

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Functional and Topographic Relationships in the Primary Sensory and Motor Areas

AUTHORS: Warren W Boling, MD,FRCS(C); Andre Olivier, MD,PhD,FRCS(C)

INTRODUCTION: Functional imaging is promising and often very useful in planning surgery in and near functional regions of the brain; however, considerable expertise, time, and cost is required making it impractical for routine neurosurgical use. A method to identify cortical areas subserving specific function by visual inspection of the brain surface alone would improve the neurosurgeons approach to surgery in and near important functioning areas by obviating the need for highly specialized and costly imaging studies and providing an immediate analysis of functional localization during surgery.

METHODS: PET activation studies performed as part of a surgical evaluation at the Montreal Neurological Hospital and Institute were reviewed. Seventy-five activation studies for hand motor, hand sensory, thumb sensory, face sensory, and tongue sensory tasks without a mass lesion involving the central area were analyzed. Each activation study was coregistered with that subject's anatomical MRI and viewed in a 3D reconstruction.

RESULTS: Significant activation was seen within predictable anatomic locations in the primary motor and sensory gyri. These functional topographic relationships were found to reliably predict the cortical localization of specific motor and sensory tasks. Tongue sensory activation was in a triangle shaped region of the postcentral gyrus immediately superjacent to the Sylvian fissure. A lower face sensory task activated the narrowed portion of the postcentral gyrus at the apex of the triangular tongue area. Thumb sensory activation was in the most narrow part of the postcentral gyrus above the face area, with a second peak of activation in the hand sensory area. Hand motor and sensory function was highly correlated with a cortical fold (pli de passage moyen) connecting the pre and post central gyri, within the central sulcus, at the level of the superior frontal sulcus.

CONCLUSIONS: A growing body of evidence suggests that unique gyral and sulcal landmarks exist that are the substratum of specific motor and sensory functions, and these landmarks reliably identify the same sensory and motor functions on the brain surface.

OBJECTIVES: 1) identify key anatomical features in the central area 2) localize cortical regions subserving hand and face functions 3) identify key functional and topographic relationships

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CATEGORY: Movement Disorders

TITLE: Lesions using DBS electrodes: experimental studies in fresh egg whites and in human cadavers

AUTHORS: Sylvie Raoul, MD,PhD; Dominique Leduc, PhD; Roger Robert, MD; Jean-Michel Rogez, MD; Marie Garcon, PhD; Joel Leborgne, MD; Youenn Lajat, MD; Andres M. Lozano, MD,PhD

INTRODUCTION: Medtronic deep brain stimulating electrodes are usually used for deep brain stimulation (DBS), but these electrodes could also in some cases be used for creating therapeutic lesions in the brain. To evaluate using DBS electrodes to create lesions in the brain, we performed experimental studies in egg whites and in cadavers.

METHODS: : Fresh egg whites were used to measure the relation between current and voltage applied and coagulation size, using the Medtronic 3387 DBS electrode. We measured current spread from the contacts used for lesioning to the adjacent contacts. After initial studies in eggs, we moved to study the coagulation size of lesions made in pallidum or thalamus of human cadavers. The ultrastructure of the contacts after lesioning was assessed using scanning electron microscopy.

RESULTS: Coagulation size increased with time but reached a plateau after 30 seconds. For a given set of parameters, reproducibility of the size of lesions was high. Using constant voltage, lesions were larger in egg white than in cadaveric brains: 3.52mm (± 0.8) in fresh eggs at 40 volts, 125 mA, impedance 233 ohms and 2.66mm (± 1.2) in cadavers at 40volts, 38mA, impedance 1333 ohms. The profile of current fall off was steep from 90 mA at the lesion contact to 6 mA at contact 1.5mm away. The electrode showed not alterations after more than 200 lesions with scanning electron microscopy.

CONCLUSIONS: This study demonstrates that DBS electrodes can be used for lesioning the brain and those adjustments in parameters can provide reproducible lesion size of the lesion in humans. The choice of lesioning parameters must take into account the differences in impedance of test media (like egg whites) and the human brain parenchyma.

OBJECTIVES: Validation of a lesioning model using Medtronic DBS electrode. Prove that RF lesioning could be used as an alternative solutions to treat Movement disorders surgery. It is the first study made in human cadavers.

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CATEGORY: Movement Disorders

TITLE: Asymptomatic MRI signal changes can be detected as early as 4 weeks and disappear no later than 3 months after DBS implantation

AUTHORS: Pantaleo Romanelli, MD; Steven Ryu, MD; Gary Heit, MD,PhD; Helen Bronte-Stewart, MD

INTRODUCTION: Tissue changes induced by DBS placement are poorly described. We have detected MRI signal changes suggestive of tissue edema in a remarkable number of asymptomatic patients having unilateral DBS. These changes seem to be time ñrelated.

METHODS: Retrospective review of post-operative MRI after unilateral DBS placement was performed in order to assess the frequency of signal changes along the DBS track in asymptomatic patients. Thirty-eight asymptomatic patients (28 men, 10 women) were selected, having 27 left and 11 right electrodes. 31 STN DBS were placed for PD, 5 VIM DBS for ET and 2 GPi DBS for segmental and generalized dystonia. MRI scans were obtained for planning of the contralateral side implantation during a time span ranging from 23 to 698 (average 92, mode 35) days after the initial implant.

RESULTS: Post-operative MRI were performed one month after the first-side DBS placement (7), between 1 and 3 months (20), between 3 and 6 months (5) or more than 6 months later (6). 23 patients (61%) showed no abnormalities. Subcortical signal changes (hyperintensity on T2 and FLAIR) anywhere along the DBS tract was noted in 15 patients (39%), ranging from mild circumferential hyperintensity either along a segment or the entire electrode to significant involvement of the subcortical frontal white matter. MRI abnormalities were detected during the first month after implantation in 8 patients and between 1 and 3 months in 9. No asymptomatic signal changes were detected after 3 months or 6 months. Therefore 15 out of 27 MRI (55.6%) done during the first 3 months after the DBS placement showed signal changes suggestive of tissue reaction while none of the 11 MRI done after 3 months showed such changes.

CONCLUSIONS: Asymptomatic MR signal changes along DBS electrode track can be detected during the first 3 months after implantation. Transitory tissue edema either related to surgical trauma or to inflammatory reaction to the DBS can be hypothesized as the basis of these postoperative MR signal changes.

OBJECTIVES: Describe clinical indication for DBS. Describe typical targets used for movement disorders DBS. Assess Brain tissue changes related to DBS implantation using MRI.

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CATEGORY: Movement Disorders

TITLE: Combined VIM-STN Deep Brain stimulation for mixed extrapyramidal tremor

AUTHORS: Pantaleo Romanelli, MD; gary heit, MD,PhD; helen bronte-stewart, MD

INTRODUCTION: Deep Brain Stimulation of a combination of targets including the Nucleus Ventralis Intermedius of the Thalamus(VIM) and the Subthalamic Nucleus(STN) can be necessary to treat Mixed Extra-pyramidal Tremor.

METHODS: A 79 year old male presented with a long-standing combination of resting, postural and intention tremor , associated with severe disability and failure of medical treatment . Brain imaging failed to reveal areas of discrete brain damage.

RESULTS: A Deep Brain Stimulation device was placed in the Nucleus Ventralis Intermedius of the Thalamus, producing improvement of intention and postural tremor with residual resting tremor , as demonstrated by clinical observation and quantitative tremor analysis. Placement of an additional DBS in the subthalamic nucleus produced resolution of the resting tremor. Independent stimulation of VIM or STN failed to produce global tremor resolution while combined VIM-STN stimulation produced global relief of Mixed Tremor without remarkable side-effects.

CONCLUSIONS: Combined VIM-STN stimulation can be a safe and effective treatment for mixed extra-pyramidal tremor.

OBJECTIVES: Differentiate tremor features characteristic of PD or ET. Give a definition of Mixed extrapyramidal tremor. Define the best DBS targets for resting, intention and postural tremor.

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CATEGORY: Transplantation

TITLE: Neurotransplantation for Basal Ganglia Stroke: Results from a Phase 2 Trial

AUTHORS: Douglas Kondziolka, MD; Gary Steinberg, MD; Lawrence Wechsler, MD; James Gebel, MD; Sharon DeCesare, ; Elaine Elder, DSc; Carolyn Meltzer, MD; Ross Zafonte, DO; David Tong, MD; Michael Marks, MD

INTRODUCTION: There is no available treatment for the brain injury caused by ischemic or hemorrhagic cerebral infarction. We have used stroke as an experimental model for cellular repair. Transplantation of cultured neuronal cells was shown to be safe and effective in different animal models. A phase 1 study tested the safety and feasibility of human neuronal cellular transplantation in patients with substantial fixed motor deficits associated with basal ganglia stroke. In a second trial, we tested whether increasing numbers of cells and implants affected safety and efficacy in comparison to an untreated control group.

METHODS: This trial was performed at two institutions. In this phase 2 study, 18 patients with basal ganglia infarcts received stereotactic implants of neurons (Layton BioScience, Atherton, CA), randomized to either 5 or 10 million cells (n=14) and followed by rehabilitation therapy, or served as non-surgical controls with rehabilitation (n=4). Adults with stroke of 1-6 years duration and a fixed motor deficit that was stable for at least 2 months were included. Pre and postoperative clinical scales were measured. MRI and FDG-PET were used to assess brain metabolism and structure. Six months of cyclosporine-A immunosuppression was used.

