatal trauma) was revealed axonotmesis by Seddan classification. Parameters of stimulation width of wave from 0.1 to 1ms/impulse, frequency 10-25 Hz. Electrostimulation was begun on the third day after operation. Control of regeneration was made in early and remote period.

Results: In 90% of patients (136) was achieved a positive result by restoration or increasing of nerve conductivity, and prevent muscles from irrevocable changing. Positive results was achieved in 69 cases (77,5%) in patients with close brachial plexus injury.

Conclusion: Long-term electrostimulation of peripheral nerves of upper extremities after the traumatic injury is an effective method of treatment, forward a nerve conductivity and prevent muscles from irrevocable changing.

BSIDT / P / 319

AN ANALYSIS OF STEREOTACTIC BIOPSY OF BRAIN LESIONS

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Background: An accurate diagnosis of intrinsic brain lesions, which is crucial in order to select the best therapeutic option, requires tissue sampling and histological verification. In the present study we reviewed our experience with stereotactic biopsy (SB) of human brain lesions.

Methods: The study was conducted within a time frame of five years. In 92 patients – 65 males and 27 females (median age 57 years) stereotactic procedure was performed. Reasons for SB were (i) an eloquent tumour location, (ii) a significant comorbidity, (iii) uncertainties concerning the diagnosis of malignant glioma and/or (iiii) multifocal brain lessions. The modified Riechert Stereotactic System (MHT Medical High Tech, Freiburg, Germany) and a workstation for multiplanar trajectory planning (Amira, Visage Imaging, Berlin, Germany) were used for the operative procedures. CT and MR images were fused for planning. The coordinates were verified on a phantom. The multiple biopsy samples were obtained stepwise along the trajectory through the entire lesion – serial biopsy. Cytopathologist in the operating room immediately evaluated the alternate tissue samples by using a touch imprints and crush smears with methylene or toluidine blue staining. The other fragments were fixed and send to the pathology laboratory for further analysis. Same specimens were also sent to the microbiological analysis, especially in the multifocal brain lesions. Within 24 hours a postoperative CT scan was performed to check for complications and to verify accurate target sampling marked by titanium ball at the target site.

Results: Ninety-two stereotactic surgeries were performed in five year period, including eight cases of deep brain stimulation, which were excluded from the analysis. Conclusive histopathologic diagnosis was achieved in 95.2% of our 84 cases. In the present series, glioma was the most common diagnosis, representing 51.2% (43 patients): 16 (19.0%) were classified as glioblastoma multiforme, 11 (13.1%) as anaplastic astrocytoma and 14 (16.7%) as low grade astrocytoma. One patient (1.2%) has the lesion classified as anaplastic oligodendroglioma and one (1.2%) as gemistocytic astrocytoma. The rest of tumours were classified as: lymphomas (9.5%), metastasis (14.3%), meningioma (1.2%) and pineoblastoma 2.4%. In one case the gliosa was reported (1.2%). The ischemic vascular lesion was reported in 3 cases (3.6%) and sclerosis multiplex in another 3 cases (3.6%). An inflammatory or infectious process was found in 7 patients. Six patients (7.5%) had brain abscess. Unexpectedly, in one case (1.2%) we confirmed the infection with Moraxella osloensis. This is the first report of brain infection by this microorganism. Diagnosis was not established in 4 patients (4.8%). The overall treatment related morbidity and mortality was 2.1% and 0%, respectively.

Conclusion: We point out the importance of the intraoperative evaluation with the smear preparations of biopsy specimens. According to our experience we strongly recommended to send the suspected sample also to the microbiological analysis especially in the case of multifocal brain lesions to exclude unusual infection. SB with multiplanar image guided trajectory planning software is reliable tool which enables trained stereotactic neurosurgeon to obtain tissue diagnosis in almost every case with very little morbidity.

BSIDT / P / 180

MODIFIED AXILLARY SKIN INCISION FOR IMPLANTATION OF DEEP BRAIN STIMULATOR: ELEGANT TECHNIQUE FOR DBS SURGERY

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Introduction: Chronic deep brain stimulation (DBS) is increasingly performed for movement and psychiatric disorders, but cosmetic problems of the surgery are scarcely taken into consideration ever. Surgery for implantable pulse generator (IPG) placement often includes subclavicular skin incision on the anterior chest wall, which is, however, liable to remain as a conspicuous surgical scar.

Methods: We relocated the skin incision from the anterior chest to the anterior axilla, and evaluated cosmetic consequences and patients' satisfaction.

Results: This technical modification resulted in making the scar drastically less prominent without any adverse factors such as prolonged surgical duration and uncomfortable pain. In only one patient with this method, IPG unexpectedly migrated from the anterior chest to the axilla several months after surgery because IPG had been implanted comparatively lateral to the ideal position with insufficient subcutaneous suturing. All the patients, especially women, were satisfied with the cosmetic appearance and preferred the same incision again in case of IPG exchange.

Conclusions: Axillary skin incision is recommended as a fundamental technique for DBS surgery, and it apparently contributes to patients' satisfaction and quality of life.

BSIDT / P / 60

NEURAL CORRELATES OF RECOVERY FROM ANARTHRIA

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Objective: To describe the functional correlates of recovery from anarthria with fMRI.

Method: A 48-year-old male patient recovering from complete anarthria after unilateral right-sided subcortical hemorrhagic stroke is described. The main outcome measures include clinical and neuroimaging data at 3 different time points (at the onset of symptoms, after 6 weeks and after 6 months).

Results: At six weeks, increased activations in the right and left frontal operculum were found and were followed by a trend towards normalization of the activation pattern at six months.

Conclusion: These results suggest a role of anterior opercular regions in recovery from anarthria after subcortical stroke. Moreover, complete recovery is possible after such lesions.

BSIDT / P / 259

BEVACIZUMAB AS SALVAGE THERAPY FOR PROGRESSIVE BRAIN STEM GLIOMAS

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Objective: There is no standard of care for patients with progredient brainstem glioma. Therefore we report about clinical, radiological and metabolic response to anti-angiogenic treamtent with bevacizumab in a series of 3 patients with gliomas involving the brain stem.

Methods: In a retrospective review between 2008-2011 three patients with histologically comfirmed gliomas involving the brain stem were treated with bevacizumab for tumor progression. The clinical data, histopathological findings as well as MRI and PET follow up examinations during bevacizumab therapy were analyzed.

Results: One patient is still progression-free 97 weeks after initiation of bevacizumab therapy, Mean progression-free survival and overall survival for the other two patients after initiation of bevacizumab therapy was 34.5 weeks and 43.5 weeks. During bevacizumab therapy mean KPS improved from 60 to 80 and mean dosage of daily dexamathasone was reduced from 7.3 mg to 1.3 mg. MRI showed showed a decrease of T2 weighted hyperintense lesions in all patients and a decrease of contrast enhancement in two patients. 18F-FET-PET showed a decrease of tracer uptake in all cases (mean maximum decrease: 25%).

Conclusion: In this series treatment of progressive gliomas involving the brainstem with bevacizumab resulted in an improved clinical condition of the patients as well as a reduction of the T2 weighted lesions and reduced amino-acid activity in the tumor area. It therefore may represent a therapeutic salvage option for this type of tumor.

BSIDT / P / 306

TRACTOGRAPHY IN PATIENTS UNDERGOING DBS FOR MOVEMENT DISORDERS: A LITERATURE REVIEW

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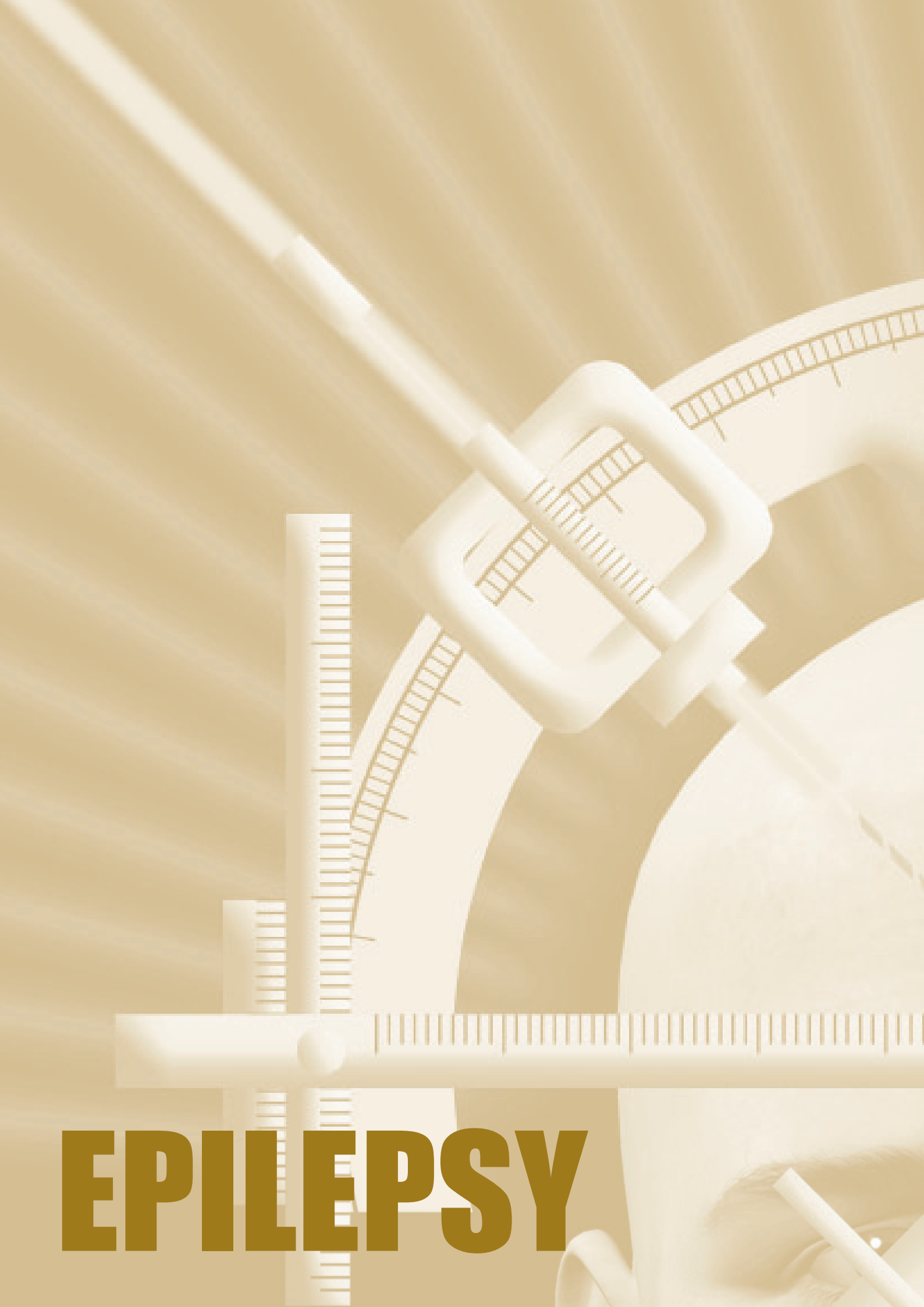
Introduction: DBS therapy generally employs structural imaging to target subcortical areas. Successful therapy largely depends on accurate targeting of anatomical structures. Defining the functional significance of anatomical targets by their structural connectivity could be a powerful tool in DBS for movement disorders. Probabilistic diffusion tractography (PDT) techniques assess the strength of possible anatomical connections between distant anatomical regions. The purpose of this review was to evaluate current literature investigating the use of diffusion tensor imaging (DTI) techniques in patients undergoing deep brain stimulation (DBS) for movement disorders.

Methods: A systematic search was performed on Medline using MeSH headings 'Deep Brain Stimulation' and 'Diffusion Tensor Imaging (DTI)'. Studies using DTI in patients undergoing DBS for movement disorders were used for this review. Articles cited from such papers were reviewed if appropriate.

Results: Nine papers from 3 centres were found to directly investigate tractography in DBS patients for movement disorders. Methodology could be broadly divided into three groups: 1. Studies that fuse postoperative images to preoperatively acquired DTI data. The seed voxel for the DTI analysis is then inferred from the location of the active DBS contact and a correlation with clinical observations is attempted. Such studies are often limited by the size of the seed voxel as well as fusion errors of the software used to merge multiple data sets. 2. Other studies compare postoperative with preoperative DTI data. However, it is impossible for the same seed voxel to be selected (as the DBS contact with a large MRI artifact is in situ in postoperative images. Although such papers restored connectivity and neuroplasticity in DBS these findings are not conclusive due to limitations on DTI methods with implanted DBS hardware. 3. Other papers utilize preoperative DTI data to guide and refine anatomical targeting. Such studies are still limited by voxel size and errors of image fusion between the acquired DTI and stereotactic image data sets. However, they provide proof of principle that DTI may be of benefit in individual patients.

Conclusions: Current studies of DTI in DBS patients show there is potential for this medium to advance the understanding of CNS connectivity. Validation of the methods used in the current limited number of studies is required before DTI becomes an accepted tool in DBS targeting.



EPILEPSY

EPIL / P / 240

EFFICACY OF VAGUS NERVE STIMULATION IN PATIENTS WITH INTRACTABLE EPILEPSY

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Introduction: Vagus nerve stimulation (VNS) as an alternative treatment for drug-resistant epilepsy has been used at our department since 2007. The goal of the study is analysis of its efficacy and complications related to treatment children and adults with refractory epilepsy.

Methods: Twenty-five patients (18 men, mean age 26,5 years) with perioperative stimulation parameter setting (output current 0,25 mA, frequency 20Hz, pulse width 250usec, ON 30 sec, OFF 3 min) were evaluated in time frame of 1,6,12,24,36 and 48 months.

Results: Five per-cent of responders were on the initial parameters one month after surgery, one patient was temporarily without seizures (he had around 200 seizures per month before VNS), six months after surgery some seizures reappeared; in general he experienced 50% seizure reduction. During 6 months follow up, there were 38% of responders, after one year 45% of responders, after 2 years 53% and after 3 and 4 years there were 52% of responders. No patient was completely seizure free. In three patients, there were temporary complications of VNS- vocal cord paresis in 2 patients and Horner syndrome in one. The most frequent experienced side effects of stimulation during ON phase were voice changes and throat paraesthesia. In one patient, VNS had to be removed due to psychological intolerance to the device. External stimulation by magnet was found useful by majority of patients-72%. Medication was decreased in one patient so far. Beneficial effect of VNS on alertness, cognition and mood was reported by all patients or their relatives.

Conclusions: VNS is effective adjacent treatment of intractable epilepsy, well tolerated by patients, improving quality of life. Cumulative effect of VNS in longer time span was confirmed; therapeutical effect of stimulation parameters and VNS duration remains individual. Predictive factors for efficacy of VNS therapy are being discussed.

EPIL / P / 155

THE ROLE OF MAGNETIC RESONANCE IMAGE (MRI) IN THE SELECTION OF CANDIDATES FOR EPILEPSY SURGERY

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Introduction: Magnetic Resonance Image (MRI) is considered a fundamental tool for the evaluation of candidates for epilepsy surgery, although its role has not been yet quantified. We present our experience over the last 20 years of existence of our Epilepsy Surgery Unit.

Materials and Methods: We retrospectively reviewed seizure outcomes and clinical, magnetic resonance imaging (MRI), histopathology, and surgical variables from 265 epilepsy surgery patients with at least two years of postoperative follow--up, operated on between 1990 and 2010, at our institution. Patients were classified, according to preoperative MRI findings, into three groups: Conventional surgical lesion (SL), patients with tumors or vascular malformations; orientative lesion (OL), including patients with cortical dysplasia, atrophy or mesial temporal esclerosis, and no lesion (NL), patients with normal MRI. Seizure outcomes were analysed in relation to this classification and to patients´ clinical features.

Results: A. - Period 1990-2000, where patients underwent 0,5 T MRI: 151 patients were analysed. Overall, 70% were in Engel class I or II, two years after surgery. According to MRI, 87% of SL, 65% of OL and 57% of NL patients were in Engel class I or II. B. - Period 2001-2008, with 1,5 T MRI assessment: 114 patients. Overall, 89% of operated patients were in Engel class I or II. According to MRI, seizure control was achieved in 100% of SL, 90% ofOL, and 81% of NL patients. In relation with the epileptogenic zone location, both temporal lobe (TLE) and extratemporal lobe epilepsy (ETLE) patients within the SL group obtained a 100% seizure control. Among the OL patients, 95% with TLE were in Engel I or II, whereas 43% of ETLE patients achieved seizure control. In the NL group, 88% of patients with TLE, and 50% of ETLE were in Engel I or II. The differences were statistically significant.

Conclusions: The presence of SL is a predictor of a favourable outcome. However, in TLE patients, very good results (80-90% of control) can be achieved despite normal MRI. In comparison to TLE, patients with ETLE and OL derived less benefit than those with normal MRI. The concept of MRI as an effective tool for the selection of surgical candidates in epilepsy surgery should be revisited and clarified.