RESULTS: All patients (ages 24-70) underwent uncomplicated surgeries. The mean age of the stroke was 3.6 years. Adverse events 5 to 15 months from randomization included one chronic subdural hematoma (without sequelae), one brief focal seizure on post-operative day one, and one syncopal episode. Complete, minimal six month results from this study will be available in November 2002. Serial evaluations from the phase 1 trial (30-36 months) showed no cell-related adverse serologic or imaging-defined effects.

CONCLUSIONS: Implantation of neuronal cells was feasible and accomplished without serious adverse effects. Basic neurobiological studies and additional clinical trials are required to answer important therapeutic questions in stroke and other neurodegenerative diseases. Phase 2 study results and new trial design issues to address immunosuppression, safety, and efficacy will be discussed.

OBJECTIVES: list current inclusion criteria for neurotransplantation, discuss experimental objectives, define complications

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Long-term Results after Radiosurgery for Benign Brain Tumors

AUTHORS: Douglas Kondziolka, MD; Narendra Nathoo, MD; John Flickinger, MD; Ajay Niranjana, MD; Ann Maitz, MS; L. Dade Lunsford, MD

INTRODUCTION: Stereotactic radiosurgery is the principal alternative to surgical resection of benign brain tumors. The goals of radiosurgery are long term prevention of tumor growth, maintenance of patient function, and prevention of new neurologic deficits or adverse radiation effects. Long-term outcomes more than 10 years after radiosurgery are needed.

METHODS: We evaluated 285 consecutive patients who underwent radiosurgery for benign tumors of the brain between 1987 and 1992, and were suitable for 10-15 year follow-up. Serial imaging studies and clinical evaluations were performed. Our series included 157 patients with acoustic neuromas, 85 with meningiomas, 28 with pituitary adenomas, 10 with other cranial nerve schwannomas, and 5 with craniopharyngiomas. Prior surgical resection had been performed in 44% of these patients, and prior radiation therapy administered to 5%.

RESULTS: Overall, 95% of patients had imaging-defined local tumor control (63% had tumor regression and 32% had no further tumor growth). In 5% of patients, delayed tumor growth was identified. Resection after radiosurgery was performed in 13 patients (5%). No patient developed a radiation-induced tumor. Eighty-one percent of patients were still alive. Median imaging follow-up was 10 years. Normal facial function was maintained in 95% of patients who had it before treatment for their acoustic neuroma.

CONCLUSIONS: Stereotactic radiosurgery provided high rates of tumor growth control, often with tumor regression, and low morbidity rates for patients with benign intracranial tumors when evaluated over the long term. This study supports the increasing reliance on radiosurgery as an alternative to surgical resection for benign brain tumors.

OBJECTIVES: Discuss long-term results after radiosurgery. Discuss indications for radiosurgery. List tumors that are appropriate for radiosurgery.

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CATEGORY: Epilepsy

TITLE: Involvement of the thalamus in epileptic networks : preliminary results about a series of 20 patients.

AUTHORS: Jean RÈgis, MD; Fabrice Bartolomei, PhD; Milan Zvedka, MD; Patrick Chauvel, MD

INTRODUCTION: Several centers have started to study the stimulation of a specific part of the thalamus (anterior nucleus) or of the subthalamic nucleus. However the role of these structures in partial seizures generation and control is unknown. This study is aim to investigate the electrical changes occurring in the part of the thalamus more closely related to the area of the supposed epileptogenic zone.

METHODS: In 20 patients with drug-resistant epilepsies requiring Stereoencephalographic recording for the delineation of the epileptogenic (EZ) and irritative zone (IZ) implantation have been done such a way to have their last contact in the targeted part of the thalamus. In addition, a study of functional couplings between neural structures involved in seizures was performed through statistical couplings between signals they generate.

RESULTS: Complete results are available for 10 patients. Patients have been separated in 3 groups. In group I, the discharge occurs simultaneously in the thalamus and the other cortical structures participating to the initial epileptogenic network (nb = 1). In the group II, discharge is seen early in the thalamus (n = 2). In the group III, the discharge involve secondarily (>5sec) the thalamus (n = 3). In group IV no discharge is identified during the seizures (n = 4). In two patients the onset of the thalamic involvement correspond to a sudden extend in the cortical spreading of the discharge. In two patients coherence analysis have revealed a strong link between the cortical activity of the ZE et the thalamic one.

CONCLUSIONS: These preliminary results demonstrate the possible involvement by an ictal discharge of the thalamus during various types of partial seizures. However this possibility appears to be rare. These changes can occur early or just before a change in the mode of propagation questioning a potential role of these structures in epileptic cortico-subcortical networks.

OBJECTIVES: Is there some evidence for the involvement of subcortical structures in epileptogenesis What is the timetable of the electrical involvement of the different structures and clinical phenomenon

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Functional Outcomes After Gamma Knife Thalamotomy For Medically Refractory Tremor

AUTHORS: John YK Lee, MD; Ajay Niranjana, MD; Doug S Kondziolka, MD; John C Flickinger, MD; L. Dade Lunsford, MD

INTRODUCTION: Patients with disabling tremor may be poor candidates for radiofrequency thalamotomy or thalamic stimulation, either due to advanced age or concurrent medical illness. We evaluated patients after radiosurgical thalamotomy to determine the effectiveness of radiosurgery for medically refractory tremor.

METHODS: Over a 4-year period, 49 patients (29 men and 20 women) with median age of 76 years (range, 32 to 92) underwent gamma knife thalamotomy for Parkinsonian (21), Essential (n=23) or MS-related tremor (n=5). The median duration of tremor was 10 years (range, 1 to 35 years). The volume acquisition and fast inversion recovery MR images were used to target ventralis intermedialis nucleus of the thalamus commonly used for initial placement of an electrode. A single 4-mm isocenter was used to deliver a median dose of 140 Gy (range, 130 to 150 Gy). Patient's handwriting, drawing and tremor were graded before and after radiosurgery using aspects of the Tolosa-Fahn clinical rating scale.

RESULTS: All 36 evaluable patients (follow-up 1-41 months) noted improvement in tremor with improved writing and activities of daily living. Objective assessment showed improvement in the post-radiosurgery tremor grade in all patients. Two patients died of unrelated causes and adequate follow-up was not available on the other 11 patients. Outcome was rated as excellent (complete or near complete arrest) in 22, good (>50% improvement) in 9 and fair (some improvement) in 5 patients. The violent action tremor in all 5 MS patients was improved. The onset of improvement was noted at a median of 6 weeks (1-24 weeks). All patients reported improvement in their activities of daily living that included the use of eating utensils, drinking water from a cup, holding a plate or using hand tools. Three patients (8%) developed contralateral arm weakness between 3-8 months, which improved on short-term corticosteroid therapy. Five patients noted partial return of tremor after initial improvement. Overall 86% (31/36) of patients noted excellent or good functional improvement.

CONCLUSIONS: Stereotactic radiosurgical thalamotomy using our technique is safe and effective for patients who may be poor candidates for other intracranial procedures.

OBJECTIVES: Identify patients who are candidates for gamma knife radiosurgery for tremor. Determine the efficacy of gamma knife radiosurgery in the treatment of tremor. Recognize potential complications of gamma knife radiosurgery for tremor.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Vagus Nerve Stimulation After Failed Cranial Surgery for Intractable Epilepsy: Results of the Cyberonics Patient Outcome Registry

AUTHORS: Arun P. Amar, MD; Michael L.J. Apuzzo, MD

INTRODUCTION: We sought to determine the effectiveness of vagus nerve stimulation (VNS) therapy among patients with persistent or recurrent seizures after callosotomy, focal resection, and other cranial surgeries for intractable epilepsy.

METHODS: Data were obtained from the Cyberonics Patient Outcome Registry, which was established in 1998 after FDA approval of the VNS device as a means of capturing open label, clinical data outside of protocol. To date, more than 1000 physicians worldwide have voluntarily enrolled more than 5500 patients in this database. The integrity of the systems for collecting and processing registry data was authenticated by an independent auditing agency. The effect of potential selection bias, however, remains uncertain.

RESULTS: Two nonconsecutive cohorts were compared: patients who had previously undergone cranial surgery (group 1, n=820) and all other registry patients (group 2, n=4436). For group 1, the median reduction in seizure frequency was 44.4% after 3 months of VNS therapy, 42.5% at 6 months, 45.0% at 12 months, 50.0% at 18 months, and 50.0% at 24 months. For group 2, analogous rates were 50.0%, 53.4%, 60.0%, 64.2%, and 69.2%, respectively. In group 1, seizures were reduced by 50% in 47.8% of patients, 75% in 24.7%, 90% in 8.0%, and 100% in 1.8% after 3 months of VNS therapy. Response rates were more pronounced in group 2: 50% in 50.1% of patients, 75% in 29.4%, 90% in 15.7%, and 100% in 5.5%. Patients in both groups experienced marked improvements in quality of life parameters.

CONCLUSIONS: The effectiveness of VNS is maintained during prolonged stimulation, and overall seizure control continues to improve with time. Patients who had previously undergone cranial surgery did not respond quite as favorably as all other patients receiving VNS. Nonetheless, many improved substantially. Thus, on the basis of this open-label data, VNS represents a potentially palliative therapy for this refractory patient population.