EPIL / P / 103

CHRONIC BILATERAL SUBTHALAMIC STIMULATION IN DRUG-RESISTANT EPILEPSY: CLINICAL AND PHYSIOLOGICAL OUTCOME IN TWO CASES

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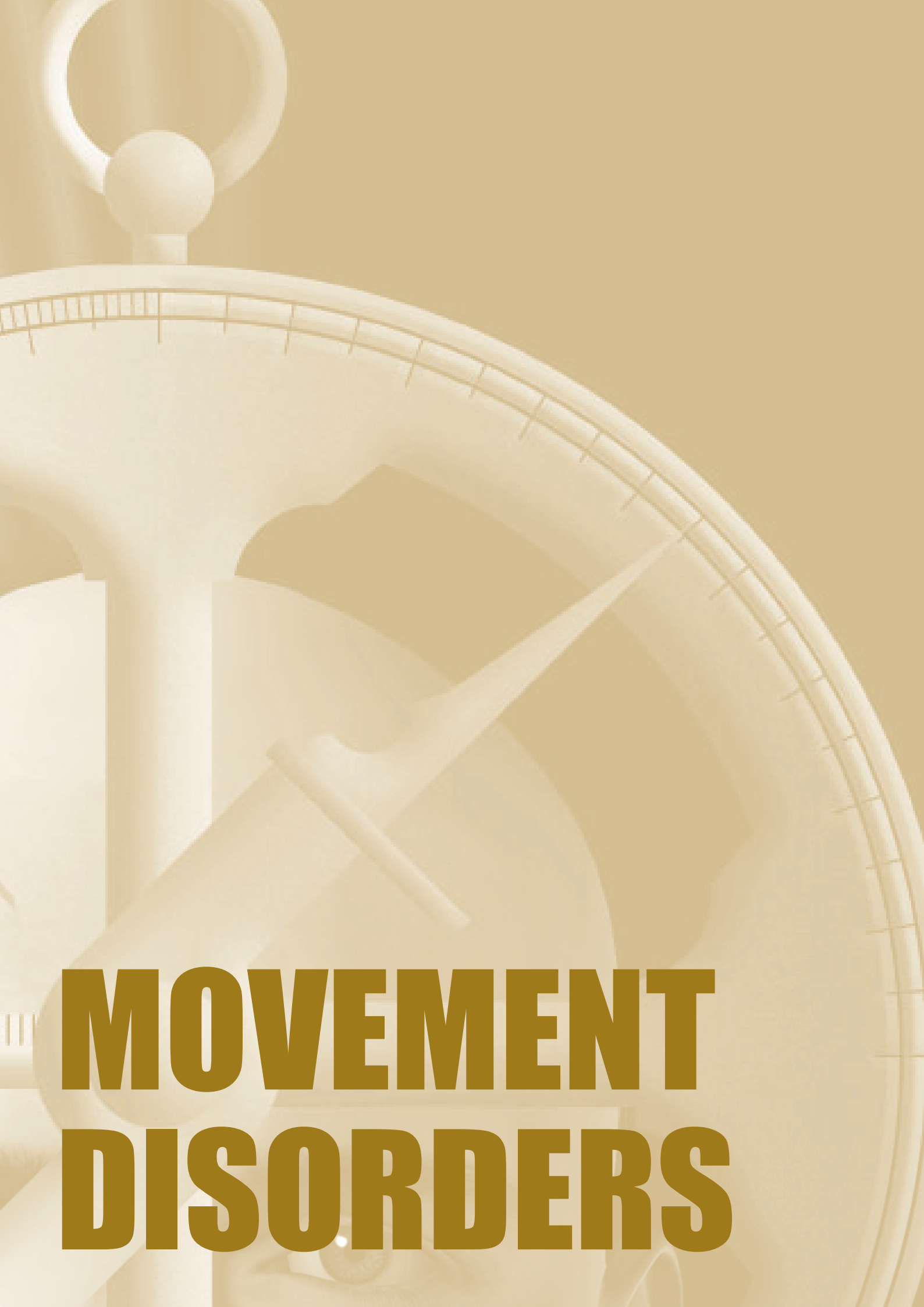
Background and Objectives: Animal and electrophysiological studies indicated the subthalamic nucleus (STN) as a site of anticonvulsant action. We analysed the efficacy and safety of bilateral SubThalamic Nucleus (STN) stimulation in two subjects with intractable epilepsy and previously treated with anterior callosotomy.

Material and Methods:
Case 1. A 35-aged right-handed male suffered from drug-resistant epilepsy since the age of three, with daily recurrent motor seizures characterised by versive attacks with the head turned right and both arms lifted up. Seizures were sometimes followed by automatisms and falls. Tonic–clonic seizures might rarely occur as well.
Case 2. A 30-aged right-handed woman suffered, since the age of 10, from drug-resistant epilepsy characterised by atypical absences, atonic seizures, focal seizures featuring sudden arrest, eyelid myocloniae, slow right or left rotation of head and gaze and stereotyped behaviour (arm automatism and vocalizations) and, rare tonic–clonic seizures.
Both cases underwent 4-year clinical and cognitive follow-up. Physiological assessment included a power spectrum analysis of Electro-EncephaloGraphy EEG power in beta1-beta2-delta-theta-alpha frequency with and without stimulation (Lg Relative Power - LgRP), performed 9 months after surgery.

Findings: Case 1 had about 65% decrease of partial motor seizures and the complete disappearance of tonic-clonic generalized attacks. When stimulation was switched ON, LgRP in the beta and alpha frequency decreased while increasing in theta frequency on frontal, temporal and occipital cortex. Case 2 did not show any meaningful seizure reduction while developing a stimulation-related increase in atypical absence rate. The EEG power spectrum analysis did not show differences between OFF and ON stimulation condition.

Conclusions: Chronic STN stimulation may exert a therapeutic influence on both generalised and focal motor seizures, but a correct patient selection and further studies are needed to implement such indication.



MOVEMENT DISORDERS

MOVDIS / P / 83

DIFFERENT TARGET STRATEGIES IN DEEP BRAIN STIMULATION FOR PARKINSON'S DISEASE

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Introduction: The subthalamic nucleus (Stn) and the Globus pallidus pars interna (Gpi) are the most reported targets for DBS in Parkinson's disease, being Gpi better to decrease diskinesias and Stn to reduce drugs; moreover, Gpi has less neuropsychological implications that Stn, but its somatotopy need a fine-tuning of the target; thalamic Vim or the uppermost part of Stn/Zona Incerta are most effective for tremor. Not all the PD patients are comparable and it seems advisable to custom the target to every different clinical features.

Materials and Methods: 264 PD patients, lasting from nov 1998 to dec 2011were considered. Patients received bilateral DBS; targets were: Stn (pars dorsalis/lateralis X 12, Y -4 Z -5 on AC-PC line; 224 pts), Stn /Zona Incerta (X 11, y -5, Z 0; 22 pts), Gpi (pars postero-infero-medialis X 20-22, Y + 3-5, Z -2; 18 pts). The inclusion criteria were: for StnDBS: classical PD symptoms, age under 65, no neuropsychological signs nor cognitive decline; for Gpi DBS: classical PD symptoms as above, age over 65 and/or mild neuropsychological signs or history of, and/or mild cognitive impairment; for Stn/ZI DBS: PD with prevalence of tremor. Patients were evaluated with UPDRS and cognitive and neuropshychiatric tests; mean follow up is 5.8 yrs.

Results: Postop UPDRS decreased of 61% in mean; best results were in the Stn and Stn/ZI groups versus Gpi (64% and 67% versus 54%); differences were not statistically significant. Stn DBS obtained a decrease in LDopa eq/day of 55%. Tremor was well controlled both in Stn and in Stn/ZI DBS without significant differences. No neuropsychological/cognitive impairment were in the Gpi group; in Stn group transient neuropsychological derangement was observed in 18%, in elder patients: in two of them psychiatric symptoms developed. The cognitive decline did not exceeded the expected one after 5 years follow-up. Two hemorrhages were observed in the Stn group.

Discussion: Despite the commonly adequate results obtained from DBS in PD, some peculiar features of the disease may suggest a tailored planning of surgery. In our experience, most of the patients benefited from Stn DBS; moreover, in case of slight neuropsychological or cognitive alterations, in otherwise good candidates to DBS, Gpi is to be considered as target of choice; finally, best treatment of PD with prevailing tremor may be achieved with dorsal Stn and ZI stimulation.

MOVDIS / P / 61

THALAMIC DEEP BRAIN STIMULATION (DBS) FOR THE TREATMENT OF POST-TRAUMATIC INTENTION TREMOR: A CASE REPORT

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Introduction: Post-traumatic tremor may be a consequence of severe head trauma. Usually, it appears after months or even years from the trauma including resting, postural, kinetic and intention tremors. Deep Brain Stimulation (DBS) in the ventral intermediate (Vim) and/or in the ventro-oralis posterior/ventro-oralis-anterior (Vop/Voa) nuclei of the thalamus has been proposed in the treatment of post-traumatic tremor. Vim, Vop and Voa are main relais on the dentate-rubro-thalamic pathways and, in addition, collect important direct afferents from cerebellum; so far, these nuclei are considered part of the cerebello-thalamic-cortical loop which impinges both on posture and on voluntary movements. Few reports deal about DBS for post-traumatic tremor and limited details and follow-up data are available.

Materials and Methods: A 23 years-old male, suffered from a severe head trauma and the progressive appearance of a post-traumatic bilateral intention tremor, trunk ataxia, dysmetria, dysdiadokinesia. MRI showed diffuse axonal injuries with spot lesions in dentate nuclei, cerebellar peduncles and mesencephalon. Treatment with primidone was not successful; therefore, the patient was candidate to bilateral DBS in the Vim-Vop. Targeting was obtained after CT/MR imaging fusion with Shaltenbrandt & Wahren atlas: the target was chosen in the anterior portion of Vim/posterior portion of Vop; neurophysiological intraoperative monitoring was performed, to record the drive of "tremor cells" and typical bursts activity of Vim/Vop.

Results: During postoperative day 2 we started the stimulation with an initial improvement of the intentional tremor, dysmetria and dysdiadokinesia. Light improvement in ataxia was observed too. At 6 months follow-up progressive improvement in trunk ataxia and a further reduction in tremor was observed. Movements also resulted to be more fluid and accurate.

Discussion: DBS in thalamic nuclei Vim is a validated treatment in patients affected with severe essential tremor. The value of DBS in the treatment of other kinds of tremors, like in MS or post-traumatic, is less clear. In our case we experimented a prompt improvement in tremor and – in a less extent – in other cerebellar symptoms. Our findings suggest that thalamic DBS may be a promising treatment for post-traumatic tremor: moreover, more cases and longer follow-up will highlight the effective worth of this therapy.

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GLOBUS PALLIDUS DEEP BRAIN STIMULATION FOR THE TREATMENT OF STATUS DISTONICUS IN TARDIVE DYSTONIA

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Introduction: Tardive dystonia generally follows long treatment with neuroleptics. An extreme condition called status distonicus may even be life threatening, determining spasm of axial musculature leading to respiratory or cardiac arrest. Despite the different causes of dystonia, pallidal DBS is particularly effective both in primitive generalized dystonia and in tardive dystonia consequent to neuroleptics.

Materials and Methods: A 19 years-old boy affected by severe behavior disorder was treated with neuroleptics (haloperidole). After three years, appeared severe neck and axial dystonia with initial involvement of the extremities, severe dysphagia and several episodes of ab-ingestis pneumonia. The patient progressively felt in a generalized status distonicus. At admission, F-M DRS was 74. For this potentially threatening for life condition, he was candidated for bilateral GPi DBS. After stereotactic localization of ventro-mesial-posterior part of Gpi on volumetric isotropic T1 MRi coupled with Shaltenbrandt & Wahren atlas, bilateral DBS was performed in general sedation, with intraoperative neurophysiology. A couple of quadripolar electrodes were inserted and immediately connected with IPG (Activa RC Medtronic).

Results. Stimulation started during postoperative day 2. After initial adjustment of the stimulation parameters we appreciated a clear reduction in the intensity and frequency of dystonic spasms, without surgical complication or adverse effects. At discharge the patient was able to walk without help, no dysphagia has been complained for and dystonic spasms were pretty much absent. At six-months follow-up F-M DRS is 20.

Discussion. The role of DBS in secondary dystonia is still debated because of several failures. Another topic of discussion is the time of early efficacy of DBS, very varying among different reports, but generally considered in the span of weeks or months. Tardive dystonia, due to neuroleptic therapy, seems to be affected from DBS, better than other secondary forms. GPi DBS has also been described to be effective in the treatment of status distonicus and it is considered the treatment of choice in the acute management of this life-threatening condition. In the reported case we found a striking improvement in F-M DRS, since the first days, with prompt resolution of status distonicus. We suggest the indication to acute treatment with DBS in case of status distonicus in course of tardive dystonia.

MOVDIS / P / 95

QUANTITATIVE RIGIDITY AND TREMOR EVALUATION USING ACCELEROMETER DURING DEEP BRAIN STIMULATION SURGERY - A PRELIMINARY STUDY

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Introduction: Deep brain stimulation (DBS) is a common neurosurgical procedure for relieving movement related disorders such as Parkinson's disease. DBS presents uncertainties associated with suboptimal target selection, partially due to incomplete knowledge of the optimal stimulation site in the brain and suboptimal exploitation of the intra-operatively obtained patient data in general. Our aim was to evaluate the feasibility to objectively assess clinical effects obtained during intraoperative test stimulation based on acceleration measurements.

Methods: Two patients referred for bilateral DBS-implantation for the treatment of Parkinson's disease were included in the study. For one patient, rigidity was evaluated by fixing a 3-axis accelerometer on the neurologist's wrist during intraoperative test stimulation. While the intensity of stimulation current was increased, the neurologist continuously moved the patient's wrist to determine the moment of and the amplitude at rigidity release ("stimulation threshold"). For the other patient, tremor was evaluated by fixing the accelerometer on the patient's wrist during stimulation. In this case, the neurologist evaluated the stimulation threshold based on visual examination of variation in tremor. In both cases, for each test stimulation position, different mathematical features were determined and statistically compared a) for the time period before reaching the stimulation threshold identified by the neurologist and b) after reaching the threshold. We then statistically identified the stimulation thresholds that would have been chosen based on the acceleration signal alone and compared them to the ones subjectively identified by the neurologist.

Results: A statistical significant change in rigidity ($p<0.01$) could be identified for signal entropy, energy and standard deviation. The signal energy seemed to be the most sensible parameter showing a higher percentage change compared to the initial clinical state. The stimulation threshold identified based on the acceleration signal was in most cases lower than the subjectively determined one.

Conclusion: The present study has demonstrated the feasibility to perform rigidity and tremor assessments from the acceleration signal of the wrist. The stimulation threshold was confirmed by the acceleration measurements, and it seems that the measurements were more sensitive than the neurologist's evaluation. Results have to be confirmed by a larger clinical study, currently in progress.

MOVDIS / P / 222

CLINICAL PICTURE OF NEUROACANTHOCYTOSIS CHANGES FROM PRIMARY HYPERKINETIC CHOREATIC TO SECONDARY PARKINSONISM DURING PALLIDAL DEEP BRAIN STIMULATION

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Objective: To report on the clinical picture of a patient with chorea-acanthocytosis treated with bilateral pallidal deep brain stimulation (GPi DBS) from primary hyperkinetic to secondary hypokinetic parkinsonian symptoms.

Background: The clinical picture of neuroacanthocytosis varies and may present most often with chorea but also dystonia and rarely parkinsonian symptoms. Despite the motor changes, alterations of behaviour and cognitive functions are observed.

Methods: We report on a 46-year-old woman who underwent bilateral DBS in the globus pallidus internus (GPi) to treat genetically confirmed chorea-akanthocytosis. Two years after implantation, the clinical picture changed and primary hypokinetic parkinsonian symptoms became prevalent. To exclude that this change was due to stimulation, UPDRS motor subscale was assessed in "on" and "off" and positron emission tomography (PET) with fluordesoxyglycosis (FDG) was performed with stimulation "on" and "off". Additionally levodopa testing was conducted.

Results: UPDRS did not change in "on" and "off" stimulation and PDG-PET did not reveal differences within the basal ganglia between "on" stimulation and "off" stimulation. The levodopa test did not improve the clinical picture. Adjustment of the stimulation setting subjectively improved the clinical picture.

Conclusions: The clinical picture of chorea-acanthocytosis may change overtime from primary hyperkinetic to secondary hypokinetic. Bilateral GPi stimulation could be excluded to be the primary cause of this change.

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ACUTE PALLIDAL OVER-STIMULATION DUE TO DECREASED ELECTRODE IMPEDANCE MIMICKING FOCAL STATUS EPILEPTICUS

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Objective: To report on a patient with an acute pallidal overstimulation mimicking a focal status epilepticus as a rare acute side-effect of deep brain stimulation (DBS) of the Globus pallidus internus (GPi).

Background: GPi-DBS has been established as an effective and safe therapy for dystonia. Stimulation-induced motor side effects can be caused by spread of current to the corticobulbar or corticospinal tract, resulting in dysarthria and tonic contraction of contralateral face and arm muscles, usually occurring gradually when increasing voltage.

Methods: We report on an 80-year-old woman with tardive segmental dystonia. After insufficient medical treatment including anticholinergics and botulinum toxin the patient in 2006 underwent bilateral GPi-DBS surgery. She was regularly followed postoperatively every two or three months, the detailed stimulation settings including impedance and current drain were registered in a database.

Results: The patient experienced a sustained clinical benefit from GPi-DBS, the mean Burke-Fahn-Marsden motor score decreased from 55 pre-OP to 16 at 47 months post-OP (bilateral monopolar stimulation with 4.1V, 130Hz and 210µs). In March 2010, the patient was admitted to another hospital with acute tonic spasms of right face and arm muscles, severe dysarthria and mild right sided hemiparesis. The symptoms were interpreted as a focal status epilepticus and treated with phenytoin and levetiracetam. Two weeks later the patient consulted our clinic, she still complained about severe dysarthria and motor disturbances of the right arm. When checking parameters of the left implantable pulse generator (IPG), a marked reduction of impedance by 45% with a resulting increase of current drain was found. We reduced voltage of the left IPG from 4.5V to 2.4V, subsequently motor disturbances and dysarthria resolved almost completely within minutes. Magnetic resonance imaging still showed correct position of both electrodes. The clear cause for the acute decrease of impedance could not be identified, we assume most likely an IPG malfunction.

Conclusions: In GPi-DBS for dystonia, motor side effects due to capsular stimulation can occur as an acute event and without a simultaneous modification of stimulation settings, subsequently to a change in electrode impedance.

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THALAMIC DEEP BRAIN STIMULATION FOR WRITER'S CRAMP: A CASE REPORT

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Introduction: Writer's cramp is a task-specific focal hand dystonia. It is characterized by an abnormally tight grip while writing with progressive difficulty in performing the task as writing continues. Symptoms appear at a mean age of 38 years and may be painless or accompanied by painful hand and forearm cramping. Recently, DBS appears to be a safe and effective therapeutic option for dystonia. We report a case of writer's cramp treated successfully by thalamic stimulation.

Materials and Methods: A 36-year-old female suffered from right hand tremor and dystonia that were worsened especially during the writing task. CT, MRI and functional MRI of brain revealed no abnormal finding. Burke-Fahn-Marsden Dystonia Rating (BFMDR) scale was used to evaluate patients' pre-operative and post-operative neurological conditions.

Results: We performed left thalamic DBS for right focal hand dystonia. Under local anesthesia, a Leksell G head frame was fixed to the patient's skull. MRI was obtained and the stereotactic target was chosen at 2 mm posterior to the mid-intercommisural point, 0.5 mm dorsal to the intercommisural line and 13.5 mm lateral to the midline. According to Schaltenbrand-Wahren atlas, MRI guided visual targeting and intra-operative microelectrode recording, we confirmed the accurate targeting point for ventral thalamic nucleus (Voa: nucleus ventrooralis anterior, Vop: nucleus ventrooralis posterior). A DBS electrode (Model 3387) with four contact points was placed through the frontal burr hole into the thalamic Vo complex (Voa and Vop). During operation, we confirmed remarkable improvement of writing by thalamic stimulation. Therefore, we decided to connect the Vo DBS lead with an implantable pulse generator without test simulation period. After the implantation of DBS lead, we implanted a pulse generator at left subclavicular area. Her immediate post-operative BFMDR scale demonstrated as 1 compared with pre-operative BFMDR scale 4. Her BFMDR scale was 1 at 3 and 12months after the surgery. Post-operative brain CT revealed the accurate electrode implantation for preoperative targeting point.

Conclusion: Thalamic stimulation appears to be an effective and safe treatment for writer's cramp. In regard of targeting area, although more cases need to be studied, we assure that thalamic Vo complex is a valuable therapeutic target for writer's cramp.

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FACTORS OF INFLUENCE FOR THE DURABILITY OF GENERATORS IN DEEP BRAIN STIMULATION

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Introduction: Previously the surgical change of generators after DBS-surgery was necessary every few years. Meanwhile, we have the possibility to implement rechargeable systems, but the indication to implant these systems was seldom declared. The aim of this study was to calculate the durability of the generators in our patients and to detect pre- or intrasurgical findings as indicators for a higher wattage and, therefore, for a shorter durability of the generator.

Methods: We retrospectively analysed all data of patients, who had their generator changed in 2009 and 2010 in our department. For every single patient we identified the durability of the generator, indication for DBS-surgery, age, gender and the endurance of disease. Furthermore, intrasurgical findings of the DBS-surgery, like border to side effects, respond of symtoms, number of microelectrodes and used trajectory for the permanent electrode, as well as postsurgical adjustment of the generator, position of active contacts and clinical outcome was documented.

Results: 78 patients (60.3±15 years of age, 39,7% female, 60,3% male) were included. Indication for DBS-surgery was Parkinson´s disease (PD) in 64,1%, dystonia in 23.1% and tremor in 12.8%. The mean durability of generators was 1488±496 days (4.1 years), in patients with PD 1659±455 days, with dystonia 1060±265 days and with tremor 1409±555 days. No correlation of intrasurgical findings, position of active contacts or clinical outcome with the durability of the generators could be detected. The operating time of the generators correlates high significant with the adjusted amplitude but not with the adjusted pulse width or frequency.

Conclusion: Overall, the mean durability of the generators was 4.1 years. Except dystonia, no pre- and intrasurgical findings could be detected as indicators for a shorter durability of the generators. Therefore, the indication for implantation of a rechargeable system remains an individual decision.

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SUBJECTIVE PATIENT PERCEPTION OF DEEP BRAIN STIMULATION: THE KIEL EXPERIENCE

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Introduction: Deep brain stimulation (DBS) is a widely employed therapeutic modality for the neurosurgical treatment of movement disorders. This study focuses on the subjective patient perception of this specific procedure.

Methods: Via comprehensive postal structured interviews, patients were asked about their subjective experience regarding DBS in a retrospective study design. Eight different areas of neurosurgical care were assessed, including neurosurgical information-giving or the neurosurgical procedure itself. For each area of care, patients were asked about (1) extent of (dis-)satisfaction, (2) recommendations for improvements, and (3) the most positive aspects of the current practice. Supplemental factors were quantitatively assessed (e. g., depression, Health-related Quality of Life [QoL]). The sample consists of 60 patients (response rate = 63%) who were surgically treated for Parkinson's disease (81%) or Essential Tremor (19%) in our department between 2009 and 2011. Mean age of the patient group was 65 years (range = 44-78, SD = 9.2). Mean time since DBS was 21.8 months (range = 4-37, SD = 10.5).

Results: The majority of patients (80%) described "very high" or "high" need-for-information prior to surgery which declined after the procedure. Most patients described themselves as satisfied with the neurosurgical education. Main suggestions for improvements were receiving more extensive information, or in additional formats (written/DVD). High levels of satisfaction were mainly attributed to extent and quality of information. Satisfaction with the experience in the operating room was "very high" or "high" in 82%. The most frequently reported positive aspects were assignment of a dedicated member of the care-team, enjoyable atmosphere, and high professionality and competence of the neurosurgical team. Main negative experiences were drilling and discomfort. Subjective patient satisfaction was mainly independent of other factors (e. g., age, QoL, and UPDRS) as well as subjective or objective surgery success. However, higher levels of depression predicted lower levels of satisfaction with the neurosurgical education.

Conclusions: This is the first study of the subjective patient perception of DBS. Although demanding, the procedure is tolerable for the vast majority of patients. Extensive qualitative analyses revealed terms for high levels of patient satisfaction as well as ideas for improvement. This might help to further improve neurosurgical patient care.

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UNILATERAL PALLIDOTOMY FOR PARKINSON'S DISEASE IN THE DBS ERA: RESULTS AND COMPLICATIONS

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Introduction: Deep brain stimulation (DBS) has become the preferred surgical approach for the treatment of medication-refractory Parkinson's Disease (PD). However, until 2001, publications on ablation in advanced PD outnumbered those on DBS[1]. Despite their previous success and widespread acceptance, lesions have fallen out of favour due to their relative lack of flexibility and reversibility in comparison to DBS. Bilateral ablation is also associated with a higher risk of side effects. Moreover, the scientific potential of DBS interventions ensured its widespread acceptance. Nevertheless, it is important that surgeons retain knowledge of ablative surgery as it can still represent a useful and cost-effective alternative, especially in societies that cannot afford the costly hardware and follow up associated with DBS. In this paper we review the published literature on unilateral pallidotomy for Parkinson's disease in the last 10 years.

Methods: A literature search of publications from 2002 to May 2012 in the PubMed/Medline database was performed to collect information about unilateral pallidotomy for the treatment of Parkinson's Disease. Only human studies written in English, French or Spanish were included.

Results: A total of 48 papers were considered from the 91 identified in the search. Patients received long-term and significant motor benefits from pallidotomy in their "OFF" state (20-32% improvement in OFF UPDRS III). Improvement occurred in all cardinal motor signs of PD including tremor, rigidity, bradykinesia, gait and balance. Drug-induced dyskinesias were also markedly improved, as were quality of life scores (32-46% improvement). A mild decline in verbal fluency and executive function processing was observed after pallidotomy, particularly related to the specific region of pallidal ablation. Complications included intracranial haemorrhage (2.1%), hemiparesis (1%) and infection (0.2%).

Conclusion: Deep brain stimulation is presently the treatment of choice in advanced PD. However, pallidotomy continues to be performed in various centres around the world and it remains a viable option for patients with advanced PD who suffer from severe unilateral disabling motor symptoms or dyskinesias.

References:

1 - Hariz MI: From functional neurosurgery to "interventional" neurology: Survey of publications on thalamotomy, pallidotomy, and deep brain stimulation for parkinson's disease from 1966 to 2001. Mov Disord 2003;18:845-853.

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QOL IN POLISH PATIENTS TREATED WITH DEEP BRAIN STIMULATION IN ADVANCED PARKINSON'S DISEASE

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Introduction: Evaluation of health-related quality of life measured using scale pdq-39 in Polish patients treated with deep brain stimulation (DBS) of the subthalamic nucleus (STN) in advanced Parkinson's disease (PD).

Methods: 30 patients, 24 men and 6 women were treated with DBS of STN for PD between 2009-2011. All of them were classified to the surgery according to CAPSIT-PD. From 3 months to 2 years after the surgery patients were posted and asked to complete the pdq-39.

Results: 66,66% of patients answered to our letter and fulfilled the questionnaire. 2 of them were unable to fulfill the questionnaire themselves. The mean pdq 39 index score was 34,11 (±10,19).

Conclutions: The study showed that DBS of STN in Polish PD patients results in diserable mean pdq 39 index score and satisfied QoL.

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CONVERSION OF LOCAL ANESTHESIA GUIDED DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS TO GENERAL ANESTHESIA

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Deep brain stimulation of the subthalamic nucleus (STN) is a widely applied procedure in the treatment of patients with advanced Parkinson's disease and is generally performed under local anesthesia. Here we report our experience with the conversion to general anesthesia in two patients with advanced Parkinson's disease because of fear reactions intra-operatively. After obtaining informed consent, patients received general anesthesia with propofol and were implanted with electrodes at the level of the STN guided by multiple-microelectrode electrophysiological recordings. During the electrophysiological recordings, the level of propofol was reduced to allow adequate recordings, but with a still acceptable levels of anesthesia. We found typical STN activity, comparable to the one found in surgeries with local anesthesia. Final electrode placement was based on the electrophysiological recordings. Postoperative clinical assessments showed marked improvements of motor disability with significant reductions of dopaminergic medication. Our case observations document the possibility of unexpected fear reactions intraoperatively and show the possibility of conversion to general anesthesia with a succesfull outcome.

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TARGETING THALAMIC TREMOR CELLS IN DEEP BRAIN STIMULATION FOR MULTIPLE SCLEROSIS INDUCED COMPLEX TREMOR

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Multiple sclerosis (MS) related tremor is a challenging one to treat due to its complexity. Deep brain stimulation (DBS) of the thalamus has been suggested as a potential treatment. The question is which part of the thalamus should be targeted. Suggested anatomical targets are Vim and Vop nuclei of the thalamus and the zona incerta. An alternative approach could be to identify thalamic tremor cells which are responsible for the generation of the tremors, like in thalamic surgery for essential tremor or Parkinsonian tremor. Here, we describe our experience with extensive multiple-electrophysiological recordings in the Vim/Vop nuclei and the identification of tremor cells in a patient with bilateral refractory MS related tremor. We performed intraoperative stimulation and observed the strongest reduction in tremor at the level where we found tremor cells. Tremor cells were electrophysiologically confirmed with simultaneous EMG recordings. Postoperative tremor assessments showed a marked improvement of the tremor biletarally. Postoperative assessment of the MRI showed that the electrodes are positioned in an area both covering the Vim and Vop nuclei of the thalamus.

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MEASURE OF SPASTICITY MODULATION BY CERVICAL EPIDURAL STIMULATION IN A CASE OF HEMISPASTICITY

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Introduction: Pain and spasticity are significant post-stroke or brain injury complications that put a burden on patient's life. In this context spinal cord stimulation is a recognized treatment for central pain while it's value to reduce spasticity is still controversial. In a patient suffering from these symptoms EMG, H-wave and F-wave modulation werew measured following implantation of a cervical epidural electrode.

Methods: A Specify® 5-6-5 electrode was implanted dorso-medially in the epidural space at the level of C5-C7 in a patient with a severe and chronic spastic hemiparesia following traumatic brain injury. The electrode extension was connected to an external stimulator for clinical testing and internalized after 10 days because of pain and spasticity reduction. All neurophysiological measures were performed between day 4 and 6 post surgery. OFF and ON (3.2 Volts, 130 Hz) states Soleus H-wave/M – wave maximum amplitude ratio were measured on both legs following poplitae fossa stimulation while the patient was sitting. Abductor Hallux F-wave was measured on the affected hand following median nerve stimulation. Free running EMG was measured on OFF and ON state in the affected hand.

Results: On the affected hand free running EMG amplitudes were similar during active thenar contraction on OFF and ON state (320 versus 280 uV/sec*5s) but relaxing time was longer (20 s OFF versus 5 sec during ON state). On the affected hand, F-wave amplitude was reduced after 10 min stimulation (2.3 mV OFF versus 0.5 mV ON state) while M wave were unaffected. On the unaffected leg, H/M ratio was 0.93 regardless of the stimulation state. On the affected leg, H/M ratios were 0.97 during OFF state and 0.91 during spinal stimulation.

Conclusions: While preliminary, our results suggest that beside reduction of central pain, cervical spinal cord stimulation can affected H reflexes and F-wave as well as free running EMG that are known to be correlated with the clinical level of spasticity.

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MANIC EPISODE FOLLOWING DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS FOR PARKINSON'S DISEASE; REPORT OF 2 CASES

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Deep brain stimulation (DBS) of the subthalamic nucleus (STN) is an established therapy for patients with Parkinson's disease (PD) associated with motor complications of long term L-dopa treatment. Here we report two cases with DBS- induced manic episode, focusing on the functional and anatomic correlates of psychiatric adverse effects of STN stimulation.

Key Words: deep brain stimulation, subthalamic nucleus, mania.

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POSTOPERATIVE DBS IMPEDANCE VARIABILITY IN PATIENTS WITH PARKINSON'S DISEASE IMPLANTED BILATERALLY IN THE SUBTHALAMIC NUCLEUS (STN)

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Introduction: Most clinical systems for deep brain stimulation (DBS) deliver stimulation using a voltage-controlled pulse generator. In voltage-controlled systems, the current delivered at each electrode is dependent on impedances. In cases where impedances vary, the resulting current will also vary and, thus, the intensity as well as the field of stimulation varies. This was described in modeling work by Butson et al. 2006 where a change in impedance of 450 Ω resulted in a 50% reduction in the volume of tissue activated. Previous researchers (Lempka et al 2010) have proposed that such instability in impedances could be partially responsible for clinical observations, such as the frequent need to reprogram stimulators in DBS patients postoperatively. A current controlled DBS system is expected to better control stimulation in the face of changing impedances (Ranck, 1981; Mortimer, 1981). However, data on long-term impedance variability in human DBS patients is limited to a few studies, and within-patient impedance variability has been proposed to be minimal (Sillay et al., 2010). In this report, impedance variability in 10 subjects with bilateral DBS over a 52 week period is presented. The impedance trends suggest that within-patient impedance variability may be an important factor to consider.

Methods: 10 patients with idiopathic Parkinson's disease were implanted bilaterally with Boston Scientific's current-controlled DBS system (Vercise system) in the subthalamic nucleus (STN). Subjects' devices were activated 2 – 18 days after implant. The impedances of the implanted electrodes were measured during office visits at activation, 12 weeks, 26 weeks, and 52 weeks post-implant.

Results: An overall trend of large changes in impedances was observed in these subjects over the entire period evaluated. A high degree of inter-patient variability was observed, with impedances ranging from 459-1790 ohms (Ω) at activation (n=10, mean=846 ± 291 Ω, median=741 Ω), 659-1708 Ω at 12 weeks (n=5, mean=1110 ±181 Ω, median= 1109 Ω), 743-1674 Ω at 26 weeks (n=8, mean=1153 ±209 Ω, median=1140 Ω), and 734-1793 Ω at 52 weeks (n=4, mean=1217 ±223 Ω, median= 1194 Ω). In addition, within-patient impedance variation on individual contacts ranged from 285 Ω (24.6%) to 822 Ω (130.9%) changes between office visits. Changes in stimulation appear to contribute to impedance variability, since 85% (6/7) of instances where an inactive contact was reprogrammed to be active showed a drop in impedance after activation, with a mean reduction of 186 Ω.

Conclusions: Impedances in DBS patients vary not only between patients, but within patients, and even on the same electrode. The variability over time and in response to stimulation is similar to that previously reported in animal data.

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EFFECT OF BILATERAL PALLIDAL DEEP BRAIN STIMULATION IN PRIMARY DYSTONIA

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Objective: To evaluate the effect of bilateral pallidal deep brain stimulation (DBS) on primary dystonia (PD) and to analyze the factors that predict the effect of pallidal DBS on PD.

Background: PD without other neurological dysfunctions or degenerative diseases has been intractable. The development of DBS brought the possibility of treatment of dystonia, and DBS was found to improve DYT1 and contribute to the improvement of patients' social activities. However, it remains unclear whether DBS has similar effects on different types of PD.

Methods: Twenty-seven patients with PD were treated by bilateral pallidal DBS for 10 years from 2001 to 2011. Patients with secondary dystonia, fixed dystonia and degenerative disease were excluded. The patients' characteristics were as follows: the numbers of males and females were 14 and 13, the mean age at operation was 28.7 (SD 15.7) years, and the mean disease duration was 10.9 (SD 7.2) years. The mean onset age was 17.9 (17.1) from 0 to 64 years old. The patients were divided into three groups: (A) hereditary PD, (B) childhood-onset PD and (C) adult-onset PD. Clinical evaluation was based on BMFDRS.

Results: There were 15 patients with PD including 12 patients with DYT1, two patients with non-DYT1 & DYT6 and one patient with DYT6 in group A. twelve patients had generalized dystonia (GD). All of the patients with pallidal DBS showed improvement. However, the outcomes in two DYT1 patients with long disease durations were not as satisfactory as those in other patients. There were five patients with GD in group B. One patient was deaf and three had speech disturbance, and the effects of DBS were moderate. The remaining other three patients showed remarkable improvement following DBS. There were five patients with GD and two with segmental dystonia (SD) in group C. The improvement was more remarkable in patients with GD than in those with SD.

Conclusions: The improvement by pallidal DBS was remarkable in patients with hereditary PD than in those with other types of PD. In the case of patients with DYT1, long disease duration was a negative factor. The improvement of adult-onset PD was less in PD patients with SD than in those with GD. In childhood-onset PD, deafness or speech disturbance was a negative factor. Pallidal DBS is effective for PD, but a long disease duration, deafness or speech disturbance, and SD might be negative factors for DBS.

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UNILATERAL DEEP BRAIN STIMULATION OF THE SUBTHALAMIC NUCLEUS FOR PARKINSON DISEASE

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A 63 year-old male with medically intractable PD is focused on behalf of the surgical treatment. Patient had a 4-year history of progressively severe hand tremor on right side. He was undergone unilateral magnetic resonance imaging–targeted, electrophysiologically guided Subthalamic nuclear deep brain stimulation, completed with a battery. The patient was successfully treated unilaterally with the STN DBS. Microelectrode recordings were taken to document electrophysiological activity of neurons in the region, and intraoperative macrostimulation was performed. Imagings were biased 2.3 mm away from precise electrical activity recorded.

Unilateral STN DBS is an effective and safe treatment for selected patients with advanced PD. Unilateral STN DBS provides improvement of contralateral motor symptoms of PD as well as quality of life, reduces requirements for medication and UPDRS score of the patient. This approach of surgical treatment may be associated with a reduced risk and may provide an alternative to bilateral STN DBS for PD, especially in older patients or patients with persistant asymmetry of parkinsonism.

To asses the effectiveness of the three diffrent centers (superior, lateral and centeral) we get the microelectrode recordings. These recordings were then used for the furher analysis. These analysed results were then compared with the out comes of the macro stimulated clinical evolution. Microelectrodal stimulations of the subthalamic milieu is essentials to investigate the correct placement of permanent electrode; in this case MRI targeting was displaced laterally. Therefore morphological findings should be completed with careful functional recordings.

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BILATERAL VIM-DBS IN VANISHING WHITE MATTER DISEASE

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Introduction: Vanishing White Matter Disease (VWM). is a kind of leukodystrophy with autosomal recessive inheritance. Genetic investigation have found mutations in either of the five genes (EIF2B1-EIF2B5) encoding eukaryotic initiation factor 2B (eIF2B), responsible for translation of mRNAs into proteins. Oligodendrocytes and astrocytes are predominantly affected and cause white matter rarefactionwhile neurons and microglia are relatively spared. Phenotypic variation includes antenatal, infantile, childhood, juvenile and adult onset. Symptoms are ataxia, spasticity, sometimes optic atrophy and epilepsy. Febrile infections, trauma or other exacerbating factors may provoke episodes of rapid deterioration, irritability, vomiting and coma. Mental impairment is usually not severe. The diagnosis is based on clinical symptoms, MRI and genetics.

Case report: A boy became irritable at the age of 7 years, 3 years later an increasing tremor appeared in his arms, legs, head and voice. When he was 13, he was referred for surgery with nystagmus, dysarthria, cerebellar ataxia, slight arm and marked leg weakness, spasticity with Babinski's signs, scoliosis and mild neck dystonia with rotation of the head to the right side. A drug-resistant grade 4 (Fahn-Tolosa-Marin scale) proximal postural and kinetic tremor was found in the arms, and a grade 2 tremor in the legs, head and voice. On the CT-scan we have found slight dilatation of all cerebral ventricles with bilateral diffuse white matter hypodensity. MRI showed abnormal white matter signal intensity with decreased T1 and increased T2 signal intensity. Genetic investigation showed that the patient is homozygous for a mutation in EIF2B2: c.638A>G, p.Glu213Gly. Under CT-guidance leads were stereotactically implanted to the Vim nuclei and connected to ITREL3 neurostimulators on both sides. The effectiveness of Vim-DBS was assessed with passive marker-based analysis of motions (infrared video, sampling rate 50/s). Retro-reflective 10-mm balls were attached to both index fingers, and two adhesive 6-mm discs were fixed on his face. Six months postoperatively the FTM score had decreased from 35 to 8. Speech, voice, neck dystonia and gait had also improved. Postoperative CT with preoperative MRI co-registration and CT scan at 2 and 5 years of follow-up reported proper electrode positions. Tremorometry showed good control of postural and kinetic arm and head tremor. After 4 years stimulators were replaced by Activa PC dual channel pulse generator. At the 5-year follow-up the effect is still lasting with slight progression of ataxia and muscle weakness.