OBJECTIVES: 1. Discuss the underlying reasons for failure after callostomy, lobectomy, and other cranial surgeries for refractory epilepsy 2. Understand the rationale for vagus nerve stimulation among patients who have failed prior cranial procedures for refractory epilepsy. 3. Compare the results of vagus nerve stimulation among patients who have undergone prior cranial surgery for refractory epilepsy versus those who have not.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Stereotactic Ventrooralis Thalamotomy for Task-specific Focal Hand Dystonia (Writer's Cramp)

AUTHORS: Takaomi Taira, MD,PhD,Prof; Tomokatsu Hori, MD,PhD,Prof

INTRODUCTION: Writer's cramp is a type of focal dystonia due to dysfunction of the pallido-thalamo-cortical circuit. The symptom is refractory to most conservative treatment, though botulinum toxin injection is generally used for symptomatic relief. As a surgical treatment of dystonia we performed stereotactic nucleus ventrooralis (Vo) thalamotomy for dystonic cramp of the hand.

METHODS: Eight patients (5 men, 3 women, age 26-40 yrs, mean 32.1 yrs) with medically intractable task-specific focal dystonia of the hand underwent Vo thalamotomy. Stereotactic target was chosen at the junction of the anterior and posterior Vo nuclei.

RESULTS: The mean duration of the symptom ranged from 3 to 6 years (mean, 4.0 yrs.) All patients had complained of difficulty of writing. Six patients were professional workers, such as comic artist, guitarist, and barber, and, because of the dystonic symptoms at their professional work, they had stopped pursuing their profession. All patients showed immediate postoperative disappearance of dystonic symptoms, and the effect was sustained during the follow up period (3-29 months, mean 13.1 mo) except in one case. One patient showed partial recurrence of the symptom and underwent second thalamotomy 5 months after the initial surgery with satisfactory results. The score of the writer's cramp rating scale significantly ($p < 0.001$) decrease after Vo thalamotomy. There was no permanent operative complication. There was no mortality or permanent morbidity.

CONCLUSIONS: The results indicates that the Vo nucleus of the thalamus plays an important role in pathophysiology of writer's cramp. Although a longer follow-up is needed, stereotactic Vo thalamotomy is a useful and safe therapeutic option for task specific focal dystonia of the hand.

OBJECTIVES: learn that writer's cramp is a focal dystonia, Vo thalamus is involved in this disorder, and that it is successfully treated with Vo thalamotomy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: A Novel Denervation Procedure for Idiopathic Cervical Dystonia

AUTHORS: Takaomi Taira, MD,PhD,Prof; Tomokatsu Hori, MD,PhD,Prof

INTRODUCTION: Bertrand's selective peripheral denervation for cervical dystonia has been well described and its effectiveness and safety are established. However, it always accompanies postoperative sensory loss in the C2 region. Intraoperative bleeding from epidural venous plexuses may also be a problem. The authors developed a new denervation procedure to avoid such complications and compared the surgical results with those of the traditional Bertrand's operation.

METHODS: The new procedure consists of intradural rhizotomy of C1 and C2 ventral roots, extradural peripheral ramisectomy from C3 to C6, and selective section of peripheral branches of the accessory nerve to the sternocleidomastoid muscle. This procedure was performed in 30 patients (Group A). The results of this procedure were compared with those of a matched group of 31 patients in our series who underwent Bertrand's operation (Group B). Changes of cervical dystonia rating score at six-month follow-up did not differ between the two groups.

RESULTS: One patient in Group A showed a sensory deficit in the C2 area, while all the patients in Group B had C2 sensory disturbance. No patients in Group A but four patients in Group B experienced occipital neuralgia. The operation time was significantly shorter in Group A. The average amount of the intraoperative blood loss was 115 ± 30 ml (mean \pm SD) in Group A and 233 ± 65 ml in Group B ($P < 0.005$).

CONCLUSIONS: Though symptomatic improvement is same as in Bertrand's operation, our new procedure for cervical dystonia carries much less incidence of complications and significant decrease of intraoperative blood loss.

OBJECTIVES: learn that peripheral denervation still plays an important role in the treatment of cervical dystonia, the traditional Bertrand's method is a preferred procedure, but the new method presented here results in less complications.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Staged-volume Arteriovenous Malformation Radiosurgery: Preliminary Results

AUTHORS: Bruce E Pollock, MD

INTRODUCTION: Stereotactic radiosurgery is commonly performed for patients with intracranial arteriovenous malformations (AVM). However, the risk of radiation-related injury generally limits this procedure to patients with AVMs of an average diameter of 3 cm or less.

METHODS: Between April 1997 and September 2002, 18 patients with a median AVM volume of 17.3 cm³ (range, 7.4 to 53.3 cm³) underwent staged-volume radiosurgery. Location of the AVMs was cerebral hemispheres (n=9), deep (n=7), corpus callosum (n=1), and cerebellum (n=1). The median interval between procedures was 6 months (range, 4-11); the median margin dose per procedure was 16 Gy (range, 16-18).

RESULTS: Twelve patients were evaluable more than 1 year after radiosurgery (median, 37 months). Six patients have undergone follow-up angiography. Two patients had complete obliteration. Three patients had more than 90 percent volume reduction and 1 patient had a 50 percent volume reduction. Two patients have undergone repeat radiosurgery because the residual AVM was outside the original dose-plans (1 marginal miss, 1 re-canalization from a prior embolization). The remaining 2 patients await 4-year follow-up angiography. Two patients suffered 3 AVM bleeds at 10, 20, and 25 months after radiosurgery. Only one patient developed a temporary deficit thought to be radiation-related.

CONCLUSIONS: Staged-volume AVM radiosurgery is technically feasible and appears to reduce the risk of radiation-related complications for patients with large-volume AVMs. More follow-up is required to determine whether this technique increases the annual bleeding risk and if it will result in an acceptable cure rate.

OBJECTIVES: 1. Participants will understand the rationale of staged-volume AVM radiosurgery. 2. Participants will understand the technique of staged-volume AVM radiosurgery. 3. Participants will be able to discuss the limitations of staged-volume AVM radiosurgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: From Functional Neurosurgery to “Interventional” Neurology: Survey of Publications on Thalamotomy, Pallidotomy, and Deep Brain Stimulation for Parkinson’s Disease, from 1966 to 2001.

AUTHORS: Marwan Hariz, MD, PhD, Prof

INTRODUCTION: During the last decade, there has been a renaissance of surgery for Parkinson’s disease. Publications on this issue are more frequent than ever. The aim of this presentation is to review the literature on surgery for Parkinson’s disease (PD) with respect to whether the first author had a neurosurgical affiliation or not, and whether the papers appeared in neurosurgical or non-neurosurgical journals. Additionally, the contributions of some non-neurosurgeons to surgery for PD will be reviewed.

METHODS: The PubMed database was searched using the words "Parkinsons disease" in combination with "thalamotomy", "pallidotomy" and "deep brain stimulation". Papers published between 1966 and 2001 were grouped in various time periods and according to the institutional affiliation of the first author.

RESULTS: Between 1966 and 1979, neurosurgeons and non-neurosurgeons (i.e., neurologists, neurophysiologists, and other neuroscientists) published almost equally on surgery for PD in both neurosurgical and non-neurosurgical journals. Between 1980 and 1995, the majority of publications were by neurosurgeons in neurosurgical journals. After 1995, especially for pallidotomy and deep brain stimulation (DBS) procedures, non-neurosurgeons were more often first-authors of surgical publications and these were more frequent in non-neurosurgical journals.

CONCLUSIONS: Non-neurosurgeons and neurosurgeons alike have been pioneers in promoting surgery for PD, but non-neurosurgeons more or less lost interest in surgery when L-dopa became routine in treatment of PD. In the last years, non-neurosurgeons tend to publish more than neurosurgeons on surgery for PD, especially DBS, and more often in non-neurosurgical journals. The fact that the first or senior author of surgical publications is more often than in the past a non-neurosurgeon may perhaps have some bearing on the reported results of surgery.

OBJECTIVES: To critically evaluate the literature on surgery for Parkinson’s disease (PD). To appraise the new role of movement disorder neurologists and their contributions in surgical issues related to patients with PD. To understand the importance for functional neurosurgeons to have training and knowledge not only in technical issues but also in the diseases that are being surgically treated.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY:

TITLE: Interobserver Variation in Nidus Determination of Brain Arteriovenous Malformations on Digital Subtraction Angiography

AUTHORS: Dennis R Buis, MD; Clemens M.F. Dirven, MD,PhD; Frederik Barkhof, MD,PhD,Prof; Rob R. Gons, MD; Jonas Castelijns, MD,PhD,Prof; Otto W.M. Meijer, MD; Ben J Slotman, MD,PhD,Prof; P. Dick Bezemer, PhD; Rene Van den Berg, MD; W. Peter Vandertop, MD,PhD,Pro

INTRODUCTION: To assess interobserver variation in measuring brain AVM nidus size and spatial conformation, for the purpose of radiosurgical target localization.

METHODS: Six observers, (2 vascular neurosurgeons, 2 neuroradiologists and 2 radiation oncologists) involved in radiosurgical target localization, independently measured AVM nidus size and spatial conformation in 28 angiograms of patients eligible for treatment with stereotactic radiosurgery for a brain AVM. Calculations of the intraclass correlation coefficient, coefficient of variation, descriptive statistics, Bland-Altman plots and contingency-table analysis were used to assess observer variation.

RESULTS: Observer reliability was good when measuring nidus-size on an AP and a lateral projection, with an intraclass correlation coefficient of 0.8225, resp. 0.7963 and a coefficient of variation of 20.35% resp. 20.27% (indicating a rather large variability). No relation between nidus-size and observer variation was found. No significant difference was found in measurements of the spatial conformation of the nidus ($p=0.0736$).

CONCLUSIONS: Overall interobserver variation in measuring nidus-size and spatial conformation is excellent, although some variability remains. This remaining variability might be clinically important when planning for radiosurgical treatment of AVMs.

OBJECTIVES: 1 tell that nidus size measurement on angiography is reliable, but some variability remains. 2 interobserver variation may result in a suboptimal stereotactic target 3 Recent imaging techniques and the use of a clear-cut, single definition of a nidus should reduce the amount of variability.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Endoscopic Selective Amygdalo-hippocampectomy: a cadaver feasibility study

AUTHORS: David J Yeh, MD; Joseph R. Smith, MD; Mark R. Lee, MD,PhD

INTRODUCTION: Unilateral selective amygdalo-hippocampectomy is an efficacious treatment of mesial temporal lobe epilepsy in appropriate surgical candidates. An endoscopic approach has not been previously described.

METHODS: Anterior, posterior, and lateral temporal approaches to the mesial temporal structures were studied in the cadaver laboratory. Rigid endoscopes and microinstruments were used to perform endoscopic selective amygdalohippocampectomy (ESAH). ESAH was attempted using each approach bilaterally on three cadaver heads and then verified with open dissection. Successful ESAH was defined as resecting 3cm of hippocampus from the pes, the anterior mesial two-thirds of the amygdala, and the parahippocampal gyrus mesially to the pia with minimal trauma to adjacent tissue.

RESULTS: Posterior approach via familiar occipital ventriculostomy readily accesses the lateral ventricle, however surgical maneuverability is compromised by the long course to the anteromesial temporal lobe. Anterior approach via the lateral orbital wall is unfamiliar and excessive retraction of the intraorbital contents or inadvertent entry into the orbital fissures is highly undesirable. However the initial corticectomy from the anterior approach allows resection of the amygdala facilitating entry into the temporal horn where the pes hippocampi is readily visualized. A lateral approach through the middle or inferior temporal gyri offers the most direct trajectory to the temporal horn. Successful ESAH was accomplished bilaterally in two specimens via the lateral approach. In one cadaver head, the temporal horns were not large enough to adequately perform the procedure.

CONCLUSIONS: ESAH is technically feasible in non-lesional cases where the interventricular structures of temporal horn can be adequately visualized and is optimally performed from a lateral cortical approach. Neuronavigational guidance would further insure optimal placement of the temporal burrhole to perform ESAH with minimal retraction of the temporal cortex. As an alternative, endoscopic amygdalohippocampotomy could theoretically decrease bleeding which would compromise operative visualization.

OBJECTIVES: Review traditional methods of amygdalo-hippocampectomy. Describe the benefits and risks of 3 different endoscopic approaches to the temporal horn. Describe endoscopic amygdalohippocampectomy via a lateral cortical approach.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Repeat Gamma Knife Radiosurgery (GKRS) for Trigeminal Neuralgia (TN)

AUTHORS: Ronald Brisman, MD

INTRODUCTION: Although GKRS has been shown to be safe and effective for treatment of TN, there are few studies that report results of a repeat GKRS.

METHODS: Between 1998 and 2002, we treated 315 primary TN patients with GKRS. All received a maximum dose of 75 Gy to the cisternal trigeminal nerve. 34 patients with recurrent TN were treated with a maximum dose of 40 Gy at a second GKRS and were available for at least 6 months of follow-up. Follow-up was obtained by either written questionnaire or phone contact at 6 months, then yearly following GKRS.

RESULTS: Time from the second GKRS to last follow-up was 451 days (mean) and range (76 to 1066 days). At final follow-up, pain relief was: =>50% in 67.6% of patients, => 90% without medicines in 26.5%, =>90% with small doses of medicines in 14.7%, 75-89% in 14.7%, 50-74% in 11.8%, and 32.4% required further surgery. There was no correlation between pain relief greater than 50% and gender, age, side, interval between first symptom and first GKRS. Moderate but not severe dysesthesias developed in 3 patients, all of whom were relieved of tic pain. No patient developed anesthesia dolorosa, keratitis, motor trigeminal impairment or extra-trigeminal complications.

CONCLUSIONS: Repeat GKRS has a good chance of relieving TN pain without complications.

OBJECTIVES: Indications, dosimetry, and results of repeat GKRS for TN.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Spasticity

TITLE: A Study On The Effects Of Dentate Nucleus Stimulation

AUTHORS: Marudhachalam Mohan Sampathkumar, PhD; Santhana Krishnan Kanaka, PhD

INTRODUCTION: Stimulation of cerebellum or one of its nuclei, dentate nucleus(DN),will result in reduction of spasticity. An attempt was made to study the effects of DN stimulation by implanting electrodes stereotactically.

METHODS: 20 young patients with average intelligence having spasticity either hemiplegic or tetraplegic types with moderate spasticity (grade 1-11, on Golgi scale) were taken up for this study. 14 patients developed spasticity after hypoxic episode during postnatal period, 4 following encephalitis, and 2 after head trauma. There were 15 males and 5 females, 18 of them were between the age group of 10 to 30 years and two were below 45 years. Eight were associated with dystonia and athetosis. Assessment of spasticity was done by 1) clinical examination 2) surface EMG & 3) calculating H:M reflex ratio. The clinical grading was done using Oswestry scale. OPERATIVE PROCEDURES: Electrode implantation was done in sitting position after general anaesthesia through a small sub occipital craniectomy, using Leksell's stereotaxic frame. Coordinates for the DN were calculated after pneumoencephalogram. Four to Six electrodes were placed in the DN, in the medial and lateral part of the DN. Stimulation studies were started after third day, using Grass stimulator. The parameters used were of frequency of 50-100 pulses per second, with the duration of pulse adjusted to 30 to 50 msec, sometimes with biphasic pulse, with the voltage between 3 to 7 volts. The stimulation was given for 4 to 6 hours per day for 6 days in a week and was given for an average period of 30 to 40 days. The relaxation effects were noticed few minutes after the stimulation. The follow-up period was between 6 and 18 months.

RESULTS: Stimulation produced reduction of tone on the ipsilateral limbs on the side of the electrode implantation. Changes were also noticed in the involuntary movements like athetosis and dystonia when it is associated with spasticity.

CONCLUSIONS: Dentate nucleus stimulation is a safe and effective method for immediate reduction of tone and for starting active early rehabilitation, to make the limbs more useful for the activities of daily living.

OBJECTIVES: 1) Dentate Nucleus stimulation is safe and effective procedure in spasticity 2) Immediate reduction of tone enables early active rehabilitation 3) Makes the limb more effective for ADL

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American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Presurgical fMRI: usefulness as perceived by the clinicians

AUTHORS: Ann Tieleman, MD; Olivier Van Damme, MD; Karel Deblaere, MD; Jacques Caemaert, MD,PhD; Eric Achten, MD,PhD

INTRODUCTION: The aim was to evaluate the value of fMRI on therapy management in patients with focal brain lesions.

METHODS: The medical records of 31 consecutive patients, with focal brain lesion of different origin and referred for fMRI were reviewed. The main reason for referral was that the planned interventional procedure could result in severe functional deficit if adjacent eloquent cortex was removed or damaged during surgery. During the fMRI examination, a variety of motor and language tasks were used in the individual patient, depending upon the localization of the lesion. All data were processed using SPM 99. Proximity was considered important if functional activation was present not more than 1 gyrus away from the bordering lesion. Language dominance was important for lesions in the vicinity of the classical primary language related areas in any hemisphere. We retrospectively reviewed how often and in which way these fMRI results contributed to the planning of neurosurgical procedures.

RESULTS: Useful functional activation from motor and/or language tasks was present for all patients but one. After questioning the referring clinicians, the results of the fMRI studies yielded additional clinical information in 26 of the 31 patients. In 5, the fMRI results were considered redundant to clinical or structural MRI information, but language lateralisation was considered a bonus in 2 of these.

CONCLUSIONS: This study indicates that fMRI yields serious information to assess possible surgical risks. In only 3/31 patient, did elective fMRI no really contribute to the surgical decision making.

OBJECTIVES: functional magnetic resonance imaging - brain abnormalities - neoplasms - sensorimotor and language cortices.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Stealth NeuroNavigation for planning microelectrode trajectories during DBS surgery

AUTHORS: Chris Honey, MD, PhD, FRCS(C)

INTRODUCTION: The use of microelectrodes during stereotactic surgery has advantages and disadvantages. For the rare patient who suffers a hemorrhage during their use, the advantage of precise nuclear localization is far outweighed by their clinical deficits. Hemorrhage during microelectrode recording in the human brain is well recognized and variously attributed to user experience, intraventricular trajectory, the need for multiple passes and their inherently sharp tips. The author describes a method of neuronavigation that enables direct visualization of the proposed microelectrode trajectory and avoidance of sulcal and periventricular veins.

METHODS: Twenty Parkinsonian patients presenting for bilateral subthalamic nucleus (STN) deep brain stimulation (DBS) were prospectively followed in this study. Each had preoperative MRI localization of their STN. Images were transferred to the Stealth Neuronavigation (Medtronic) computer in the operating room. Sequences for visualizing the STN were merged with post-gadolinium T1 weighted images through the entire head and stereotactic frame. Framelink software was then used to plan individual microelectrode trajectories. Examples of pre-operative trajectory correction because of expected sulcal or periventricular vein penetration are presented. Patients had pre-operative and four month post-operative UPDRS motor measurements. Hemorrhagic complications were defined as new post-operative clinical deficits due to hemorrhage. The first half of the cohort had routine post-operative CT scans (but none showed any significant hemorrhage). Post-operative imaging was then used only if patients had any clinical deterioration.

RESULTS: No patient in this series had any hemorrhagic complications and all left hospital the following day. UPDRS (III) motor scores were improved 65% in the off state with stimulation. The nuances of this technique will be described.