Discussion: To our knowledge this is the first patient with VWM who underwent DBS surgery for bilateral severe postural and kinetic tremor. As the dominant frequency was nearly 3.0 Hz, and with involvement of proximal muscles, we considered, that the possible origin of it is cerebellar-rubral. Good results in our patient sustained for 5 years. Despite the fact that he continued to have some residual tremor and ataxia, he was able to drink, eat, and use his hands without any assistance.

Conclusions: Based on long-term follow-up Vim-DBS can successfully control severe tremor in patients with VWM.

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SUBTHALAMIC NUCLEUS, VILLAIN OR HERO?

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The subthalamic nucleus (STN) was first described by Jules Bernard Luys in 1865 and the term Luys' body is still sometimes used. The STN is a biconvex lens-shaped obliquely oriented nucleus located on the dorsomedial surface of the peduncular part of the internal capsule. This structure has important connections within basal ganglia to the globus pallidus participating in both motor and cognitive processes. Unilateral lesion of the STN via a small vessel stroke produces hemiballismus.

Highfrequency electrical stimulation of brain targets can have the effect of a lesion without the need for destroying brain tissue. The STN has been used as a target for Parkinson's disease treatment since the nineties. The real effect of STN stimulation remains unknown but may be based on the inhibition of an overactivity of the STN.

The authors debate about which specific behavioral changes are related to bilateral STN stimulation that can act as villain or hero.

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REDUCTION OF THALAMIC TREMOR WITH DEEP BRAIN STIMULATION PERFORMED FOR POST STROKE CHRONIC CENTRAL PAIN

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Introduction: In the study we present reduction of thalamic tremor with stimulation of VPL for pain in the patient with post stroke chronic central pain. Tremor rarely occurs as a consequence of thalamic lesion. Posterolateral thalamic region which belongs to the territory of the thalamogeniculate artery may be responsible for delayed tremor . The reason why lesions in the posterolateral thalamus induce tremor is unknown.

Methods: We present a patient who experienced ischemic stroke within the posterolateral part of left hypothalamus with subsequent severe burning pain localised in right upper limb, predominantly within the hand and thalamic tremor both postural and present at rest which occurred 4 months after stroke. The patient was offered implantation of electrodes to periventricular grey matter (PVG)/ periaqueductal grey matter (PAG) as well as implantation an electrode to ventroposterolateral thalamic nucleus (VPL). Microelectrode recording, microstimulation, and macrostimulation were all used in the process of target localization, apart from defining the exact target for stimulation by the stereotactic MRI. Correct target localization in the VPL was conformed when a 50Hz stimulation elicited paresthesia in the contralateral limb.

Results: We achieved reduction of pain after surgery. Pain intensity was assessed using the McGill-Melzack visual analogue scale for 7,9 points before stimulation and 4.9 points during stimulation, additionally, the next day after surgery we observed significant alleviation of the patient's thalamic tremor in the hand, which may be attributed initially to microlesion effect but persisted over subsequent months probably as a consequence of VPL stimulation.

Conclusions: Since PVL and VIM are located in close vicinity, stimulation in the PVL could either spread to the VIM. Higher amount of current during PVL stimulation might be sufficient to achieve a similar tremor suppressing effect compared to VIM stimulation.

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RIGHT HEMICHOREA TREATED SUCCESSFULLY BY SURGICAL REMOVAL OF A LEFT PUTAMINAL CAVERNOUS ANGIOMA

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Introduction: There are only a few reports observing movement disorders like hemidystonia, hemichorea or hemiparkinsonism due to cavernous angioma (CA) located in basal ganglia. The object of this study was to present a case of right hemichorea successfully managed by extirpation of CA located in the left putamen.

Methods: We report on 58 year-old-woman with a 9 years history of right sided hemichorea. The hemichorea of the right hemibody appeared spontaneously at age 49. The magnetic resonance imaging revealed a well-defined lesion with a central focus of reticulated high signal intensity surrounded by a rim of void signal, ensuring the diagnosis of CA. The surgery was proposed. The informed consent was obtained from the patient. The extirpation of CA was performed with microsurgical technique under general anesthesia. The postoperative course was uneventful.

Results: We observed gradual amelioration of right-sided hemichorea during hospital stay. Hemichorea subsisted during subsequent postoperative months. The patient is completely free of dyskinesia at 24 months follow-up.

Conclusions: In a very limited world-wide experience with CAs located in the basal ganglia presenting with hyperkinesias the microsurgical extirpation of this malformation is feasible and safe with subsequent amelioration of diskinesia. The lesions located in the putamen may be even more surgically accessible than CAs localized in deeper structures like caudate nucleus. Surgical extirpation of deep seated CAs may also prevent the risk of intracerebral bleeding.

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BILATERAL PALLIDAL STIMULATION FOR INTRACTABLE, PHARMACOLOGICALLY RESISTANT BLEPHAROSPASM IN A PATIENT WITH LONG-STANDING MEIGE SYNDROME

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Introduction: Meige syndrome (MS) is an adult-onset dystonia characterized by combination of blepharospasm, oromandibular, facial and frequently cervical dystonia. The symptoms of MS may produce severe limitations in performance of simplest activities of daily living. Central neuromodulation procedures targeting globus pallidus internus (GPi) revealed effective for various form of intractable dystonia. The aim of the study was to assess influence of bilateral pallidal stimulation in a patient with intractable long-standing MS using Burke-Fahn-Marsden Dystonia Rating Scale (BFMDRS).

Methods: We report on a 47-year-old woman with 32 years history of cranio-cervical dystonia. The patient's oromandibular dystonia associated with severe blepharospasm markedly affected the patient's occupational and social life. Over last months the intractable blepharospasm rendered the patient functionally blind. The patient was referred for surgery. Before surgery the patient's dystonic status was assessed using BFMDRS. The patient underwent bilateral GPi electrodes implantation.

Results: We observed immediate and marked benefit from bilateral GPi stimulation, especially on blepharospasm, and oromandibular dystonia and to a lesser degree on neck dystonia and speech/swallowing. In 12 months follow-up the functional BFMDRS scores decreased from 12 to 2 scores. Motor BFMDRS decreased from 34 to 9 scores.

Conclusions: We can preliminary conclude that bilateral GPi is effective for intractable MS. Moreover, this treatment modality can be also a vision-saving approach.

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UNILATERAL PALLIDAL STIMULATION FOR THE TREATMENT OF TRUNCAL AND UPPER LIMB GIRDLES DYSTONIA

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Introduction: Stimulation of the globus pallidus pars interna - GPi is an approved treatment modality for patients suffering from generalized, segmental, and focal dystonia. Dystonia affecting symmetrically truncal and upper limb girdles musculature is very rare. The aim of the study was to present a patient with truncal and upper limb girdles dystonia, who underwent unilateral GPi stimulation.

Methods: We present a case of 54-year-old man with 11 years history of dystonia. In the first years the dystonia was confined only to the paravertebral muscles in upper thoracic region. In the following years dystonia involved symmetrically the truncal, abdominal, upper limb girdles musculature with lesser involvement of his neck by dystonic movements. After obtaining informed consent the patient underwent right-side unilateral GPi electrode implantation. The internal pulse generator was activated on the first postoperative day.

Results: The neurological status was assessed using Burke-Fahn-Marsden-Dystonia Rating Scale - BFMDRS. His disability and motor BFMDRS scores decreased from 15 and 33 to 2 and 4 scores at 12 months respectively. We abounded the initially planned left-side procedure in this patient because of good control of trunk dystonia.

Conclusions: Unilateral GPi stimulation may substantially decrease dystonic movements affecting the axial musculature. The stimulation effect can be visible also ipsilaterally to the stimulated hemisphere.

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HEMODYNAMIC CORTICAL RESPONSE INDUCED BY DEEP BRAIN STIMULATION OF SUBTHALAMIC NUCLEUS AND A MOTOR TASK: AN OPTICAL IMAGING OBSERVATION

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Introduction: Deep brain stimulation of SubThalamic Nucleus (STN-DBS) is an effective treatment for Parkinson disease. However, the efficacy of STN-DBS relies on unclear mechanisms. In this study, using optical imaging, we evaluated the cortical hemodynamic changes induced by STN-DBS of a parkinsonian patient.

Material and Methods: We performed an optical imaging study using Near-InfraRed Spectroscopy (NIRS) in a parkinsonian patient after STN-DBS. We measured bilateral local cortical hemodynamic changes under "On" and "Off" stimulation conditions and during a motor task (left hand movement). Relative concentration changes of oxy-Hb, deoxy-Hb, and total Hb were continuously analyzed.

Results: Oxy-Hb and total Hb increased immediately after the onset of the motor task and then gradually decreased when the motor task was continued. In period of electrical stimulation a decrease in HbO and an increase in Hb can be seen in the cortical regions on specific sensori-motor area and premotor cortex. Decrease in HbO is more important in right hemisphere where stimulation is more important (1,5 volt versus 0,5 volt). During motor task and STN-DBS "On", a specific increase of HbO -ie cortical activation- of motor cortex and pre-motor cortex is objectivized whereas other cortical regions still presented decrease of HbO.

Conclusion: This study shows that NIRS is an efficient tool to measure local cortical hemodynamic variation during STN-DBS. This study corroborates those with PET and provides new arguments in favour of STN-DBS main cortical effect is to reduce regional cerebral blood flow in the primary sensorimotor cortex and premotor cortex areas.

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BILATERAL PALLIDAL STIMULATION IMPROVES CHOREA IN A PATIENT WITH ANTIPHOSPHOLIPID ANTIBODY SYNDROME

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Introduction: Antiphospholipid syndrome is an autoimmune disease which is associated with venous and arterial thrombosis, fetal abort and rarely with movement disorders such as chorea or dystonia. There are only few reports on deep brain stimulation for chorea related to Huntington's disease, choreaacanthozytosis or cerebral palsy. We report on a patient suffering from progressive choreo-athetotic movements due to antiphospholipid antibody syndrome treated with bilateral deep brain stimulation.

Methods: A 38-year-old woman developed progressive choreo-athetotic movements of the limbs at 16. Later, she developed also orofacial dyskinesias which were considered as tardive dystonia after longtime medication with haloperidol. Antiphospholipid syndrome was diagnosed at age 24 when elevated titers of cardiolipin antibodies and an asymptomatic ischaemic lesion in the right frontal lobe were found. Therefore anticoagulation with coumarin was started. Symptomatic medication with tetrabenazin and tiaprid reduced chorea, but was limited because of side effects.

Results: Bilateral implantation of quadripolar DBS electrodes in the globus pallidus internus and chronic stimulation led to marked improvement of chorea as well as of orofacial dyskinesias by about 80%. The medication with tetrabenazin was reduced from 150 to 25mg and tiaprid was cut off. The effect was sustained at 26 months postoperatively.

Conclusions: Bilateral pallidal DBS is an effective treatment for chorea in antiphospholipid antibody syndrome. It may not only improve the choreatic movement disorder but also side effects induced by therapy such as tardive dyskinesia.

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HEMORRHAGIC COMPLICATIONS IN DBS SURGERY

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Introduction: Functional neurosurgical procedures are rarely life-saving and are mainly aimed at improving quality of life in patients with progressive, though essentially non-fatal, neurological illness. Although not all hemorrhages lead to clinically relevant problems, lowering the overall incidence of all hemorrhages is likely to reduce the risk of those that cause permanent disability or death. We undertook a review of cases of hemorrhagic complications in deep brain stimulation operated during the last 12 years.

Patients and Methods: The medical records and post-operative Imaging Studies of all patients undergoing frame-based image-guided DBS surgery at the Clinic Hospital of Santiago de Compostela (Spain) between March 2000-April 2012 were review. Only patients that underwent postoperative TC scan or MRI were included.

Results: During the period under study 221 DBS (436 electrodes) were performed. The DBS procedure included: 213 Parkinson cases, 4 essential tremors and 4 dystonias. The total incidence of hemorrhage was 1.7% (4 patients) and no patients experienced after-effects. The average number of tracts was 5.3 (range 3-11).

Conclusions: Deep brain stimulation surgery is a very safe technique with a low index of complications. Brain hemorrhage is a rare complication and in our experience is accompanied by a minimum morbidity.

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SUBTHALAMIC REGION DEEP BRAIN STIMULATION FOR ISOLATED HEAD TREMOR WITH LATEROCOLLIS: CINICAL OUTCOME IN 5 CASES

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Introduction: Head tremor has shown inconsistent or unpredictable improvement with thalamic deep brain stimualtion (DBS). Several reports indicates that stimualtion in subthalamic region may be particularly effective for axial and proximal tremor. The optimal site within subthalamic region for stimulation is the subject of ongoing debate. Also, experience with subthalamic region DBS in head tremor with head tilt is limited. The aim of the study was to assess the efficacy of bilateral subthalamic region DBS for medication-refractory disabling head tremor without appendicular tremor with laterocollis and to examine trajectory planning for the suitable subthalamic target.

Materials and Methods: All five patients (3 females and 2 males) had failed extensive medical treatment. The mean duration of the disease was 4.5 ± 2.5 years The mean age at time of surgery was 63.8 ± 7.2 years. The mean follow-up period was 3,4 ± 1.6 years. Patients were assessed pre and postoperatively using the head tremor rating scale used by Fahn-Tolosa-Marin and laterocollis severity scale of Toronto Western Spasmodic Torticollis Rating Scale and subjective assessment by patient. DBS electrodes (DBS-3389; Medtronic) were implanted bilaterally into the subthalamic region using microelectrode recording and stimulation guidance. The final mean target of 4 cases was 12.1 ± 0.3 mm lateral, 2.0 ± 0.4 mm posterior, and 2.0 ± 0 mm inferior to the midcommissral point for a rostral zona incerta-subthalamic target in the junction of the rostral zona incerta and the dorsal subthalamic nucleus. The other final target as 14 mm lateral, 5.8 mm (the right) or 3.8 mm (the left) posterior, and 2.0 mm inferior to the midcommissral point for the caudal zona incerta. After mean 2.2 days of a trial test, the stimulation device was implanted subcutaneously.

Results: Preoperatively, head tremor was all marked amplitude (1-2 cm). Constant laterocollis or head tilt was all mild type within 15 degrees. Lead placement was achieved easily by passing micro-electrodes to the calcualted target area of a rostral zona incerta-subthalamic target which identified charcteristic neural firing pattern of the zona incerta and the STN, But the caudal zona inceta target, microelectrode recording method did not help. Postoperatively, excellent improvement in their head position occurred soon after surgery, and head tremor was markedly improved in the first 3 months in all patients and maintained long-term benefit. Reversible mild dysarthria was observed in 2 patients who had a rostral zona incerta-subthalamic target.

Conclusion: Our findings provide evidence that bilateral subthalamic region DBS is an effective treatment of isolated head tremor with mild type of laterocollis without significant adverse effects. A rostral zona incerta-subthalamic area may be a valuable target for treatment of them, based on microelectrode recording. More cases and studies will be required to confirm it.

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ACUTE SEVERE DEPRESSION INDUCED BY STIMULATION OF THE RIGHT GLOBUS PALLIDUS INTERNUS

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Introduction: It is well known that depression may occur after STN DBS, which has often been attributed to the marked reduction of L-dopa postoperatively, and not to a direct effect of STN stimulation. Several cases have however been presented with acute stimulation induced depression following STN DBS. Pallidal DBS seems not to be associated with depression, and to the best of our knowledge, acute stimulation induced depressive symptoms have never been reported after pallidal DBS.

Methods: We present a patient with acute depressive symptoms induced by pallidal DBS.

Results: The patient was a 64 years old male operated with bilateral pallidal DBS for Parkinson's disease with severe on-off phenomena. No complications occurred in relation to the procedure and a postoperative CT-scan fused with the pre-operative MRI demonstrated the electrodes to be well placed within the intended target. When the stimulation was initiated 4 weeks after surgery stimulation of the left electrode resulted in a clinical improvement and no side effects of interest. Unilateral stimulation of either of the two deepest contacts on the right electrode did, however, cause an unexpected side effect at monopolar stimulation with 0.5 V, 60 uS and 130 Hz. About 2 seconds after the stimulation was started the patients face was distorted by an expression of severe sorrow. He started to sob and cry, and buried his face in his hands. He explained that he felt the deepest sorrow he had ever felt. When turning the stimulation off the patient recovered completely within 10 seconds. The patient was tested in a blinded condition with stimulation and sham-stimulation, and the findings were objectively reproducible. A less pronounced effect was also seen at the third deepest contact, but at higher stimulation strength. No long--term evaluation has yet been performed.

Conclusion: In the case here presented, stimulation of the right globus pallidus internus resulted in acute depressive symptoms.

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TWIDDLER'S SYNDROME: AN UNCOMMON CAUSE FOR HARDWARE DYSFUNCTION IN DEEP BRAIN STIMULATION

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Introduction: Nowadays, deep brain stimulation represents standard of care in medically refractory and dehabilitating conditions such as Parkinson's disease, tremor or dystonia. Its outstanding results and increasing availability justify a greater number of surgical procedures being undertaken each year. Hardware failure or malfunction is relatively infrequent with currently available systems, and usually involves electrode disconnection.

Case Report: The authors present the case of a 65 year-old female patient with predominantly tremoric Parkinson's disease and no relevant psychiatric history, received bilateral subthalamic nucleus stimulation in October 2011. As usual in our department, the implanted pulse generator (IPG) was placed in a left pectoral pouch and sutured to the underlying muscle tissue. Functional results were quite favorable allowing for a significant reduction in medical therapy and the patient was discharged with no evidence of surgical complications. Four months later, the patient started to display signs of recurrent disease, with an increasingly smaller response to stimulation. Over the following three months, the clinical condition eventually resumed the same characteristics as in the preoperative period. X-ray studies of the system showed "twisted" extensor leads and gaps between these and the electrodes proximally. Around the IPG, the extensors seemed to "curl" around the IPG. A change in electrode impedance was also identified. The patient denied any hardware mobilization but was at the time on a regular gym exercise plan. She underwent revision surgery, which confirmed the radiographic findings and allowed for similar functional results as those previously obtained.

Discussion: Twiddler's syndrome represents an uncommon form of hardware mobilization and subsequent dysfunction in which a patient voluntarily or involuntarily induces rotation of the IPG and/or the extensor leads in a way that provokes their deattachment proximally. Initially described in Cardiology patients submitted to pacemaker or ICD placement surgery, increasing numbers in deep brain stimulation surgery will likely allow for this condition to surface as a relevant cause of system failure and recurrent symptoms in a previously controlled patient.

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IMPAIRMENT OF CLAUSTROPHOBIA AFTER BILATERAL SUBTHALAMIC NUCLEUS STIMULATION IN A PATIENT WITH PARKINSON'S DISEASE

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Introduction: In the last decade the number of patients treated with deep brain stimulation of the subthalamic nucleus (STN-DBS) in Parkinson's disease (PD) has increased significantly. Neuroanatomical studies have demonstrated that the STN can be functionally divided into sensorimotor (dorsolateral), limbic (medial) and cognitive-associative (ventromedial) areas. The function of the STN in the extrapyramidal system is well known and many studies were published on this subject, but its role in the limbic system just became now into the centre of interest. This nucleus also can be involved in the treatment of psychiatric disorders. Lately human PET studies verified that the stimulation of human STN induces changes in the function of the limbic system. Claustrophobia is typically classified as an anxiety disorder. The amygdala, as the part of the limbic system plays a key role in the pathophysiology of the anxiety disorders, and its smaller size has been found in patients with panic disorder.

Case report: This paper presents a 63-year-old man with 7 years of PD in his history, Hoehn-Yahr III stage with motor fluctuations. He was successfully treated with bilateral STN-DBS with significant motor improvement and consequent daily L-dopa dose reduction. The position of the leads (model 3389) has been confirmed by postoperative CT to preoperative MRI co-registration. On both sides the contact 2 has been positioned just below the AC-PC line. Activation of this contact provided sustained beneficial motor effect at C+,2- 90 microsec, 130Hz and 2,3 Volts. Claustrophobia of this patient, which had been known before the operation without demanding any treatment, worsened significantly on the course of 6 months of follow-up. To determine the anxiety level we used the Claustrophobia Scale, that consists of 20 questions. The patient has been assessed before and after monopolar stimulation of each contact for 1-2 days.

Conclusion: This is the first case demonstrating the possible role of STN-DBS in the worsening of claustrophobia as a stimulation-related complication. This case confirms that the STN via limbic system modulation would take part in the pathomechanisms of anxiety disorders such as claustrophobia.

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GENDER-DEPENDENT FAVORABLE PREDICTORS IN ADVANCED PARKINSON'S DISEASE TREATED WITH SUBTHALAMIC STIMULATION

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Background: A few studies have specially addressed the gender-related efficacy and safety of deep brain stimulation (DBS) of the subthalamic nucleus (STN) for advanced Parkinson's disease (PD), and also with conflicting results.

Objectives: To investigate gender differences in and favorable predictors of six-month surgical outcomes after bilateral STN-DBS.

Methods: Sixty-three (42 men, 21 women) consecutive patients were retrospectively reviewed. Absolute changes of the Unified PD Rating Scale scores in the "drug-off, DBS-on" state were compared using (a) the preoperative 'drug-off' state and (b) the "drug-off, DBS-off" state at six months after surgery as the baseline. The favorable factors were analyzed using the linear regression model.

Results: Before surgery, women presented with slightly worse clinical severity especially in poor cognitive function than men ($p<0.05$). No significant gender differences were noted in clinical improvements, reduced anti-parkinsonian drug use and surgical complications after STN-DBS therapy. A multivariate regression analysis revealed that tremor-dominant presentation and a longer duration of illness were favorable predictors for men; whereas women exhibited significant improvement if they were younger at time of surgery.

Conclusions: STN-DBS therapy is safe and beneficial for both genders in a similar manner. Women are suggested to consider for surgical therapy as earlier as possible.

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OUTCOME OF YOUNG ONSET PARKINSON'S DISEASE PATIENTS AFTER 7 YEARS SUBTHALAMIC STIMULATION

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Background/Objectives: Age of Parkinson's disease (PD) patient has been considered as one of significantly prognostic factor after STN-DBS. Nevertheless, young onset PD (YOPD) who suffered great life impact from disease might influence the long-term clinical profiles.

Methods: A cohort of 17 YOPD patients with a mean disease onset at 32.3 years was prospectively followed up at 1, 2, 5 and 7 years after subthalamic deep brain stimulation (STN-DBS).

Results: Clinical results including 4 subgroups (part I ~ IV) of unified Parkinson's disease rating scale (UPDRS) significantly improved 5 years after operation. While a progressive worsening of part III in "Med on" at 5 years, synergistic effect of "Med on / DBS on" consistently improves motor disabilities. Disease evolution revealed by clinical status "Med off / DBS off" revealed higher part III scores after 5 years, which consolidate inherent progressive nature of PD. STN-DBS could also remarkably reduce levodopa equivalent daily dose (LEDD) up to 67.3% at 2 years. Although reported psychiatric incidence and cerebral bleedings were comparable as literatures, these patients seem to have more stimulation dyskinesia and dopamine dysregulation syndrome.

Conclusions: STN-DBS is an effective and safe surgery to improve clinical and neuropsychiatric status for YOPD patients over 7 years follow-up. Prominent LEDD reduction through STN-DBS is especially important for this specified group who suffered more complications from medication.

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UNEVEN BENEFIT OF SUBTHALAMIC DEEP BRAIN STIMULATION IN PARKINSON'S DISEASE'S MOTOR SYMPTOMS – A 7 YEARS CROSS-SECTIONAL STUDY

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Subthalamic deep brain stimulation (STN-DBS) is well established as an alternative treatment modality for Parkinson's disease (PD) since 1992. The long-term effect of STN-DBS for motor symptoms of PD is also well documented. However, uneven benefit exist as un-resolving problems in PD therapy. In this report, we will focus on the long-term effect of STN-DBS on motor symptoms of PD, with or without levodopa.

Method: From 2002-02 to 2011-02, Hualien Tzu Chi General Hospital had treated 120 PD patients with STN-DBS. Cross-sectional analysis during follow-up period of 1, 2, 5, 7 years were performed (N=88, 60,31,17 respectively). UPDRS was evaluated in 4 conditions of DBS/levodopa On/Off combinations.

Result: In the state of DBS On/levodopa Off, UPDRS part III score improved significantly within 7 years follow-up (p=0.0000). Decrements in the degree of improvement were observed on part III axial symptoms [sub-items of UPDRS 18 (speech), 27 (arising from chair), 28 (posture), 29 (gait) and 30 (posture instability)] after 5th year follow-up. In the state of DBS Off/ levodopa Off, part III score and all sub-items deteriorated in comparison to pre-op levodopa Off score after 5th year follow-up, in which, bradykinesia was significantly poorer at 5th and 7th year follow-up (p=0.04, 0.007 respectively) and axial component was significantly poorer at 7th year follow-up (p=0.0154).

Conclusion: The long-term effect of DBS on motor disability is promising. Disease progression may be modified and slowed down by DBS within 5 years, and then accelerated. Axial symptoms were less improved by DBS with/without levodopa .

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INDIVIDUAL DIFFERENCES OF THE STN / IN ORDER TO MORE ACCURATE DBS SURGERY

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Introduction: While the STN-DBS surgery, we cannot see STN as a target directly. So we must suppose the shape, the size, and the location of the STN. Then it is very important to grasp the degree of the average and the individual differences about the shape, the size, and the location of the STN.

Methods: We composed ten 3D images of the STN on the computer from the digital photographs of the frozen serial sections of ten Japanese human hemispheres fixed with formalin.

Results: We clarified the 3D shapes of the STN, then we investigated the averages and the individual differences of the length of the long axis and the location of the center of each 3D STNs on the computer. The long axis of the STN ran from anteromedial-inferior to posterolateral-superior, and it was a mean of 10.7mm(9.1-12.1)long. Their individual differences were 3mm maximum. The location of the center of the STN was 11.9 mm(10.6-14.0) lateral from the midline, 1.1mm(0-2.3) posterior to the midcommissural point(MCP), and 2.7 mm(1.3-4.5) inferior to the line leading from the anterior commissure(AC) to the posterior commissure(PC) on average. Their individual differences were about 2-3mm.

Conclusions: After all we reconfirmed that it was essential to identify the location of the STN by the microelectrode recordings(MERs) in order to compensate these individual differences during the DBS surgery.

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THALAMIC TARGET IDENTIFICATION USING PROBABILISTIC DIFFUSION TRACTOGRAPHY

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Introduction: Target coordinates for stereotactic thalamotomy are usually derived from atlas-based coordinates. Individual anatomy is used to scale the coordinates based on the third ventricular reference landmarks. On conventional MR imaginges the borders of the individual thalamic nuclei are not identifiable. MR diffusion tractography defined connectivity profiles can delineate individual thalamic nuclei.

Methods: We investigated the inter-individual variation of the location of target nuclei for thalamotomy: the putative ventralis oralis posterior (Vop) and the ventral intermedius (Vim) nucleus as defined by probabilistic tractography.

Results: The mean inter-individual distance of the peak Vop location is 7.33 mm and 7.42 mm for Vim. The mean overlap between individual Vop nuclei was 40.2% and it was 31.8% for Vim nuclei. We present a male patient with drug-resistant tremor due to posttraumatic mesencephalic bleeding, who underwent unilateral Vop/Vim thalamotomy and a female patient with essential tremor, who underwent unilateral Vim thalamotomy. The probabilistic multi-fiber tractography indicated that the successful tremor control was achieved with lesions in the Vop/Vim and Vim respectively.

Conclusions: Connectivity-based segmentation of the thalamus by MR diffusion probabilistic tractography may help in better appreciation of the individual anatomy when planning stereotactic functional operations.

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THE ROLE OF MER IN STN DBS FOR PD

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Objective: Identification of subthalamic nucleus (STN) based only on MRI and CT for deep brain stimulation (DBS) for Parkinson's disease (PD) might cause suboptimal clinical effect. The authors analyze alterations of permanent electrode location chosen after intraoperative neurophysiological evaluation compared to MRI based calculated target.

Methods: We have analyzed the trajectories of 131 electrodes which were implanted in 66 PD patients (32 females and 34 males) aged 57.6 (38-76). The patients were qualified for the surgery according to the CAPSIT-PD criteria. STN was identified using the direct and indirect method based on 1.5T MRI and CT. The surgery was performed under local anesthesia. 2 to 5 microelectrodes were used for microrecording and macrostimulation.

Results: After intraoperative neurophysiological evaluation, anterior (49,2%), central (35,6%) and lateral (13,6%) trajectories were most frequently used for permanent electrode placement. The stimulating electrode was most frequently placed at the depth: +2/+3 (58,3%) or +1 and +5 mm (36,4%) with regard to the planned target point. Differences in selection of the trajectory and depth of final electrode position were statistically significant ($p<0,05$).

Conclusions: Intraoperative neurophysiological evaluation optimizes the final DBS electrode placement and increases the efficacy of the STN DBS therapy for PD.

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EVALUATION AND TREATMENT OF DYSTONIA: CASE SERIES OF 101 PATIENTS

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Objective: Variability of the clinical picture in Dystonia is one of the most frequent causes of misdiagnosis, which might lead to inadequate treatment. When the disorder is genetic or the cause is unknown and dystonia is the sole feature, the disease is called primary or idiopathic, conversely secondary dystonia (SD) may be caused by various brain insults. Both primary (especially generalized) and SD have been notorious for their poor response to medical treatment, today stereotactic neurosurgical procedures are offered to improve the disability and quality of life of patients who do not respond to medical therapy. There is very scanty literature regarding big series of treated patients, we aim to full fit this necessity bringing together the experience of two major centers.

Design: Retrospective descriptive case series.

Methods: 101 patients treated in 2 centers. Patient details including gender, age at onset, age at initial treatment, genetic status, magnetic resonance imaging status, history and clinical findings were analized. Data on severity of dystonia (Burke Fahn Marsden Dystonia Rating Scale—Motor Scale, Barry Albright Dystonia Scale), disability (Burke Fahn Marsden Dystonia Rating Scale—Disability Scale), quality of life (subjective global rating from 1 to 10 obtained retrospectively from patient and caregiver) as well as data on supportive therapy, concurrent pharmacotherapy, stimulation settings, adverse events and side effects were collected. This study was carried out to describe characteristics of all patients.

Results: In general primary dystonia is more responsive than secondary dystonia, with a 74% improvement, patients with secondary dystonia had a total mean BFM improvement of 41.6%. SD was separated into four broad categories according to the suspected or diagnosed etiology: SD to perinatal insults, tardive syndromes (TS), genetic syndromes and posttraumatic cases.The mean change in G TS was 70.6% and 73.4% in S TS. The group of patients with GS consisted of 3 cases, followed up for a period of 9 months to up to 36 months. All cases were studied and diagnosed by movement disorders specialists with genetic syndromes: Parkinsonism dystonia, Pantothenate Kinase-associated neurodegeneration and secondary degenerative dystonia (Wilson´s disease).

Conclusions: There is need to highlight the presentation of the disease amongst clinicians and patients as this would improve diagnosis rate, early intervention and appropriate management. Genetic studies need to be done. Neuroimaging findings have prognostic significance for response to treatment.If the anatomical images (MRI) are normal in the basal ganglia, the first alternative treatment should be DBS. If the images show distortion of the anatomy of the basal ganglia, one should separate patients into two groups:

a. Hemidystonia group: They Should Receive a DBS trial.

b. CP group: ITB Should be the first trial step. Since published literature shows conflicting results, and our group is too small to draw firm conclusions, we offer doses of Baclofen progressively higher first. Titrating doses to up to 150mcg.

Regarding targets for DBS: Gpi is our first target when tonic component predominates.In cases of dystonic tremor not responding to Gpi DBS, we Propose Vim (ventralis intermedius nucleus), Vop (nucleus ventralis oralis Rear) or subthalamic DBS.

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BILATERAL DEEP BRAIN STIMULATION; IS THE PLACEMENT OF THE FIRST ELECTRODE MORE ACCURATE THAN THE SECOND ONE?

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Objective: Deep brain stimulation (DBS) is recognized as an effective treatment for movement disorders. The first aim of this study was to evaluate whether the brain shift, which leads to a less accurate position of the implanted electrode, is more important on the second side of operation. The second aim was to analyze if cellular microrecording and macrostimulation helped to place the definitive electrode closer to the pre-planned MRI target.

Methods: We retrospectively reviewed operation protocols and post-operative MRI's of 32 patients who underwent bilateral subthalamic nucleus DBS for Parkinson's disease or ventral intermediate DBS for essential tremor. For microrecording and macrostimulation, we used the three horizontal parallel channels distant from 2 mm of the "Ben Gun" device, centered on the pre-planned MRI target. Pre- and post-operative MRI images were merged. The distance between the planned target and the center of the implanted electrode artifact was measured. For the patients for whom it was decided peri-operatively not to choose the central channel, we compared the real position of the electrode to the hypothetical position of the electrode if the central channel had been chosen.

Results: On average, the electrode on the first side was placed 0.2mm medially and 0.02mm posteriorly to the planned target, while the second electrode was placed 0.13mm medially and 0.39mm anteriorly. The first electrode was placed significantly closer to the planned target in the anterior-posterior axis compared to the second electrode ($p=0.04$). The central channel was chosen in 68.7% of cases on the first side and 46.9% on the second side. In the group of patients for whom another channel than the central one was chosen to implant the definitive electrode, electrophysiology helped to approach the anatomical pre-planned target significantly in the medio-lateral plan (0.78mm laterally to 0.43mm medially on the first side and 0.9mm laterally to 0.07mm medially on the second side).

Conclusions: Our results show that more trajectories seem to be necessary to reach the second target, and this may be due to brain shift that is more important on the second side of operation. Thus, in our experience, it is important to perform microrecording and marcrositmulation on the second side of surgery. Precision on the second side could be improved by assessing the five channels of the "Ben Gun".


PAIN.

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ENDOSCOPIC ASSISTANCE IN SURGICAL TREATMENT OF TRIGEMINAL NEURALGIA

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Introduction: Microsurgical treatment of compression syndromes of the cranial nerves at the present time remains a challenge. Traditional microsurgical intervention is not always effective, due to the difficulty of diagnosis, anatomical features, limitations of microsurgical techniques. In some cases, visualization of the cranial nerve compression with a microscope is not possible. Use of endoscopic assistance can help to visualize vascular compression of the cranial nerve root, which is not visualized by using an operating microscope.

Methods: Total of 30 patients underwent microvascular decompression of the cranial nerve roots under video endoscope assistance. Of these, 28 patients (93.3%) suffered from trigeminal neuralgia and 2 patients (6.7%) were operated due to hemifacial spasm. The age of patients was from 27 to 72 years, the average age was 53,3 ± 10,5 years. Duration of illness ranged from 1 to 21 years, an average of 7,3 ± 5,8 years.

Results. Vascular conflict was found at microsurgical and endoscopic stage. In 2 patients (6.7%) was significantly compressed FSK was visualized only by using an endoscope. In 80.0% of the trigeminal nerve was compressed by superior cerebellar artery (24 patients), in a smaller number of observations compression was caused by anterior inferior cerebellar artery (2 patients) and the basilar artery (2 patients). After surgery, trigeminal neuralgia was treated in most of patients (23 or 82.1%), in 2 patients with hemifacial spasm clinical picture completely regressed. These findings are consistent with studies of other authors on the effectiveness of endoscopic assisted intracranial microvascular decompression of the cranial nerves.

Conclusion. The advantage of the endoscopic technique is a better view, the ability to visualize the difficult to see parts of the wound, which may improve the results of surgical treatment of intracranial vascular compression of cranial nerves. Endoscopic technology also can reduce the surgical trauma, resulting in a more favorable postoperative period.

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OCULOMOTOR EFFECTS OF ELECTRICAL STIMULATION OF THE MEDIAL LONGITUDINAL FASCICLE AND ITS ROSTRAL INTERSTITIAL NUCLEUS IN HUMAN

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Oculomotor disturbances have been reported in several chronic cluster headache (CCH) patients treated by retro-hypothalamic deep brain stimulation (DBS), but have never been characterized, due to their complexity and discomfort. We characterized for the first time these DBS-induced ocular movements and show that they were related to the stimulation of the medial longitudinal fascicle (MLF) and its rostral interstitial nucleus (riMLF).

A four-contact DBS electrode has been implanted stereotactically in the left retro-hypothalamic region in a patient with refractory CCH. The coordinates of the contacts relative to the bicommissural plan were calculated on postoperative MRI and then projected into a 3D MRI-based atlas of the diencephalon-mesencephalic junction. In the parameters setting period, transient diplopia was induced by the stimulation (from 1,6V, similarly for 30 and 130 Hz). Among neighboring structures involved in oculomotor control and whose stimulation could be related to the oculomotor effects observed, the compact portion of the MLF, the closest fibers and nuclei of the oculomotor nerve (III) were located respectively 2,1 mm, 3,6 mm and 9,7 mm from the contact 0. Stimulation on contact 0 induced limitation of the elevation and adduction of the left eye, and hyperactivity of the right eye antagonist muscles on the Lancaster red-green test. We hypothesize that these effects were related to stimulation of supranuclear gaze control pathways and could result from a stimulation of the left MLF. The oculomotor disturbances induced by stimulation on contact 1 suggested a skew deviation, associated with a concomitant right hypertropia, confirmed by the Lancaster test. Considering the electrode location, this skew deviation may be due stimulation of the left MLF and riMLF.