CONCLUSIONS: This small cohort demonstrates the feasibility of utilizing Stealth Neuronavigation to plan microelectrode trajectories during DBS surgery. No patients suffered any hemorrhagic complications. Potential sulcal and ventricular vein penetration by the microelectrode were visualized pre-operatively and avoided. This method may help to reduce the hemorrhagic complications associated with microelectrode use.

OBJECTIVES: At the completion of this session, participants should: 1. know that microelectrodes can be beneficial and potentially dangerous in stereotactic surgery. 2. understand how the Stealth Neuronavigation computer is used 3. understand how hemorrhages from microelectrodes may be reduced

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: High-resolution MR Imaging of Patients with Primary Trigeminal Neuralgia: comparison to age-matched controls.

AUTHORS: Sam P Javedan, MD; Adrian Harvey, BA; Andrew G Shetter, MD; John P Karis, MD; Bruce L Dean, MD; Kris A Smith, MD

INTRODUCTION: To investigate the role of vascular compression in trigeminal neuralgia (TGN), we compared MRI evidence of neurovascular compression in TGN patients against age-matched controls.

METHODS: Two blinded neuroradiologists evaluated 1mm acquisition single-proton gradient (SPGR) axial images after gadolinium enhancement in 75 TGN patients and 72 age-matched controls. TGN patients with multiple sclerosis or previous intracranial surgery were excluded. The neurovascular relationship was graded 1-4 according to the method of Brisman as follows: 1 = no relationship, 2 = close (within 1mm), 3 = contact, 4 = contact and deformation. Contact was graded as venous or arterial.

RESULTS: TGN group contained 27 males and 48 females, aged 41-83 (mean = 65 median = 67). The control group contained 24 males and 48 females, aged 42-83 (mean = 64 median = 67). Inter-observer reliability in TGN patients between readers was good ($\kappa = .677$). High grade (> 2) contact was seen in 52/75 (69%) of symptomatic nerves and 115/219 (53%) of asymptomatic nerves. The mean grade was significantly higher in TGN sides than in control sides ($p=0.03$) and than in all sides in control patients ($p<0.001$). Among TGN patients, the symptomatic side was more likely to demonstrate any high grade vascular contact (OR = 2.09) and especially high grade arterial contact (OR = 2.8). Compared with control patients, symptomatic sides in TGN patients were more likely to demonstrate high grade contact (OR = 2.02) and high grade arterial contact (OR = 2.40).

CONCLUSIONS: High-resolution SPGR axial MRI with gadolinium demonstrated a significantly greater number of high-grade neurovascular contacts, especially arterial, in TGN patients when compared both to asymptomatic sides and to all sides in age-matched control patients. While MRI is of limited diagnostic utility in individual cases, these pooled data lend support to the role of neurovascular compression in trigeminal neuralgia.

OBJECTIVES: 1. Understand the role of high-resolution MR imaging in trigeminal neuralgia. 2. Understand the theory of the etiology of trigeminal neuralgia. 3. Understand the differences between TGN neuralgia patients and controls with regard to high-resolution MR imaging.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Comparison of MRI Position and Size of STN to Schaltenbrand and Wahren Brain Atlas

AUTHORS: Erich O. Richter, MD; Hoque Tasnuva, BSc; Saint-Cyr Jean, PhD; Lozano M Andres, MD, PhD

INTRODUCTION: There is poor concordance for the relative position of the subthalamic nucleus (STN) in standard brain atlases compared to the general population. We compared the size and position of the STN using MRI in a general Parkinson's disease population to the Schaltenbrand and Wahren brain atlas.

METHODS: The positions of both subthalamic nuclei relative to the anterior and posterior commissures were evaluated on 19 preoperative T2 MRIs (2mm slice thickness). The most anterior, posterior, medial and lateral extent of the STN was measured from axial scans. Dorsal and ventral measurements were taken from coronal images. Measurements were obtained by two independent observers, and averaged for each point. A senior investigator arbitrated interobserver differences of 2mm or greater and compared medial and lateral measurements between axial and coronal series.

RESULTS: Thirty-five STNs had borders in the following ranges (95% CI): anterior border \bar{n} 2.0 to 3.7 mm behind the MCP, posterior border 4.3 to 9.3 mm behind the MCP, medial border 8.6 to 12.1 mm from midline, lateral border 12.8 to 15.4 mm from midline, dorsal 0.5 to 3.8 mm below the intercommissural plane (ICP), and ventral 5.2 to 8.4 mm below the ICP. Three STNs were not clear enough to be reliably evaluated. These findings were similar for males and females.

CONCLUSIONS: The size and position of the STN are highly variable. It is frequently more posterior than expected from the 3 brains of the Schaltenbrand and Wahren atlas. This must be taken into account when performing STN procedures.

OBJECTIVES: 1) Describe the MRI variables that allow adequate visualization of the STN 2) Contrast the location of the STN in the Schaltenbrand and Wahren atlas with the typical location in Parkinson's disease patients 3) Describe the relationship between the imaged STN and that defined by histologic and intraoperative microelectrode recordings.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Bilateral Anterior Thalamic Nucleus Lesions are more protective than Stimulation against Pilocarpine induced Seizures and Status Epilepticus.

AUTHORS: Clement Hamani, MD,PhD; Flavio I.S. Ewerton, ; Saulo M. Bonilha, ; Gerson Ballester, MD,PhD; Luiz E.A.M. Mello, MD,PhD; Andres M. Lozano, MD,PhD,FRCS(C)

INTRODUCTION: The thalamus is thought to play an important role in secondary generalization of seizures. The aim of the present study was to investigate the influence of anterior nucleus thalamotomies and thalamic stimulation in the pilocarpine (Pilo) model of secondarily generalized seizures in experimental animals.

METHODS: Adult Wistar rats had thalamotomies (unilateral n=7; bilateral n=10) or stimulation electrodes implanted in the anterior thalamic nucleus (unilateral n=4; bilateral n=9). Seven days later, animals were given pilocarpine (320 mg/Kg i.p.) to induce seizures and status epilepticus (SE). Electrographic recordings from hippocampal and cortical electrodes were evaluated and ictal behavior was recorded.

RESULTS: Sixty seven percent of control animals (n=6 of 9) developed status epilepticus with pilocarpine, with a mean latency of 15.3 ± 8.8 minutes. Neither unilateral anterior nucleus lesions nor unilateral stimulation significantly reduced the propensity for developing status epilepticus after pilocarpine. Bilateral thalamic stimulation did not prevent status epilepticus (seen in 55% of the animals with bilateral stimulation), but this treatment was associated with a prolongation of latency to its development ($48 \text{ min} \pm 17.7 \text{ p}=0.02$). Strikingly, no animal with bilateral anterior nucleus thalamotomies developed seizures or status epilepticus after pilocarpine.

CONCLUSIONS: Bilateral anterior thalamic nucleus lesions are highly protective against pilocarpine induced seizures and status epilepticus. In the future, similar results may be achieved with stimulation.

OBJECTIVES: Investigate the influence of anterior thalamic nucleus lesions and stimulation in pilocarpine induced seizures and status epilepticus.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Peri Insular Hemispherotomy: Potential pitfalls and complication avoidance

AUTHORS: Roy T Daniel, MS; Jean-Guy Villemure, FRCS(C)

INTRODUCTION: Hemispherectomy for epilepsy has evolved from Anatomical hemispherectomy (Krynauw 1950) through Functional hemispherectomy (Rasmussen 1974) to Peri-insular hemispherotomy (Villemure 1995).

METHODS: Hemispherotomy entails minimal brain excision and maximal disconnection which results in a functionally complete isolation of the diseased hemisphere. We analyzed our experience with this technique in the last 10 years in order to define the changes made in the procedure with a view to avoid potential complications. In this series there were 48 patients with ages ranging from 1 to 44 years (mean 12.4 years).

RESULTS: There was one technique related mortality, which was due to brain swelling as a result of the creation of a continuous peri-insular window to the ventricle. Multiple openings are now used during this step thus preserving the arterial supply of the unresected neocortex. The line of resection of the amygdala has been elucidated so as to avoid inadvertent entry into the basal ganglia. The ideal location of corpus callosotomy and posterior hippocampotomy are also described. Resection of the insula was found to be cumbersome in some and has been replaced by claustrotomy / extreme capsulotomy. Special consideration needs to be given during hemispherotomy in hemimeganencephaly as the amount of brain tissue that needs to be disconnected is much larger and the working space within the ventricle is much smaller.

CONCLUSIONS: Hemispherotomy yields excellent seizure results but the operative procedure can be complicated at many stages which could lead to devastating post operative results. These refinements in the technique would make this surgery much safer.

OBJECTIVES: Surgery for hemispheric epilepsy has evolved a great deal from anatomical to disconnective hemispherectomy. The goal of the surgery is to achieve a functionally complete hemispherectomy with removal of minimal brain tissue. Preservation of vascular supply to the unresected cortex and attention to a few anatomical landmarks can avoid most potential complications with this technique.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Stimulation of the Subthalamic Nucleus is Not Associated with Increased Striatal Dopamine Release as Assessed by [11C]-Raclopride Displacement

AUTHORS: Aviva Abosch, MD,PhD; Shitij Kapur, MD,PhD; Anthony E. Lang, MD; Doug Hussey, BSc; Elspeth Sime, RN; Janis Miyasaki, MD; Sylvain Houle, MD,PhD; Andres M. Lozano, MD,PhD

INTRODUCTION: The subthalamic nucleus (STN) is a target in the surgical treatment of Parkinson's disease (PD). The mechanism by which electrical stimulation of the STN ameliorates the symptoms of PD remains unknown. One consistent aspect of STN stimulation is the ability to reduce the dosage of dopaminergic medications, sometimes eliminating them altogether. Further, the nigrostriatal projection axons are apposed to the dorsal surface of STN and are likely affected by the application of current in this region. We sought to determine whether STN stimulation could release endogenous dopamine in the striatum.