Semeiologic analysis of these complex horizontal, vertical and torsional movements suggested that these symptoms were related to stimulation of supranuclear gaze control pathways and structures. Our anatomical study showed that the electrode was located close to the MLF and the putative location of the riMLF whose existence in human has been suggested by lesion studies and animal studies. Thus we hypothesize that these ocular movements were related to stimulation of the MLF and riMLF, which add arguments in favor of the existence of riMLF in human and their role in vertical gaze control.

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PERIPHERAL NERVE AND PERIFERIC NERVE FIELD STIMULATION FOR THE TREATMENT OF CHRONIC NEUROPATHIC PAIN SYNDROMES

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Objectives. Peripheral nerve stimulation (PNS) and Periferic Nerve Field Stimulation (PNFS) is known to be effective for the treatment of neuropathic pain. We aim to present the results of this methods of stimulation for the treatment of chronic neuropathic pain syndromes in our institution.

Material and method. A total number of 37 patients were treated with chronic peripheral nerve stimulation (PNS) for the last four years. There were 16 males and 21 females, aged 32 – 72 years (mean 41,3 years). Mean pain duration was 5 years. Seven patients suffered from postthoracotomic pain syndrome. In 10 patients post herpetic neuralgia was diagnosed; in 7 of them pain was localized in the chest wall, and in 3 ones – in the perineum. 15 patients had pain syndromes secondary to neuropathy of various peripheral nerves; 5 of them suffered from neuropathy of V nerve branches, II (3 cases) and I (2 cases); three of the last 15 patients suffered from occipital neuropathy. Pain characteristics were evaluated by international pain scales: DN4, LANSS, PAIN DETECT. In all patients neuropathic pain or obvious predominance of neuropathic component of complex pain syndrome were confirmed. Pain severity was assessed with Pain and Quality of Life Card (PQLC), based on Visual Analog Scale (VAS) and numeric range scale for evaluation of pain intensity and influence on various quality of life aspects. Pain severity was evaluated at admission to hospital, during trial stimulation, during the immediate postoperative period and at follow-up. Based on trial stimulation results PNS was implanted in 32 patients. Mean follow-up was about 3 years.

Results. Following immediate postoperative results were obtained. Complete pain relief was achieved in 8 patients (25%); in 20 patients (62,5%) pain relief was ranged 50 to 75% in comparison with baseline; in 4 patients (12,5%) pain improvement was less than 50%. At follow-up (to 36 month) 6 from 8 patients keep beneficial pain control with neurostimulation; 22 patients (68,75%) keep 50 to 75% pain relief in comparison with baseline (persistent good outcome); 6 patients had satisfactory pain relief; finally in 3 cases initial benefit of stimulation was gradually lost. In the last 3 patients reprogramming attempts, and electrode reimplantation were failed and their devices were removed soon thereafter. Overall, 29 patients significantly decrease doses of analgetics (mean by 65%) due to neurostimulation, and in 4 cases patients stopped to use analgetics. Daily life activity increase (mean by 70%) was noted.

Discussion: Based on analysis of all negative results and all cases of negative dynamics we have detected factors, that affect on long-term outcome of neurostimulation. In practice, these factors don't differ from ones, described earlier in foreign publications. To our opinion the most important factors, that impair prognosis of chronic neurostimulation, are follows:
1) late referring to neurostimulation
2) multiple repeated neurolysises
3) patient's non-adequate steep demands of neurostimulation outcome.

Adherence to exact patient selection criteria is essential condition for improving of long-term efficacy of neurostimulation.

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SUBCUTANEOUS ELECTRIC STIMULATION: A FEW TRICKS TO AVOID COMPLICATIONS

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17 patients affected by different hronic pain syndromes at different sites were submitted to subcutaneous stimulation. (peripheral nervev field stimulation). A few complications have been reported with this technique and they all bring to the suspension of the treatment or to a further surgery. They are mainly due to wound infection and electrode dislodgement.

In our case series we didn't have wound infections and only one case fo electrode dislodgment was observed in one patients at the beginning of our experience in this field.

To avoid wound infections due to skin erosions next to the prosthetic devices we always implant both the Stimulator and the connection cables away from the wounds. Moreover to avoid both infection and dislodgmement of the electrode we usue to fix the tip of the electrode through a transcutaneous suture and leaving a cable loop at any skin incision along the pathway of the cable to the stimulator. The average time of an implant is 15 minutes. These techniques will be described.

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PERCUTANEOUS TREATMENT OF TRIGEMINAL NEURALGIA

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This study presents our evolution in the percutaneous treatment of trigeminal neuralgia during the last 20 years. One hundred and ninety patients with trigeminal neuralgia were treated by percutaneous techniques. Techniques included radiofrequency, microcompression of the Gasserian ganglion with image intensifier and more recently microcompression with neuronavigation.

Follow-up period ranged from 3 months to 20 years with an average of 5 years; 74% of the patients have remained pain free and the recurrence rate was 39%. Postoperative complications included hypo-aesthesia in 80%, dysaesthesias in 9% of the patients and masticatory weakness in 3%.

The main advantages of the procedure are the short hospital stay (two days on average) and no severe complications. The disadvantages include the recurrence rate and the need for a general anesthesia (unusual for a percutaneous procedure). The use of neuronavigation permits a safer approach for this percutaneous treatment.

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LONG TERM EFFECT OF THALAMIC DEEP BRAIN STIMULATION FOR PAIN DUE TO BRACHIAL PLEXUS INJURY

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Introduction: Brachial plexus injury is associated with intractable long-term pain of the upper limb in up to 20 to 30%. Deafferentation pain is the result of avulsion of the root from the spinal cord. Traction on the brachial plexus results in rupture of the rootlets from the cervical spinal cord. Chronic intractable pain resulting from brachial plexus avulsion is the major indication for the DERZ(dorsal root entry zone) coagulation procedure. Recently, deep brain stimulation (DBS) is known to be another tool for the treatment of chronic pain states that do not respond to less invasive or conservative treatment options. The authors report a case of thalamic DBS for the relief of recurred deafferentation pain after DREZotomy.

Purpose and methods: The patient was a 53-year-old female who presented neuropathic pain on right shoulder and upper extremity since she was 12 years old due to brachial plexus injury. Preoperative electromyography and scapular magnetic resonance imaging revealed brachial plexopathy and atrophy of rotator cuff and supraspinatous muscle. In 2000, the patient underwent DREZotomy on C3-C5 level with resultant pain relief. Preoperative Visual Analogue pain Scale (VAS) was 9, decreasing to 2 after the DREZotomy. But the same symptom had recurred in 3months after DREZotomy. In 2001, The authors performed left VPL nucleus (ventral posterior lateral nucleus of thalamus) stimulation.

Results: After the DBS, paresthesia has reduced in the preoperative painful area. Preoperative VAS was 8, decreasing to 2 immediately after the DBS. A good relief of the pain was achieved after the DBS. In August 2010, the patient experienced significant pain reduction during long-term follow-up monitoring and her pain medication has been dramatically reduced. Her pain has been reduced to 50%, and almost daily attack of pain episodes have been reduced to 1 to 2 episodes per week. Ths VAS has been steady 2 to 3 as well.

Conclusion: Chronic intractable pain resulting from brachial plexus avulsion is the major indication for the DREZotomy. However, the authors think many neurosurgical institute might experience recurring cases of deafferentation pain after DREZotomy for the brachial plexus injury. In this report, the authors assumed that DBS can be helpful and effective treatment in recurred deafferentation pain due to the brachial plexus injury.

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SPINAL CORD STIMULATION FOR PERIPHERAL MYOCLONUS ASSOCIATED WITH NEUROPATHIC PAIN: A CASE REPORT

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In this report we will present a 63 year-old female suffering from neuropathic abdominal wall pain associated with myoclonic jerks. The symptoms appeared four months following a bilateral lumbar sympathectomy in order to cure an obliterative arteriopathy in the lower extremities. 4 month after the surgical manoeuvre, the patient complained about involuntary, shock-like jerks of the lower left quadrant of the abdominal wall as well as about burning pain in distribution of the left iliohypogastric nerve. O/E the patient had mechanical allodynia and hypaesthesia in the bottom-left quadrant of the abdominal wall and involuntary rhythmic contractions in the same area. Later the jerks extended to the right side of the abdominal wall. The rest of the physical examination showed no abnormality.

According to all the examinations performed, we can conclude that there was no corticospinal aberration and that the origin of the described myoclonic jerks is the peripheral nerve (left iliohypogastric nerve). We can exclude the central origin of the myoclonus. The patient could not tolerate gabapentine, valproic acid, carbamazepine. Local anaesthetics injection in the distribution of the iliohypogastric nerve gave temporary pain relieve and stop myoclonic jerk. After all, we implanted an octad lead at the level of L.1. – T. 12. and after the sucsessfull test period we internalized a neuropacemaker - which is a widely accepted treatment for neuropathic pain. In our situation, the dorsal root stimulation ceased both the pain and the myoclonic jerks. In medical literature, we have not found any publication or case report about SCS effect in peripheral myoclonic jerks.

To conclude, this case report confirms that myoclonus can arise from peripheral origin. As well as Dorsal Root Stimulation has proved to become a potential option in treatment of peripheral myoclonus. Until now the exact mechanism of SCS in PM has not been cleared, hence further examinations, tests and researches are required to speculate how SCS diminishes the peripheral myoclonus.

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PERCUTANEOUS BALLOON COMPRESSION OF THE TRIGEMINAL GANGLION IN 80 PATIENTS WITH IDIOPATHIC TRIGEMINAL NEURALGIA

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Introduction: We assessed the surgical results of percutaneous balloon compression of the trigeminal ganglion in 80 patients with idiopathic trigeminal neuralgia. Furthermore, authors analyzed possible prognostic factor regarding the procedure.

Methods: Eighty patients with follow-up of more than 12 months were retrospectively analyzed. The mean follow-up period was 65 months (range 12–118). The mean age was 66.5 years (range 27–91). Twenty four patients (30%) had other previous surgical procedures. The balloon was inflated by injecting radio-contrast media 0.5 to 1.0 ml in amount under brief general anesthesia according to Mullan's technique using volume control. The mean inflating time was 73 seconds (range 45–120).

Results: We reported excellent and good results in 65% of the cases, poor in 5% as annoying dysesthesia, recurrence in 24%, and 6% failure due to technical deficiencies. Seventy-one patients (89%) were initially relieved of their pain. There were permanent motor weakness of the masseter muscle in 3% of patients and transitory diplopia in 5%. Neither anesthesia dolorosa nor keratitis occurred. We obtained inflated balloon in four shape types that were pear (71%), dumb-bell (9%), oval (14%), and cylindrical (6%). The various balloon shapes did have statistically meaningful significance (P=0.00). The pear shape had the most positive influence on the satisfactory outcomes with 60 seconds compression time, that did not occur the severe dysesthesia. The dumb-bell shape had a higher chance for favorable result (5/7) with 45 seconds compression time. The cyrindrical and oval type balloon shapes were not effective (P=0.00).

Conclusion: This study shows the procedure would be an effective method with acceptable morbidity in the treatment of idiopathic trigeminal neuralgia. We also emphasize that the surgeon should make every possible effort to obtain the pear-shaped balloon with one minute compression time for favorable results.

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THE SPINAL CORD STIMULATION TO PATIENTS WITH PAIN AND SPASTIC SYNDROMES

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Objective: One of the most important problems of today's neurosurgery and neurology practice is strict patient selection for spinal cord neurostimulation. For this purpose it is very important to define the character and the power of pain and the level of the muscle tone, to analize the results of stimulation electromyography and to implant the trial system before operation.

Material and Methods: Samara Regional Hospital neurosergery department use spinal cord stimulation systems implanting in the posterior epidural space to patients with pain and spasticity (muscle spasm, spastic limbs) as a part of a complex therapy. 26 patients have been operated: 8 women and 18 men with there age ranging from 22 to 63 years. In 10 cases there was an injury of cervical region, in 12 cases - thoracic region and in 4 cases – lumbar region of the vertebral column. The electrode was implanted in the posterior epidural space on the lumbar level by a standard procedure.

Results: The result of neurostimulation is improvement of the quality of life of the patients (using the SF-36 survey): pain relief for 35-40%, muscle tone decreasing – for 1,5 – 2 points, what is confirmed by the results of stimulation electromyography.

Conclusion: The results of spinal cord stimulation depend on strict patient selection. After operation patients with chronic pain and spasticity find that neurostimulation positively impacts the quality of their lives: they achieve reduction in pain and decreasing of muscle spasm in limbs. Patients find that they can decrease or stop taking painkillers or other pain medications, they return to a more normal lifestyle and normal activities, a physical therapy program recommended for them becomes more various.

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RESULTS OF THE SURGICAL TREATMENT OF NEUROPATHIC PAIN SYNDROME IN PATIENTS WITH CONSEQUENCES OF TRAUMATIC AND NON-TRAUMATIC SPINE INJURY

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Treatment of the neuropathic pain syndrome is one of the most important goals in program of enhancing the quality of life (QoL) of patients with spine pathology.

Materials and Methods: We performed an analysis of the neuropathic pain syndrome treatment of 52 patients. 39 among them had consequences of traumatic spine injury, 8 – consequences of viral myelitis, 5 – radices of brachial plexus avulsion. Assesment of the results was made by VAS scale. Perfect result was attained if sensation of pain was reduced more than 75% in postoperative period, good – 50-75%, tolerable – 35-50%, bad – less than 35%. We used method of the epidural electrostimulation of spinal cord in 36 cases, DREZ-tomy – 16 patients, dorsal radicotomy – 4 patients, anterior commissural myelotomy - 2 cases, in 5 cases were performed reoperation.

Results: In 39 patients with consequences of traumatic spine injury method of epidural electrostimulation was used in 28 cases. Perfect result was achieved in 10 patients, good in 12, tolerable in 1, bad in 5 cases. In last 5 cases we performed reoperation and had done dorsal rhizotomy in 3 cases (achieved a good result), anterior commissural myelotomy in 2 (achieved a good and perfect result). DREZ-tomy was performed in 11 cases. In 7 cases was achieved a perfect result, in 3 – good result, in 1 case – tolerable result. In patients with the consequences of inflammatory spine diseases for the correction if pain syndrome was used only the method of epidural electrostimulation. Among 8 patients perfect result was achieved in 2 patients, good in 6 and in 2 cases bad result. In all 5 cases with pain syndrome associated with brachial plexus radices avulsion unilateral cervical DREZ-tomy was performed. Perfect result was achieved in 2 cases, good in 1 case, bad result in 2 patients. We implanted electrodes for the cortex stimulation in both last cases. Was achieved a good result in both cases.

Conclusion: 1. Surgical treatment is an effective method for the correction of neuropathic pain syndrome in patients with consequences of traumatic and non-traumatic spine injury. 2. Efficacy of surgical treatment depends on the accuracy of choice method of operative intervention individually in every separate case.

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MULTIMODAL TREATMENT ALGORITHM FOR TRIGEMINAL NEURALGIA. A RETROSPECTIVE REVIEW

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Objective: To review all surgical procedures for treatment of trigeminal neuralgia (TN) performed in Department of Neurosurgery, Karolinska University Hospital over the past 8 years.

Methods: This retrospective review included 502 patients, 34-99 years of age, undergoing surgical treatment for TN between 2004 and 2011. The treatment modalities used were microvascular decompression (MVD), percutaneous Gasserian ganglion rhizolysis using glycerol, balloon compression of retroganglionic fibers, or selective thermocoagulation, and stereotactic Gammaknife surgery (GKS).

Results: A total of 662 surgical procedures were performed in 502 patients with TN refractory to medical therapy. Patients were assigned to treatment according to an algorithm based on age, medical condition, concomitant medication, anatomical distribution of pain, MRI-identified structural causes, the history of previous surgical interventions, and patient preference. Surgical therapy was most common in the age group 70-79 year (213 procedures), followed by 60-69 year (143 procedures), and 80-89 year (103 procedures). Patients with an ipsilateral neuro-vascular conflict were selected for MVD. This group consisted of 89 patients with a mean age of 55 years (range 34-77 years). Percutaneous procedures were performed in 327 patients with a mean age of 70 years. Glycerol rhizolysis was the most common first line treatment, with 349 procedures in 246 patients. Fifty patients were treated a second, third and even a fourth time (2) for pain recurrence with varying latencies. This group consisted of elderly patients with a male:female ration of 1:2. A total of 114 balloon compressions were performed in 75 patients, of which about half suffered from multiple sclerosis (MS). In this group, the mean age was 60 years, and the male:female ratio 1:1. A total of 39 repeat balloon compressions were done due to pain recurrencies in MS patients, or as repeat procedure in patients who failed glycerol rhizolysis due to technical reasons. Selective thermocoagulation was performed in 3 patients only, with pain recurrence in V2 or V3. GKS, the only non-invasive technique, was performed in 86 patients with a mean age of 67 years. These patients were either selected based on their medical condition, concurrent medication, or on patient's preference.

Conclusions: A range of surgical procedures are available for treatment of trigeminal neuralgia which most commonly afflicts the elderly. Our treatment algorithm is consistent with the AAN-EFNS guidelines for treatment of TN (2008). The procedures range from quick outpatient procedures conducted under local anesthetic, to open surgery under general anesthesia, or GKS in patients not eligible for standard surgical procedures.

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MANAGEMENT OF PAINFUL TIC CONVULSIF

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Introduction : Trigeminal neuralgia(TN) and hemifacial spasm(HFS) are caused by compression of the fifth and seventh cranial nerves by adjacent vessels. Both are the most frequent hyperactive cranial rhizopathies. Rarely reported disease, "painful tic convulsif" describes the concurrent TN and ipsilateral HFS. This study was carried out to provide clinical presentations and management strategy of painful tic convulsif.

Methods: Data was collected retrospectively on 11 patients diagnosed with painful tic convulsif among 2012 cases of HFS and TN, treated at our institute (March 1986– Jun 2011).

Results: Of the 2012 patients, only eleven patients (0.54%) were found to have painful tic convulsif 6 patients were treated by concurrent microvascualr decompression(MVD) of both cranial nerve V and VI, . 2 patients have treated by sequential intervaled MVD for each, and 2 patients have treated by MVD for HFS and medication for TN. One patient was managed conservatively only for high perioperative risks. Long term follow up, eight atients were pain and spasm free after surgery and one patient suffered reduced facial pain after decompression without hamifacial spasm. Remained one patient without MVD, TN controlled by medication.

Conclusion: These results indicate that when the vascular compression is confirmed in patients with tic convulsif, MVD for both the cranial nerve V and VII is recommended as the 1st choice of treatment.

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NEUROSTIMULATION IN ANAESTHESIA DOLEROSA AND CENTRAL PAIN SYNDROME

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Background: Anaesthesia dolerosa is a complication of trigeminal rhyzotomy to treat refractory trigeminal neuralgia. It is more common after repeated procedures, and destructive procedures and is very difficult to treat medically and surgically. Neurostimulation had been proposed to be an effective treatment in selected patients. This study aimed to examine the role of neurostimulation in the managment of aneathesia dolerosa and compre its efficacy to neurostimulation in central pain syndrome.