METHODS: Five patients with PD, who had previously undergone surgical implantation of bilateral STN stimulators, underwent [11C]-raclopride-PET scanning. Levodopa (LD) was withheld for 12 hours, and bilateral stimulators were turned off 9 hours prior to scanning. The right STN stimulator was turned on at 45 minutes after the initiation of each [11C]-raclopride infusion and scanning (corresponding to striatal binding equilibrium), and scanning continued for an additional 45 minutes. Motor UPDRS evaluations of patients were performed prior to and following each scan.

RESULTS: Comparison between the right and left striatum, pre- and post-initiation of right-STN stimulation demonstrated no significant difference in [11C]-raclopride binding, despite significant improvements on the motor score of the Unified Parkinson's Disease Rating Scale (mUPDRS) from unilateral stimulation (mean % improvement = 26.1 ± 16.4 ; $p = 0.05$). This finding was unchanged when the striatum was partitioned into dorsal and ventral caudate and putamen and each of these four regions analyzed separately.

CONCLUSIONS: Our results suggest that STN stimulation does not mediate its anti-parkinsonian effects via the release of endogenous dopamine, as assessed by [11C]-raclopride displacement.

OBJECTIVES: Learning objectives N/A

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Role of Subthalamic lesion for Parkinson's disease.

AUTHORS: Jorge Guridi, MD; Miguel Manrique, MD; Mari Cruz Rodriguez-Oroz, MD; Jose Angel Obeso, MD

INTRODUCTION: Subthalamic nucleus (STN) is the current target for Parkinson's disease (PD) according with experimental monkey studies. High frequency stimulation (HFS) is the elective surgery but there are some patients in whom ablative procedures may be chosen. In this work we report our experience in unilateral subthalamotomy in four patients and bilateral in one case with PD.

METHODS: Five patients with medical complications were selected for subthalamic lesion. Three of them were mainly tremoric-bradykinetic patients (Hoehn-Yahr I) and the other two cases axial patients (Hoehn-Yahr IV-V). The assessment of parkinsonian signs were evaluated by UPDRS III and II. Motor complications and dyskinesias were also evaluated. We performed fusion image (Radionics) and the target was chosen according intercommissural line and T2 MRI. Microrecording and microstimulation defined the sensorimotor region of the STN during the surgery. A thermolytic lesion was placed accordingly. In all the cases a Magnetic Resonance Image were performed 24 hours and 3 months after surgery.

RESULTS: There was a significant reduction in UPDRS part II and III (motor assessment) in the "off" condition at 3, 6 and 12 months after surgery. Tremor, rigidity and bradykinesia contralateral to the surgery were alleviated or disappeared in all the patients. After surgery all the cases had levodopa reduction. Lesion induced dyskinesia in three patient during lesioning but disappeared after surgery in 24 hours in two of them. Only one case had a postoperative mild chorea that persisted during three months. One patient had an intracerebral abscess one month after subthalamotomy that was stereotactically evacuated

CONCLUSIONS: Subthalamotomy in advanced PD may ameliorate the cardinal signs of PD. There are a considerable reduction in levodopa therapy. Subthalamotomy may be a surgical option in some specific patients with PD. The hemichorea-ballism is mild during postoperative follow-up.

OBJECTIVES: Subthalamic lesion performed with microrecording is an good and safe option to some specific patients not available for deep brain stimulation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Deep Brain Stimulation for advanced Parkinson's Disease: First 100 cases, Indications, Technique, Results, and Morbidity

AUTHORS: Gordon H Baltuch, MD,PhD; Jurg Jaggi, PhD; Andrew Siderowf, MD; Amy Colcher, MD; Howard Hurtig, MD; Matthew Stern, MD

INTRODUCTION: Subthalamic Deep Brain Stimulation has recently been FDA approved to treat the motor symptoms of advanced PD. This study retrospectively reviewed the first 100 cases of STN DBS performed in our institution

METHODS: 100 patients with advanced PD underwent STN DBS between Jan 1999 and Sept 2002. All procedures were performed with MRI targeting combined with intraoperative microelectrode recordings. Post-op MRI was performed in all cases to R/O hemorrhage and assess lead location. All patients underwent formal pre and post-op testing by a movement disorder neurologist.

RESULTS: UPDRS 3 improvement of 52% was seen at 12 months with an average 60% reduction in medication. Young age and good levo-dopa responsiveness positively predicted good outcome. Serious adverse effects were seen in 10% of patients, major permanent morbidity in 4%, and mortality in 2%. Morbidity was significantly higher in older patients (>65yrs).

CONCLUSIONS: This study demonstrates that STN DBS is an effective therapy for the motor symptoms of advanced PD. Young patients with excellent levo-dopa responsiveness have the most robust response to surgery with acceptable morbidity.

OBJECTIVES: 1) understand indications for STN DBS for advanced PD 2) understand the surgical technique of STN DBS 3) Understand morbidity of STN DBS procedure

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: A prospective randomised trial protocol for deep brain stimulation in dystonia: techniques and preliminary results

AUTHORS: Christopher J Koebbe, MD; Douglas Kondziolka, MD; A. Leland Albright, MD; Sue Ferson, ARNP

INTRODUCTION: Generalized dystonia and hemi-dystonia are progressive and debilitating clinical syndromes often refractory to medical management. Historically, ablative lesions to the thalamus or globus pallidum offered temporary relief with significant morbidity. Recently, case reports suggest deep brain stimulation is a successful neurosurgical option. We have begun a prospective randomized protocol to determine the efficacy and safety of pallidal deep brain stimulation in dystonia

METHODS: Our protocol evaluates treatment to patients with generalized dystonia or hemi-dystonia who have failed all conservative measures and are profoundly disabled by their condition. Each patient undergoes bilateral placement of deep brain stimulating electrodes into the globus pallidus interna (GPI) under general anesthesia using MRI guided, frame-assisted stereotactic placement of the leads by the stereotactic neurosurgeon. This is followed by subcutaneous lead and battery placement and connection by the pediatric neurosurgeon. Each patient is then randomized to either the on or off state for three months followed by three months in the opposite state. A neurosurgeon responsible for setting stimulation parameters and making subsequent adjustments is not blinded to the patient's clinical response over this six-month period to maximize optimal battery and lead function. Each patient is then monitored for an additional six-month period in the stimulator state which provided the best clinical response over the previous six months.

RESULTS: The first two patients (ages 12 and 20) enrolled underwent uncomplicated stimulator placement within the last six months. Both patients showed significant clinical improvement during one of the first three-month blocks compared to the other but suffered hardware complications prompting stimulator removal on one side in one patient and lead failure in the other. The clinical improvement has subsequently declined contralateral to the side of stimulator removal in both patients however they retained improvement on the other side.

CONCLUSIONS: We have begun a randomized controlled trial to evaluate the safety and efficacy of pallidal deep brain stimulation in dystonia and report our initial results.

OBJECTIVES: 1) Understand the historical evolution of neurosurgical treatment of dystonia 2) Explain the postulated model of basal ganglia dysfunction responsible for dystonia 3) Evaluate a prospective randomized trial protocol of pallidal deep brain stimulation for dystonia

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Bilateral Nucleus Ventralis Intermedius stimulation for severe tremor in a patient with Bassen-Kornzweig syndrome

AUTHORS: Olivier Van Damme, MD; Philip Bourgeois, MD; Marc Deruytter, MD

INTRODUCTION: Deep brain stimulation is becoming an accepted therapeutical alternative in the treatment of movement disorders, especially in parkinsons disease and essential tremor. Nucleus Ventralis Intermedius (VIM) stimulation has proven to succesfully suppress tremor in parkinsons disease, essential tremor and multiple sclerosis associated tremor. We report our experience with bilateral vim stimulation for severe tremor in a patient with a Bassen-Kornzweig syndrome (also known as abetalipoproteinemia)

METHODS: A 32-year-old man, with a history of abetalipoproteinemia and disabling action tremor of the head and especially of both arms (Tolosa-Fahn score : 95) was referred to our department for bilateral stereotactic VIM stimulation. Abetalipoproteinemia is a rare autosomal recessive disease, characterized by pigmentary retinopathy, periferal neuropathy and progressive spinocerebellar degeneration, resulting from a deficiency of apoprotein B and chylomicron formation, with subsequent malapsorption of fatsoluble vitamins E, A and K. Bilateral implantation of electrodes in the Nucleus Ventralis Intermedius was performed in a single operation using a CRW frame with iodoventriculographic and MRI guided target localisation. Peroperative stimulation resulted in a significant tremorarrest without stimulation related side effects. Because the tremor was more pronounced on the left, the right Vim required a higher amplitudo

RESULTS: After a followup period of 1 year bilateral VIM stimulation resulted in a 79 % tremor reduction according to the Tolosa Fahn rating scale (preoperative : 95, postoperative 20) . Stimulation parameters were set at 3,2 V, 130 Hz, 90 µsec for left stimulator and 3,5 V, 130 Hz and 240 µsec for the right. Stimulation was continuous and bipolar on both sides. The tremor reduction enabled the patient to perform daily functions more independently. The progression of motor impairment caused by the neurodegenerative processes involved in Bassen Kornzweig syndrome could of course not be inhibited.

CONCLUSIONS: This case demonstrates that Nucleus Ventralis Intermedius stimulation can significantly reduce severe bilateral action tremor in patients with Bassen-Kornzweig disease This is to our knowledge the first report of a Bassen Kornzweig associated tremor treated with deep brain stimulation.

OBJECTIVES: Value of deep brain stimulation in less common neurological disorders Treatment of tremor with VIM stimulation Tremor control in patients with Bassen-Kornzweig disease is possible with VIM stimulation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Motor Improvement's Effect on Quality-of-Life Following Subthalamic Stimulation is Mediated by Changes in Depressive Symptomatology

AUTHORS: Alexander I Tröster, PhD; Julie A Fields, BA; Steven Wilkinson, MD; Rajesh Pahwa, MD; William Koller, MD, PhD; Kelly Lyons, PhD

INTRODUCTION: Subthalamic (STN) deep brain stimulation (DBS) alleviates motor symptoms of Parkinson's disease (PD). STN DBS has been associated with both acute depression and improvements in depressive symptomatology. However, whether STN DBS-associated motor improvement impacts quality-of-life directly or via alterations in mood state and/or affect is unknown.

METHODS: Twenty six PD patients free of dementia and major depression, consecutively receiving bilateral STN DBS, underwent pre- and about 3 month post-operative neuropsychological evaluation, including, among others, measures of depressive symptoms (Beck Depression Inventory) and quality of life (Parkinson's Disease Questionnaire). T-tests and correlational techniques were used to analyze data.

RESULTS: Motor symptoms (UPDRS motor score) improved significantly from pre-operative baseline scores with STN stimulation in both the medication "on" and "off" conditions, even though average levodopa equivalent medication dosage was almost halved post-surgery. Depressive symptoms and QOL also improved significantly. Change in motor symptom severity and change in depressive symptom severity were both significantly associated with change in QOL. Specifically, those patients with greater motor and depressive symptom improvements also reported greater improvements in QOL. Partial correlational techniques revealed that change in depressive symptoms remained significantly associated with change in QOL once change in motor symptoms was controlled for. The converse was not true. That is, once depressive symptom change was controlled for, the association between change in motor symptoms and change in QOL was no longer significant.

CONCLUSIONS: STN DBS is associated with improvements in motor symptoms, depressive symptoms, and quality-of-life. The impact of improved motor function on quality-of-life, however, appears to be mediated by this motor improvement's effect on depression. Thus, much of STN's motoric benefit on quality-of-life may be indirect.

OBJECTIVES: 1. Describe STN DBS effects on depressive symptoms and quality of life
2. Discern whether motoric improvements after STN DBS impact quality of life directly or indirectly
3. Identify two measures of depression and quality of life appropriate for use in Parkinson's disease

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Deep Brain Stimulation in High-field Intraoperative Magnetic Resonance Imaging Environment

AUTHORS: Michael WY Lee, FRCS,MBBS; Antonio AF DeSalles, MD,PhD,Prof; Leonardo Frighetto, MD; Rodrigo C Torres, MD; Eric Behnke, BS

INTRODUCTION: To evaluate the feasibility of functional neurosurgical procedures, the reliability of electrophysiological studies, and the accuracy of deep brain stimulation (DBS) in the high-field intraoperative magnetic resonance imaging (iMRI) environment.

METHODS: Thirty-five DBS surgeries were performed in the 1.5 Tesla(T) iMRI operating room from December 2001 to June 2002. DBS were implanted in 26 patients, 18 males and 8 females with their ages ranging from 12.3 to 87.9 (mean 57.6) years old. They were targeted at subthalamic, thalamic and pallidal nuclei in 27, 6 and 2 cases respectively. Electrophysiological studies including macrostimulation and microelectrode recordings for localization were obtained in the 0.5 to 10mT fringes of the magnetic field in 29 surgeries. iMRI confirmation of the electrode position during the procedure was performed after electrophysiological localization.

RESULTS: The magnetic field associated with the iMRI scanner did not contribute significant noise to microelectrode recordings. Anatomical localization of electrode position was confirmed by the DBS electrode artifacts demonstrated by the iMRI. No symptomatic hemorrhage was detected during the operation. Image quality of the 1.5T iMRI scan was much superior to our former low-field 0.2T iMRI scan. Image fusion with preoperative scans permitted unparalleled visualization of the DBS electrode in relation to the preoperative planning track. The mean of Euclidean displacement between the planning target and final electrode position was 2.34(SD 1.14) mm.

CONCLUSIONS: This study shows that conventional stereotactic localization, microelectrode recordings, electrical stimulation, and implant of DBS hardware are possible in the 1.5T iMRI environment. The convenience of having an imaging modality that can visualize the brain during the operation is ideal for stereotactic procedures.

OBJECTIVES: To understand the feasibility of performing deep brain stimulation surgeries in high-field MRI environment and appreciate the usefulness of intraoperative MRI in confirmation of electrode position and identifying complications, if any, for prompt surgical intervention.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Analysis of Tumor Control and Toxicity in Patients Who have Survived at Least One Year after Radiosurgery for Brain Metastases

AUTHORS: John M Varlotto, MD; John C. Flickinger, MD; Ajay K. Bhatnagar, BA; Douglas Kondziolka, MD; Dade Lunsford, MD

INTRODUCTION: To better evaluate tumor control and toxicity from radiosurgery for brain metastases, we analyzed these outcomes in patients who had survived at least one year from radiosurgery.

METHODS: We evaluated the results of Gamma Knife® Radiosurgery (SRS) for 208 brain metastases in 135 patients who were followed for a median time of 18 months after radiosurgery. Median patient age was 53 years. Ninety-two patients had solitary metastases and 43 had multiple tumors. Sixty-nine patients had initial SRS with whole brain radiotherapy (WBXRT), 39 had initial SRS alone, and 27 failed prior to WBXRT. Median treatment volume was 1.9cc (range:0.05-21.2). Median marginal tumor dose was 16Gy (range 12-25).

RESULTS: At one and five years: local tumor control was 89.6% (+/- 2.1%) and 62.8% (+/- 6.9%), distal intracranial relapse occurred in 23 (+/-3.6%) and 67.1 (+/- 8.7%), and post-radiosurgical sequelae developed in 2.8 (+/-1.2%) and 11.4 (+/-3.5%) respectively. Multivariate analysis found that local control decreased with tumor volume ($p=0.0002$), SRS without WBXRT ($p=0.008$), and extensive edema ($p=0.024$); distal intracranial recurrence correlated inversely with patient age ($p=0.0018$); and post-radiosurgery sequelae with increasing tumor volume ($p=0.0085$). There was a non-significant trend ($p=0.0827$) in favor of higher distal control rates in the brain when whole brain radiotherapy was administered with SRS as part of initial treatment strategy.

CONCLUSIONS: This retrospective series demonstrates the long-term control and complication rates of brain metastases in patients who survived for at least one year after radiosurgical treatment are similar to previously reported actuarial estimates. Large metastases (> 2cc) were associated with lower local control rates and a higher incidence of complications. Extensive edema is associated with lower rates of local control. Only small lesions without extensive edema should be considered for SRS without concomitant whole brain radiotherapy.

OBJECTIVES: 1. Recognize that larger metastases (>2cc) are associated with lower rates of local control and higher rates of complications from Gamma Knife Radiosurgery 2. Extensive edema is a newly recognized factor associated with worse long-term local control of brain metastases. 3. Whole brain radiotherapy given as part of a planned treatment strategy with Gamma Knife Radiosurgery for brain metastases was associated with higher rates of local control, but did not significantly affect the distal intracranial control

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Use of a frameless stereotactic robot for movement disorder surgery

AUTHORS: Thelekat R K Varma, FRCS; Paul E Eldridge, FRCS; Alan Forster, MD; Susan Fox, MD; Nick Fletcher, MD; Malcolm Steiger, MD; Patricia Littlechild, FRCS; Patricia Byrne, RN; Ann Sinnott, RN

INTRODUCTION: The NeuroMate Stereotactic Robot (Integrated Surgical Systems, Lyon, France) has been widely used for movement disorder surgery using conventional stereotactic frame localisers. It can however also be used in a frameless mode with a novel and unique skull fixed fiducial along with an ultrasound registration process.

METHODS: The novel frameless ultrasound registration method was used in 40 patients undergoing movement disorder surgery (25 bilateral STN-DBS for Parkinson's Disease, 4 Gpi DBS for dystonia, 9 thalamic DBS for essential tremor and 2 thalamotomies for MS tremor). With the localiser in place MR imaging was performed under general anaesthesia and trajectories planned 24 hours before surgery. The Vim target was identified indirectly from a T1 volume dataset while the STN and Gpi were directly targeted from reformatted images based on contiguous axial T2 slices. After robotic targeting final verification of the target was determined using microelectrode recording and macrostimulation.

RESULTS: Satisfactory abolition of tremor was obtained with the thalamic procedures with significant improvement in ETRS. One thalamic procedure was abandoned due to haemorrhage. Following bilateral STN-DBS there was a 52.6% improvement in UPDRS motor Off scores. Mean daily Ldopa equivalent dosage was reduced from 1424 +/- 194 to 872 +/- 146 mg. 10 out of 11 patients have discontinued continuous apomorphine.

CONCLUSIONS: The NeuroMate Robot can be used effectively in the frameless mode for movement disorder surgery and the results of STN-DBS are in keeping with frame based systems. The facility to undertake imaging prior to the day of the surgical procedure has major advantages in allowing for detailed MR imaging and convenient planning.