Methods: Patients who had a neurostimulator implanted in their brain because of refractory facial pain in a hospital in Tayside in the last fifteen years were asked to complete pain assessment and quality of life questionnaires (VAS and SF-36 questionnaires were used). A retrospective case note review was done to assess the outcome of the neurostimulator through clinical response and medication analgesia reduction, and basic information was compared in the cases.

Results: Most of the treatments tried by the patients before they had motor cortex or spinal cord neurostimulation had no effect on their pain. Motor cortex stimulation and spinal cord stimulation has had a good outcome in this group, with 9/10 patients having a positive response. The facial pain patients did better than the thalamic pain patients with a better overall response.

Conclusion: Neurostimulation is a worthwhile procedure in patients with refractory aneasthesia dolerosa or central pain syndrome.

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CYBERKNIFE RADIOSURGERY IN MANAGEMENT OF OLD AGE PATIENTS WITH TRIGEMINAL NEURALGIA

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Purpose: We retrospectively analyzed the outcome of 26 old aged patients to evaluate whether Cyberknife radiosurgery is an effective and safe mode of therapy for medically intractable trigeminal neuralgia.

Methods and Materials: Between March 2004 and May 2005, 26 patients who failed to or refused surgery or were not suitable candidates for invasive intervention were treated by Cyberknife radiosurgery. To obtain an accurate distortion-free localization of the trigeminal nerve, a CT cisternography was performed. The CT images were networked to the Cyberknife workstation, where the trigeminal nerve was outlined. Radiosurgery doses of 60~64 Gy were delivered to the 80% isodose line prescribed to an 8-mm length of the nerve, sparing the most proximal 3mm away from the trigeminal nerve root entry zone. The median follow-up after Cyberknife radiosurgery was 15 months.

Results: Preliminary results from a cohort of 26 patients undergoing Cyberknife radiosurgery for TN showed that pain relief was achieved in 13 patients within the first 24 hrs after treatment. At last follow-up, 25 of the 26 study patients reported early pain relief within 7 days. The actuarial pain control rate was 96% at median follow up of 15 months. A relapse of pain (or loss of improvement) developed in 2 of 26. 3 patients had hyperesthesia (11.5%), which was the only complication observed with any of our patients.

Conclusion: With these results, authors assumed that Cyberknife radiosurgery could be one of safe and effective therapeutic methods old aged patients with several medically intractable trigeminal neuralgia.

PSYCHO-SURGERY

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DEEP BRAIN STIMULATION OF THE GLOBUS PALLIDUS INTERNUS AND THE THALAMUS IN TOURETTE SYNDROME. CASE REPORT

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Introduction: Deep brain stimulation (DBS) for the treatment of refractory Tourette syndrome has been successful in several cases, and different targets, including the anterior and posterior internal part of the globus pallidus (GPi), different parts of the medial thalamus, internal capsule and nucleus accumbens have been explored.

Case report: A male in his early thirties suffering from severe Tourette's disease since childhood was considered for deep brain stimulation therapy. DBS electrodes were implanted into the bilateral internal part of the globus pallidus (GPi) and the bilateral centro-median parafascicular (Ce-Pf) complex of the thalamus. Electrode placement was verified by postoperative CT scan fused with the preoperative MRI scan. Stimulation was performed with random start in the pallidal targets for 3 months and the thalamic targets for 3 months. A consultant neurologist performed rating blinded to the stimulation targets. Scoring was based on the Yale Global tic Severity scale and RUSH video-based rating scale. Also, neuropsychological evaluation and quality of life measures were used. During the initial observation period of 6 months there was a marked reduction in verbal tics. Motoric tics varied in severity and frequency; though were not at any time as severe as preoperatively. Most stable and prolonged effect was seen on the thalamic stimulation. The patient improved emotionally and psychologically and reported better concentration and quality of life. There were only mild and temporary side effects observed.

Conclusion: We here present a successful case of deep brain stimulation in a patient with severe Tourette's syndrome. Thalamic stimulation was superior to GPi stimulation in this patient.

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DEEP BRAIN STIMULATION AS A SYMPTOMATIC TREATMENT FOR MEMORY IMPAIRMENT IN ALZHEIMER DISEASE

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Recent studies have suggested that neuronal circuits involved in memory can be modulated by deep brain stimulation (DBS) and that this property might be used to slow the cognitive decline of patients suffering from dementia including Alzheimer Disease (AD).

We conducted a prospective pilot study whose objective was to evaluate the feasibility and safety of DBS in AD patients. Inclusion criteria were: adult patients under 70 years old, with AD diagnosed for less than 2 years, with Mini Mental Status (MMSE) between 20 and 24 and predominant impairment of episodic memory (Grober & Buschke test). The fornix was stimulated bilaterally through electrodes implanted stereotactically in the hypothalamus (2,2 V, 130 Hz). Clinical, biological, neuropsychological and imaging evaluation was conducted 3 months before and 3, 6 and 12 months after surgery.

During the one year- inclusion period in a specialized consultation, we screened 108 patients with recently diagnosed AD and episodic memory impairment. Only 8 patients out of 108 fulfilled all the inclusion criteria, 4 accepted to be included but only one was finally operated. No complication occurred and the stimulation was perfectly tolerated. After one year of stimulation, the memory scores (MMSE, ADAS-Cog, Grober & Buschke) were stabilized compared to baseline.

This pilot study brings new argument about the safety of fornix DBS in the hypothalamus. However the acceptability of this surgery by AD patients seemed to be low, and raised questions about the future of this approach.

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DEEP BRAIN STIMULATION (DBS) IN THE TREATMENT OF COMORBIDITIES OF THE TOURETTE SYNDROME (TS)

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Introduction: The clinical spectrum of TS is broad and includes often behavioral symptom. About 90% of TS patients present a comorbid a so called neuropsychiatric disorder and the most common is Obssessive Compulsive Disorder (OCD). DBS in severe, refractory TS patients is now considered a promising treatment which have shown efficacy not only for tics but also for behavioral comorbidity.

Matherial and methods: Since november 2004 fifty patients affected by severe TS underwent DBS surgery at our Department. Of these patients, eleven had a persistent OCD. These patients underwent twelve surgical procedure. Nine out of these eleven patients were targeted at the NA-ALIC. In three cases were a rescue surgery, two had a previous electrode in the Vo-Cm/Pf and one in the posterior globus pallidus (Gpi). In three cases the antero-medial part of the globus pallidus internus was targeted; in one patient it was chosen as first target, in another it was a rescue surgery of a previous Vo-Cm/Pf stimulation. In the last case it was chosen the antero-medial Gpi as a last resort, considering that this patient have previously been targeted at Vo-Cm/Pf and NA-ALIC removed for inflammatory complications.

Results : The mean YBOCS of patients who underwent DBS at NA-ALIC at the presentation in our department was 31.6 (22-38). Four years after DBS the average YBOCS diminuished to 18 (4-31). One patient asked for removing of DBS devices after three months of the surgical procedure and was excluded from the follow up. Another patient was considered a poor responder with YBOCS reduced from 35 to 31. The remaining seven patients has an important reduction of YBOCS of about 50%. The results of the remaining three patients who underwent electrode implantation in the antero-medial part of the globus pallidus, are still preliminary.

Conclusions : DBS for TS is frequently efficacious on amelioration of comorbidities of TS such as OCD.

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UNDERSTANDING THE PATHOPHYSIOLOGY OF TOURETTE SYNDROME WITH INTRACEREBRAL ELECTROPHYSIOLOGICAL RECORDINGS

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Introduction: Deep brain stimulation (DBS) for patients with Tourette Syndrome (TS) is effective in reducing tics and comorbid conditions. Despite intense research, TS pathophysiology is still largely based on models and indirect evidence. Neural activity from DBS target structures can provide direct information about neural dysfunction in TS. The three structures preferentially chosen as targets for DBS in TS are the thalamus, the globus pallidus internus (GPi) and the nucleus accumbens (NA). Local field potentials (LFPs) from ventralis oralis/centromedian-parafascicular (Vo/CM-Pf) nucleus of the thalamus showed oscillations at low frequencies (LF, 2–15 Hz) band (Marceglia et al., 2010) and neural activity recorded from GPi showed irregular neuronal activity correlated with motor tics (Zhuang et al., 2009).

Methods: We recorded LFPs in three patients with TS: (1) from Vo/CM-Pf during severe vocal tics three days after DBS surgery, (2) from Vo/CM-Pf at rest 12 months after DBS surgery, and (3) from Vo/CM-Pf and NA at rest in a patient with TS and obsessive compulsive syndrome (OCD).

Results: (1) Bilateral LFP recordings from Vo/CM-Pf showed an abnormal frequency modulation from the LF band activity to the high beta band (20-35 Hz) activity only in the dominant hemisphere in the time frame corresponding to tic. (2) the Vo/CM-Pf LFPs recorded twelve months after DBS surgery shows activity within the LF band (2-7 Hz). (3) NA LFPs show strong activity within the beta band (8-20 Hz) whereas in Vo/CM-Pf LFPs beta activity is virtually absent.

Conclusions: Although the abnormal frequency modulation observed in the Vo/CM-Pf was not time-locked to the tic, but it is lateralized on the same side of language function, it could be causally related to tic. We also found that Vo/CM-Pf LFPs are stationary over time, suggesting that the Vo/CM-Pf LF activity is a specific rhythm of TS in time. The abnormal NA beta LFP activity observed could be associated with OCD and, in turn, can drive the thalamo-cortical activity ultimately resulting in behavioral dysfunctions. Hence, Vo/CM-Pf and NA DBS in patients with TS could induce its beneficial effects by modulating specific pathological neural rhythms in the cortico-basal ganglia-thalamic network.

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HAS PALLIDAL STIMULATION A PROTECTIVE EFFECT ON COGNITION IN HUNTINGTON DISEASE?

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Background: Huntington Disease (HD) is known to be an autosomal dominant neurodegenerative disorder associated with motor, psychiatric and cognitive deterioration over time. To date, Deep Brain Stimulation (DBS) of the posteroventral Globus Pallidus Internus (GPi) have been reported to improve chorea

Objective: Long term neuropsychological assessment of a cohort of patients with Huntington's disease treated by DBS.

Patients: Seven patients (Stimulated Group) were evaluated pre-operatively and annually post-operatively throughout a 3 years follow-up period under treatment. Three other HD patients were screened and followed up for four years; two of them selected for treatment. This group of patients (Non Stimulated Group) was used as a control group. Patients of these two groups were comparable in terms of disease evolution (six years in average) and disease severity (45 CAG repeats in average for SG; 43 for NSG).

Method: The main outcome measure is the score obtained at the Mattis Dementia Rating Scale (MDRS) for investigating changes in cognitive function. Clinical assessment was performed using the motor section of the Unified Huntington's Disease Rating Scale (UHDRS).

Results: Among SG patients, we observed a great improvement on the MDRS (mean = +13 points; range +1 to +23 points) one year after DBS for three patients. One of them remained stable and MDRS scores slightly worsened (mean = - 3 points; range: -1 to -7 points) for the last three ones. Data at three years were available for only five patients. One of them could not be evaluated by the MDRS because of dysphasia. We obtained a three-points gain on one patient and MDRS scores of the last three ones indicated a worsening (-5.5 points in average). A consequent MDRS score decline was enhanced for two NSG patients with a mean loss of 28.5 points after four years follow-up. The last one, who did not present any cognitive dysfunction at the first evaluation, remained stable. UHDRS motor scores show an improvement at one year of the choreic symptoms with a trend of worsening subsequently.

Conclusion: We report on a possible and unexpected influence of GPi stimulation on cognitive evolution in HD patients at least during the first year of the treatment.

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ACUTE STIMULATION EFFECTS OF DIFFERENT STIMULATION SETTINGS VIA EXTERNALISED ELECTRODES IMPLANTED IN THE BED NUCLEUS OF THE STRIA TERMINALIS/ VENTRAL STRIATUM-INTERNAL CAPSULE IN TREATMENT-RESISTANT OBSESSIVE COMPULSIVE DISORDER

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Objective: To report about the acute stimulation effects of different stimulation settings via externalised electrodes implanted in the bed nucleus of the stria terminalis/ ventral striatum-internal capsule in treatment-resistant obsessive compulsive disorder.

Background: Deep brain stimulation (DBS) in different targets emerges as a promising therapeutic option for patients with treatment-resistant obsessive compulsive disorder (trOCD). We here describe the acute effects of different stimulation settings on OCD symptoms and mood states in a patient with trOCD after implantation of DBS electrodes in the bed nucleus of the stria terminalis/ ventral striatum-internal capsule (BNST/VS-IC).

Methods: Quadripolar DBS electrodes (Medtronic 3387) were implanted bilaterally with stereotactic guidance and microelectrode recordings in the BNST/VS-IC. Electrode location was confirmed via postoperative stereotactic CT. On the following day, the target was stimulated using different amplitudes (1V, 2V, 3.5V) and different contacts (0-/1+, 0-/3+, 2-/3+) with a constant pulse width of 210 µsec and a frequency of 130 Hz for 5 minutes, respectively. Obsessive-compulsive symptoms and mood states were assessed by an independent rater using visual analogue scales.

Results: Subjective intensity of obsessive-compulsive thoughts was reduced most by acute stimulation with 2V but, however, deteriorated with higher amplitudes. Subjective feelings of pleasure and spontaneous smiling were induced also at low voltage. Stimulation of different contact pairs located either in the BNST (0-/1+) or in the IC (2-/3+), and combined stimulation (0-/3+) produced differential and particularly specific effects.

Conclusions: We here show acute effects on core symptoms of OCD after stimulation in the BNST/VS-IC. The induction of positive feelings accompanied symptom reduction.

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THE SEARCH FOR AN INDIVIDUALIZED TARGET IN DEEP BRAIN STIMULATION FOR OBSESSIVE-COMPULSIVE DISEASE: IS THE SIDE RELEVANT?

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Introduction. Deep brain stimulation for obsessive-compulsive disease (OCD) has targeted several subcortical nuclei, including STN and Nucleus Accumbens. While the most appropriate target is still being searched, little attention has been given to the side of the stimulated hemisphere in relationship to outcome.

Methods. We report 2 cases of patients diagnosed with OCD, one having symmetry obsessions and the other one with sexual--religious obsessive thoughts. They were implanted bilaterally with deep electrodes located at both STN and Nuclei Accumbens. The effectiveness of the stimulation was tested for every possible paired combination of electrodes guided by the YBOCS score.

Results: The combination of electrodes which best relieved their symptoms was both the left STN and left accumbens. In case 1, Preoperative YBOCS was 33 and after activating the best combination it scored 16. All other possible combinations scored from 28 to 20, the lower scores always including one of the left electrodes. Case two scored an YBOCS of 33 preoperatively and 12 after both left electrodes stimulation (range 15-18). The patient has now a stable YBOCS of 3 and reports to be free of obsessions. High density EEG tomography confirm the selective stimulation effect at the frontal lobe in both cases.

Conclusions: Other reports have sustained that stimulation only of right side reliefs OCD symptoms. However, fMRI shows that different OCD dimensions recruit different cortical areas, and this may lead to different striatal targets individualized for each patient. This concept possibly applies to the site of stimulation. This has led us to change our OCD DBS protocol. Probably each patient has an individualized target including the side to stimulate.

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BREEDING-INDUCED DEFICIENT SENSORIMOTOR GATING IS ALLEVIATED BY DEEP BRAIN STIMULATION OF THE CENTROMEDIAN PARAFASCICULAR NUCLEUS IN RATS

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Introduction: In Tourette`s syndrome deep brain stimulation (DBS) of the globus pallidus internus (GPi) and the anterior region of the centromedian parafascicular complex (CM-Pf) have been shown to alleviate tics and associated phenomena possibly related to deficient sensorimotor gating. Breeding-induced deficient prepulse inhibition (PPI) of the acoustic startle response (ASR) has been used as an endophenotype for deficient sensorimotor gating. Recently, we showed that DBS of the rat equivalent of the GPi alleviates breeding-induced deficient PPI. We here investigated whether DBS of the rat CM-Pf would improve breeding-induced deficient sensorimotor gating as well.

Methods: Electrodes were stereotactically implanted bilaterally in the CM-Pf of rats with breeding-induced low and high PPI. After two weeks of recovery, rats were stimulated with 100 µA and 150 µA, or sham-stimulated with 0 µA (130 Hz and 80µs pulse width) for epochs of five days via a cable connected to a stimulator with a swivel interposed to allow free movement of the rats. At the end of each epoch the effect of ongoing stimulation on PPI was tested.

Results: CM-Pf DBS alleviated sensorimotor gating in PPI low rats with 150 µA being more effective than 100 µA. In PPI high rats, stimulation had no effect. ASR was not affected by stimulation in PPI high and low rats. Histological analysis verified electrode placement in the CM-Pf.

Conclusion: This work indicates an important role of the CM-Pf in the modulation of sensorimotor gating. This model may be useful to further investigate the pathophysiological mechanisms of deficient sensorimotor gating and mechanisms of action of DBS in certain neuropsychiatric disorders.

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THE EFFECT OF ELECTRICAL STIMULATION IN ORBITOFRONTAL CORTEX ON SPONTANEOUS BEHAVIOR IN RATS AS AN OBSESSIVE COMPULSIVE DISORDER (OCD)

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T-maze model is based on "spontaneous alternation behavior" which can be modified by 5HT1a receptor agonist (8 OH-DPAT). This substance decreases releasing of 5HT at the basal ganglia and produces a repetitive selection of the same arm in T-maze (perseveration). We hypothesized that DBS of the Orbito-Frontal Cortex at High frequency could elicited a significant decrease on perseverative behavior in T-maze model.

Method: We assessed 9 groups of rats Wistar male of 250 to 350 grams: 1. Control (saline solution) (n = 10); 2. 8-OH-DPAT (n = 10); 3 Clorimipramina (n = 9); 4 Electrode without stimulation (n = 9); 5 Low frequency stimulation (n = 10); 6 High stimulation frequency (n = 10). Results: Median (mínimo-máximo) for each group. Group-NaCl 1 (1-2). Group-8 OH-DPAT 4 (1-7). Group Clorimipramina 2 (1-5). Group without stimulation 2 (1-5). Group stimulation low frequency 2 (1-2). Group stimulation HF 3 (1-7). EECP low frequency decreases the 86% RR $p<0.05$ en comparación al 8 OH-DPAT. en="" comparación="" al="" 8="">Sham surgery produced a partial amelioration of compulsive behavior in rats without significant differences.

RADIO-SURGERY

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VISUAL OUTCOME AND TUMOUR CONTROL AFTER FRACTIONATED STEREOTACTIC RADIOTHERAPY FOR ANTERIOR SKULL BASE TUMORS

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Introduction: Few reports on the visual outcome after fractionated stereotactic radiotherapy (FSRT) for anterior skull base tumours exist. We conducted a prospective cohort study of patients treated with FSRT for anterior skull base meningiomas and pituitary adenomas to determine visual outcome and tumour control.

Methods and materials: Treatment was delivered using stereotactic accelerators dedicated to cranial stereotactic radiotherapy (Novalis Tx®, BrainLab AG, Germany, and Varian Medical Systems, US). Collimation and field shaping was provided by micro--multileaf collimators and conformal arc therapy utilizing the iPlan® planning and treatment system (Brain Lab). Visual acuity (VA) and visual field (VF) examinations and brain magnetic resonance imaging (MRI) studies were performed pre FSRT and at 9 months, 2, 3½, 5, 7 and 10 years post FSRT. Tumour control, defined as stable size or regression, was determined from the most recent post-treatment MRI study. Dose plans were analyzed for total optic chiasm irradiation dose. Patients treated between January 1999 and December 2009 with ≥ 2 years follow-up were included in the analysis.

Results: Thirty-eight patients with anterior skull base meningiomas and 55 with pituitary adenomas were included. Median follow-up was 62 months (range 24-146). *Anterior skull base meningiomas*: VA was stable in 21 (55%), improved in 10 (26%) and worsened in 9 (24%) patients. Of preexisting VF defects in 14 (37%) patients, 9 (24%) remained stable, 2 (5%) normalized and 2 (5%) improved. New VF defects developed in 4 (10,5%) patients. *Pituitary adenomas*: VA was stable in 36 (65%), improved in 11 (20%) and worsened in 8 (15%) patients. Of pre-existing VF defects in 22 (40%) patients, 15 (27%) remained stable, 5 (9%) normalized, 1 (2%) improved and 1 (2%) worsened. New VF defects developed in 2 (4%) patients. Preexisting visual affection correlated with post treatment visual affection. Chiasm irradiation dose did not correlate with visual affection post treatment. Tumour control rate of anterior skull base meningiomas was 100% at 2 years, 97% at 3 years and 90% at 5 years. Tumour control rate of pituitary adenomas was 100% at 2 years, 97% at 3 years and 96% at 5 years.

Conclusions: Visual outcome and long term tumour control after LINAC based FSRT treatment for anterior skull base meningiomas and pituitary adenomas is favourable.

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THE EFFICACY AND SAFETY OF LINAC STEREOTACTIC RADIOSURGERY BOOSTER AFTER WHOLE BRAIN RADIOTHERAPY FOR CEREBRAL METASTASES

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Introduction: Whole brain radiotherapy (WBRT) either as an adjunct or sole treatment for cerebral metastases has been employed for over 50 years. Studies have compared the efficacy of WBRT when used as adjunct for open neurosurgery or radiosurgery or as a stand alone treatment. But not many studies have looked at the booster effect of radiosurgery. The aim of this study is to review the efficacy and safety of LINAC (LINear ACcelerator) based stereotactic radiosurgery for cerebral meatastases after the administration of whole brain radiotherapy at a single institution.

Method: Patients with history of cerebral metastases treated with WBRT and subsequent X-kinfe LINAC stereotactic radiosurgery booster were retrospectively reviewed over 5 years in a single institution. All patients were adults above 18 years of age. Patients with prior craniotomies were included. Different primary carcinomas were included. The dosages of radiotherapy, follow-ups, complications and survival were reviewed and presented in the study.

Results: From January 2007 to March 2012, 15 patients with cerebral metastases treated with WBRT received booster X-knife LINAC stereotactic radiosurgery to reccurrent or residual lesions were identified. All patients received standard WBRT treatment of 30 gray (Gy) in 10 fractions. X-knife therapy booster were given to 2 isocenters in 3 patients and single isocenters in other 12 patients. Radiosurgery booster were given from 1 month after WBRT to 21months after WBRT. The dosage for X-knife booster ranged from 14 Gy at 85% isodose line to 20 Gy at 90% isodose line. Only one patient reported significant cerebral oedema as a result of the radiosurgery requiring steroid cover and the rest of the patients recorded no complication from radiosurgery. Follow-up period ranged from 3 months to 25 month following radiosurgery. Survival ranged from 5 months to 25 months after radiosurgery.

Conclusion: Stereotactic radiosurgery booster can be safely administered to patients with cerebral metastatic lesions who have been treated with WBRT in the past. Radiosurgery booster in majority of the cases seem to offer effective local control of the disease with little risk of undesirable effects.

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GAMMA KNIFE RADIOSURGERY IN BENIGN SKULL BASE TUMORS AFTER PLANNED SUBTOTAL RESECTION: PRELIMINARY RESULTS IN COMBINED APPROACHES

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Aim: The management of large lesions of the skull base, such as vestibular schwanommas (VS), meningiomas (MEN) or pituitary adenomas (PA), is challenging, with microsurgery remaining the main treatment option. Planned subtotal resection is now being increasingly considered to reduce the risk of neurological deficits following complete resection. The residual part of the tumor can then be treated with Gamma Knife Radiosurgery (GKR) to achieve long-term growth control.

Methods: This case series documents early results with planned subtotal resection followed by GKR in Lausanne University Hospital, between July 2010 and March 2012. There were 24 patients who underwent surgery, with 22 having already undergone GKR and 2 waiting for GKR. We analyzed clinical symptoms for all patients, as well as audiograms, ophthalmological and endocrinological tests, when indicated.

Results: Nine patients had VS surgery (mean diameter 35 mm; range 30-44.5) through a retrosigmoid approach. There were no post-operative facial nerve deficits. Of the 3 patients whom had useful hearing pre-operatively, this improved in 2 and remained stable in 1. Four patients with clinoid MEN (mean diameter 26.5 mm; range 17-42) underwent subtotal resection of the tumor, and the component in the cavernous sinus was later treated with GKR. The visual status remained stable in 3 patients and one had complete visual recovery. 4 patients underwent subtotal resection of petro-clival MEN (mean diameter 36 mm; range 32-42): 3 had House-Brackmann (HB) grade 2 facial function that recovered completely; one continues to have HB grade 4 facial deficit following surgery. Of the 7 patients with PA (mean diameter 34.5 mm; range 20-54.5), 2 had acromegaly, the others were non functional PA. Six patients underwent trans-sphenoidal surgery, while one patient had a transcavernous sinus resection of the tumor (with prior staged trans-sphenoidal surgery). Visual status improved in 3 patients while the others remained stable. Two patients had transient diabetes insipidus following surgery. Up to now, no additional deficit or worsening has been reported after GKR.

Conclusions: Our data suggest that planned subtotal resection has an excellent clinical outcome with respect to preservation of cranial nerves, and other neurological functions, and a good possibility of recovery of many of the pre-operative cranial nerve dysfunctions. The results in terms of tumor control following GKR need further long-term evaluation.

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EVALUATION OF THE ACCURACY OF THE CYBERKNIFE XSIGHT SPINE TRACKING SYSTEM

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Indroduction: The CyberKnife Xsight spine tracking system has enabled the increasing use of radiosurgery to ablate spinal lesions. The Xsight spine tracking system enables the continuous tracking of spinal lesions based on anatomical landmarks instead of surgically implanted fiducials. The Xsight system localizes spinal targets by direct reference to the adjacent vertebral elements. The purpose of this study was to evaluation of the accuracy of the CyberKnife Xsight spine tracking system.

Methods: The Xsight integrates with the CyberKnife radiosurgery system to eliminate the need for implantation of radiographic markers or fiducials prior to spinal radiosurgery. It locates and tracks spinal lesions relative to spinal osseous landmarks. The accuracy of the spinal radiosurgical procedure was assessed with an anthropomorphic head and cervical spine phantom. Using this device, all tracking modalities provided by the CyberKnife system can be simulated: fiducial tracking, 6D skull tracking and Xsight tracking for spinal targets. Dose planning was based on 1.0 mm thick computed tomography slices in which an inverse treatment planning technique was used. The end-to-end test was conducted 10 times. The total targeting error is calculated as the length of the distance vector.

Results: The total targeting error of the 6D skull tracking system and fiducial tracking system were 0.53 mm and 0.74 mm. And total targeting error of the Xsight spine tracking system was measured to be 0.53 mm.

Conclusion: The Xsight spine tracking system is practically important because it is accurate and eliminates the use of implanted fiducials. Fiducial-free spinal radiosurgery has a significant advantage for spinal radiosurgery in terms of time, cost of treatment, and quality of the life of the patient.

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INTERSTITIAL RADIOSURGERY WITH IODINE-125 SEEDS IN THE TREATMENT OF BRAIN METASTASES AND BRAIN TUMORS

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Interstitial radiosurgery (IRS), a form of brachytherapy (brachy from the Greek meaning "short") is an internal radiotherapy where a radiation source is placed inside or nearby a radiosensitive lesion for treatment. Brachytherapy has a long and well-established tradition in the department of Stereotactic Neurosurgery in Freiburg.

In earlier years permanent implants of Iridium-192 made from thin flexible wires that could be cut to any length were implanted using a stereotactic procedure. Iridium-192 has a half-life of 73.83 days and a mean energy of 380keV. Iodine-125 seeds used nowadays are sized 4.5 x 0.8 mm with 59.43 days half-life delivering much lower photon energy of 27.4, 31.4 and 35.5keV. These seeds contain Iodine-125 adsorbed onto a radio-opaque silver rod hermetically encapsulated in a welded titanium capsule. Typically available apparent activities range from 1 to 25mCi. Due to their favorable physical properties and attenuation in tissue these seeds present a sharp dose decline and are therefore well suited for the treatment of small (10–30mm) intracranial lesions, also nearby eloquent and radiosensitive areas. The lower photon energy and thereby high natural absorption in tissue has the additional advantage that surrounding persons get a radiation exposure far below 1mSv, which generally can avoid shielding and isolation of the patient.

Since January 1st, 1990 1375 patients (45% male, 55% female) underwent interstitial radiotherapy with 1594 Iodine-125 seeds in our department. In a retrospective study we analyzed the data of these patients. An overview on the contribution of brachytherapy to the treatment of brain metastases (20%), pilocytic (18%), fibrillary (29%) and anaplastic astrocytoma (7%), oligoastrocytoma (6%) and hypothalamic hamartoma (60) in children (310) and adults (1065) will be presented. Statistical analysis of the target volumes, reference doses, seed activities, number of seeds, implantation time and dose rates for these entities will be given.

Conclusion: Interstitial radiosurgery is a safe, minimally invasive, well-tolerated, cost and time efficient neurosurgical procedure with a very low rate of permanent morbidity and adverse events. For adults it can be applied under local anesthesia. If there is no histopathological diagnosis available, a stereotactic biopsy can easily facilitate the diagnosis.

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FOLLOW-UP STUDY OF VESTIBULAR SCHWANNOMA TREATED BY RADIOSURGERY WITH A VOLUMETRIC ANALYSIS BASED ON A 3D SEGMENTATION TECHNIQUE

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Introduction: The outcome of radiosurgery for vestibular schwannoma (VS) is assessed by a good evaluation of tumor size. Up to now, none evaluation of morphologic changes based on 3D segmentation has been realized.

Materials and Methods: Retrospective analysis was performed on 84 patients of the 281 with VS treated by Leksell Gamma Knife Radiosurgery 4C between 2004 and 2007 at the Center in Lille. we selected the patients with regular MRI scans and a follow-up at least of 4 years after treatment. Pre- and post-treatment tumor volumes were calculated by using Osirix software and a manually contouring lesion on each MR imaging was done.

Results: The initial median volume calculated was 1 341 mm3 (32.4 – 6300 mm3) including 11% Koos I, 60% of Koos II, 23% of Koos III and 7% of Koos IV. At last follow-up MR imaging, a tumor control was obtained in 92,4% with a variation of -15.5% of initial volume. From the sixth month, 47% of the patients presented a transient swelling. During the follow-up, we noticed four evolutionary profiles: 63.8% of the schwannoma decreased rapidly, 12.7% of them showed a late diminution, 14.5% were stable and 7.6% were considered as failure with a significant progression.

Conclusions: Tumor-volume measurements by standardized T1-weighted gadolinium-enhanced high-resolution 3D MR imaging follow-up protocols revealed good local control of VS after radiosurgery. The follow-up MR imaging at 2 years or 3 years appears insufficient to differentiated transient progression from ongoing progression. Volumetric analysis helps to make a diagnosis of failure.

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INTERSTITIAL BRACHYTHERAPY WITH IODINE-125 SEEDS FOR LOW-GRADE GLIOMAS OF THE BRAINSTEM IN ADULTS

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Objective: Gliomas of the brainstem are rare and therapeutic opportunities are limited. An alternative to external beam radiation is interstitial brachytherapy with Iodine-125 (I-125) seeds. Therefore, we report about this operative technique and retrospectively reviewed the results of I-125 brachytherapy in 10 adult patients with low grade gliomas of the brainstem.

Patients and Methods: 10 patients with well-circumscribed lesions of the brain stem and with intraoperative histological confirmation of a low grade glioma were treated with stereotactically implanted I-125 seed (half-life of 60.2 days, photon energy spectrum ranging between 27 and 35 keV) in our department between 1995 and 2011. Brachytherapy planning was performed with the Stryker Leibinger system to obtain a conformal dose distribution with application of 60 Gy on the outer tumor margin. Regular clinical and radiological follow-up examinations were performed until progression of the disease.

Results: Stereotactic serial biopsy revealed 3 pilocytic astrocytomas, 3 astrocytomas grade II, and one ependymoma grade II. In six patients the lesion was treated with one I-125 seed and in one patient two spatial separated lesions were implanted, therefore a total of 8 I-125 seeds were implanted. The mean volume of the 8 lesions was 3.87ml (range: 0.5-7.2 ml), mean activity of the seeds was 7.73 mCi (range: 1.5-11.1 mCi), mean duration of irradiation was 27 days (range: 21-41 days) and mean effective dose rate was 9.6 cGy/h (range: 6.2-12 cGy/h). All patients with pilocytic astrocytomas and one patient with an astrocytoma grade II are free of progression until now (follow up between 106 and 171 months). Mean progression free survival in the remaining three patients with a grade II tumor was 25 months (range: 12-42 months). Treatment modalities in the recurrence situation were external beam radiation and chemotherapy (PCV scheme, temozolomide, HD alpha calcidol).

Conclusion: I-125 brachytherapy is a valuable alternative therapeutic approach in low-grade gliomas of the brainstem with tumor control rates similar to those of conventional radiotherapy. The possibility to re-irradiate in case of tumor recurrence makes this treatment modality especially attractive.

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WOMEN PIONEERS IN FUNCTIONAL STEREOTACTIC NEUROSURGERY

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Introduction: Functional stereotactic neurosurgery has a long history, and pioneers in this field have mostly been men. The aim of this presentation was to find out whether there have also been women who made innovative contributions to this field.

Methods: A survey of old and new scientific literature was performed in order to find the first innovative publications related to functional stereotactic neurosurgery in which women had a pioneering contribution.

Results: We identified six women who contributed original groundbreaking work related to stereotactic surgery for functional brain disorders: Marion Smith was a British neuropathologist who made unique observations on stereotactic lesions of basal ganglia and thalamus on autopsied brains of Parkinson´s disease (PD) patients, and their relation to reported clinical outcome. Nathalia Bechtereva was a neurophysiologist from Leningrad who pioneered the technique of chronic deep brain stimulation as a method to treat functional brain disorders, including PD. Denise Albe-Fessard was a French neurophysiologist who pioneered the technique of microelectrode recording (MER) in stereotactic functional neurosurgery. Gunvor Kullberg is a retired Swedish neurosurgeon from Lund who contributed in early CT imaging as well as early functional imaging of stereotactic lesions in PD and in psychiatric patients. Hilda Molina is a retired Cuban neurosurgeon who established the Centro International de Restoration Neurologica (CIREN) in La Habana and pioneered in Cuba cell transplants, including MER-guided transplant surgery, in PD patients. Veerle Visser-Vandewalle is an active Belgian-Dutch neurosurgeon who in 1999 pioneered Deep Brain Stimulation for Gilles de la Tourette Syndrome, inaugurating thus the modern era of DBS for neuropsychiatric illness.

Conclusions: Although historically the great majority of neurosurgeons, neurologists and other neuro-specialists who have made groundbreaking contributions in functional stereotactic neurosurgery have been men, there are women who have made equally important and unique contributions to the field: The principal two techniques used today in functional neurosurgery, that is, microelectrode recording and deep brain stimulation, have once upon a time been pioneered by women.

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NEURAL TIME VS SUBJECTIVE TIME: THE LEGACY OF BENJAMIN LIBET AND THE ROLE OF FUNCTIONAL NEUROSURGERY IN THE STUDY OF HUMAN CONSCIOUSNESS

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Defining specific spatiotemporal relationships between neural activity and subjective experience is a key objective in the science of consciousness. Beginning in the 1960s, Benjamin Libet and co-workers conducted a series of such experiments in patients undergoing functional neurosurgery, the results of which have formed the foundation of contemporary neuroscientific studies on the nature of volition. Despite such prominence, the original series of studies have been criticised on various grounds and extensively debated. We review the methods, results and criticisms of the original Libet studies and discuss how the key issues raised in those experiments may be re-examined by contemporary neuroscientists. We draw on the wider literature in subjective time perception and discuss how opportunities afforded by intracranial recording and stimulation in neurosurgery may build on the work of Libet and co-workers. Such studies on the relationship between neural time and subjective time will contribute to the wider project of defining the relationships between neural activity and subjective experience and further our understanding of the nature and function of conscious experience.

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IS FRAME-BASED SURGERY IN PATIENTS UNDER SEVEN YEARS OLD SAFE? EXPERIENCE OF THE FREIBURG UNIVERSITY FROM 99 CASES

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Introduction: Stereotactic frame-based procedures proved to be precise, safe and are of widespread use among adult patients. Regarding patients under seven years old there are few data available, therefore the use of the stereotactic frame remains controversial in this population. This motivated us to report the experience in stereotactic procedures in the youngest patient population and describe pertinent surgical details.

Method: For this purpose all frame-based procedures performed in patients under seven years-old in the University of Freiburg during the last 10 years were retrospectively analyzed. All patients underwent frame-fixation under general anesthesia, which was followed by a CCT scan. The studied population was composed by 72 patients with mean age of 3,4 (±2,1) years, in which 99 stereotactic procedures were performed. Brain tumor was present in 60 patients, hydrocephalus in five, cystic lesions and intracranial abscess in three each and epilepsy in one case. Stereotactic surgery was performed in 36 cases for brachytherapy, in 29 for biopsy, in 20 cases for cyst puncture, in eight for stereotactic-guided endoscopic ventriculostomy, in five for catheter placement and in one case for depth electrode insertion.

Result: The overall complication rate was 5% (five out of 99). There were three cases of pin penetration through the skull, one case of frame dislocation after extensive cyst drainage and one skull fracture. Neurologic deficit related to the frame fixation was observed in none of the cases. In disagreement with other authors, no case of pin related infection, air embolism, hematoma or CSF leak was observed.

Conclusion: Stereotactic-frame fixation is a feasible and safe technique in patients under seven years old. Extensive cyst drainage and age under three years may be associated with neurologic silent complications as frame dislocation and skull fracture.

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