OBJECTIVES: Understand the use of a stereotactic robot for movement disorder surgery. Use of a frameless registration technique. Outcome for STN-DBS

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Stereotactic Accuracy of a 3 Tesla Magnetic Resonance Imaging Unit

AUTHORS: Hooman Azmi, MD; Michael Schulder, MD

INTRODUCTION: The standard diagnostic magnetic resonance imager (MRI) has a magnetic field strength of 1.5 Tesla (T). Recently MRIs with 3 T magnets have been approved for clinical use. The spatial accuracy of these higher resolution scanners has yet to be proved.

METHODS: A CT and MRI compatible skull phantom with various targetable objects inside was imaged in a General Electric (GE) CT scanner and in 1.5 T (GE) and 3 T (Siemens Corp.) MRI scanners. Fiducial markers were placed on the skull surface. The phantom was filled with water for the MRI scans. MR data was acquired using T1 weighted images at 1.5 mm and 3 mm slice thicknesses. The model was fixed to an operating room table and registered to the images using an infrared-based surgical navigation system (StealthStation, Surgical Navigation Technologies, Broomfield CO). On each scan for each of 13 points the distance between the predicted position of the navigation probe tip and the actual target on the image was measured. Errors were noted in X, Y, and Z axes. We also compared the accuracies for points at the center and periphery of the images. Statistical analysis was done using Student's paired and non-paired t-tests.

RESULTS: There was no significant difference in registration accuracy with CT, 1.5 T MRI, or 3 T MRI scans. Mean errors were for CT 0.9 mm, 1.5 T MRI (1 mm slices) 1.0 mm, 1.5 T MRI (3 mm) 0.6 mm, 3 T MRI (1 mm) 0.6 mm, and 3 T MRI (3 mm) 0.7 mm. Standard deviations were < 1 mm for all scans. Errors did not vary in different planes nor at the periphery of the images.

CONCLUSIONS: 3 T MRI scans are inherently accurate as stereotactic datasets. They may be used for stereotactic targeting for SRS and other techniques.

OBJECTIVES: Understand the difference between 3 Tesla and lower strength MRIs; appreciate the need for spatial accuracy of stereotactic imaging; understand the accuracy of 3 T MRI.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Preservation of Olfaction in Olfactory Groove Meningiomas with Stereotactic Radiosurgery

AUTHORS: Hooman Azmi, MD; Michael Schulder, MD

INTRODUCTION: Surgery for olfactory groove meningioma (OGM) has a low general morbidity, especially for patients with small tumors. However, anosmia, as a result of surgery is inevitable. The loss of olfaction can significantly affect patient quality of life, resulting in malnutrition, safety risks, and even depression. Although the limits of SRS are known for certain cranial nerves (CNs), they are not known for the first CN. This is the first report to elaborate on the safety of SRS in relation to the olfactory nerves and tracts.

METHODS: Three women, a 46 year old, a 62 year old and a 52 year old presented with incidentally discovered olfactory groove meningiomas. They were all asymptomatic from these tumors and had intact olfaction; all tumors were less than 25 mm in diameter. Two patients received single session SRS, one with 2000 cGy to the 85th percentile line, and the other 1500 cGy to the 85th percentile line. The third patient, a hospital employee who did not wish to be seen by her colleagues with a stereotactic frame, chose hypofractionated SRS. She received 2600 cGy in five daily fractions.

RESULTS: All three patients have had tumor control with no complications and remain symptom free with intact olfaction.

CONCLUSIONS: SRS provides an excellent treatment alternative for a select group of patients with olfactory groove meningiomas who wish to maintain their sense of smell. The tolerance of the olfactory nerves to SRS is unknown, but this report indicates it may be higher than the tolerance of the optic nerves and chiasm. SRS may be an ideal treatment for patients with incidentally discovered OGMs who desire intervention for tumor control but want to avoid anosmia.

OBJECTIVES: Appreciate the importance of olfaction; compare the merits of surgery and radiosurgery for patients with olfactory groove meningiomas; understand the technique of radiosurgery for treating these patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Thalamic Stimulation in Patients with Multiple Sclerosis: Long Term Followup

AUTHORS: Michael Schulder, MD; Reza Karimi, BA

INTRODUCTION: We assessed the long-term effect of deep brain stimulation (DBS) in patients with multiple sclerosis (MS).

METHODS: Nine patients with MS-induced tremor underwent placement of a DBS electrode in the thalamus. Intraoperative macrostimulation was done under local anesthesia before permanent implantation. Preoperative and postoperative evaluation included MRI, the Extended Disability Status Scale (EDSS), the Bain-Finchley tremor scale, neuropsychological testing, and patient assessment of the benefit from surgery.

RESULTS: There were no surgical complications. Followup ranged from 9 months to 48 months (mean 32 months). EDSS scores averaged 7.2 before surgery, 6.8 at 6 months after surgery, and 7.8 at late followup. Tremor scores averaged 5.4 before surgery, 1.7 at 6 months after surgery, and 2.1 at late followup. Four patients who had significant tremor reduction at 6 months had severe MS progression afterwards, and one was lost to late followup. Another patient, in whom excellent tremor control was obtained, developed increasing stimulation-induced fatigue, and the implant was removed at his request. The 3 other patients have maintained worthwhile benefit from DBS. MRI scans did not show any new MS plaques in relation to the electrode, although imaging was consistent with disease progression in all patients. Neuropsychological testing showed a mild to moderate decline in cognitive function consistent with disease progression.

CONCLUSIONS: Chronic thalamic stimulation decreases tremor in patients with MS. However, this improvement does not correlate with improvement in objective measures of function. Any actual benefit may be limited in most patients by the progression of underlying disease.

OBJECTIVES: Understand the indications for DBS in patients with multiple sclerosis; appreciate the often progressive nature of MS; understand the likely long term benefits of DBS for MS patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Evaluation of CyberKnife Frameless Real-Time Image-Guided Stereotactic Radiosurgery for Spinal Lesions: A Series of 70 Patients

AUTHORS: Peter C Gerszten, MD; Steven A Burton, MD; Cihat Ozhasoglu, PhD; William J Vogel, ; Barbara A Atkins, RN; William C Welch, MD,FACS; Shalom Kalnicki, MD

INTRODUCTION: The role of stereotactic radiosurgery for the treatment of intracranial lesions is well established. Its use for the treatment of spinal lesions has been limited by the availability of effective target immobilization devices. This study evaluated the CyberKnife Real-Time Image-Guided Radiosurgery System (Accuray, Inc., Sunnyvale, CA) for the treatment of spinal lesions with a single fraction radiosurgical technique using real-time image guidance.

METHODS: This frameless image-guided radiosurgery system utilizes the coupling of an orthogonal pair of x-ray cameras to a dynamically manipulated robot-mounted linear accelerator that guides the therapy beam to the intended target without the use of frame-based fixation. Cervical spine lesions were located and tracked relative to skull bony landmarks; lower spinal lesions were tracked relative to fiducial markers. Ninety spinal lesions in 70 patients were treated with single fraction radiosurgery (31 cervical, 31 thoracic, and 20 lumbar, and 8 sacral). There were 14 benign tumors and 76 metastatic lesions. Fifty lesions had received prior external beam irradiation with maximum spinal cord doses.

RESULTS: Tumor volume ranged from 0.3 to 168 cc (mean 29.7 cc). Dose plans were calculated based upon CT images acquired using 1.25 mm slices. Tumor dose was maintained at 12-18 Gy to the 80% isodose line; spinal cord volume receiving greater than 8 Gy ranged from 0.0 to 1.3 cc (mean 0.2 cc). All patients tolerated the procedure in an outpatient setting. Testing demonstrated alignment of the treatment dose with the target volume within 1 mm. No acute radiation toxicity or new neurological deficits occurred during the follow-up period. Axial and radicular pain improved in all patients who were symptomatic prior to treatment.

CONCLUSIONS: CyberKnife spinal radiosurgery was found to be feasible, safe, and effective. The major potential benefits of radiosurgical ablation of spinal lesions are short treatment time in an outpatient setting with rapid recovery and symptomatic response. This technique offers an alternative therapeutic modality for the treatment of spinal lesions not amenable to open surgical techniques, in medically inoperable patients, lesions located in previously irradiated sites, or as an adjunct to surgery.

OBJECTIVES: 1. Understand the technique and concept of real-time image-guided spinal radiosurgery. 2. Understand the feasibility and indications for spinal radiosurgery. 3. Understand the limitations of spinal radiosurgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Bilateral Anterior Capsulotomy for Refractory Obsessive-Compulsive Disorders

AUTHORS: Alberto MD Aparicio, MD; Bartolomè Oliver, MD,PhD; J. Gascon, MD; marcel Garcia Bach, MD; J.L. Maestro de Leon, MD; Emilio Ayats, MD; Rodrigo Rodriguez, MD; P.A. Soler, MD

INTRODUCTION: Obsessive-compulsive disorder (OCD) refractory to behavioral and pharmacological therapy and suffering severe incapacitating disease are detected 1 in every 400 cases

METHODS: Since the opening of our Psychosurgery Program in 1998, 15 patients have accepted for surgical treatment after complementation of the presurgical requirements. Medium duration of the OCD was 18.1 years (range 11-26). 18 Bilateral anterior capsulotomies have been performed in these 15 patients. Reoperations in 3 (13%). Methodology was TC and RM stereotactic operation with Leksell frame, recently planning with Target stereotactic planning program. Radiofrequency lesions with Radionics RF3.

RESULTS: Results have been evaluated with Yale-Brown scale. Obsessive and compulsive aspects have shown a parallel evolution. 52% of the cases show a 33% recovery on the Y-B scale. 29.4% of the cases show a 50% recovery on the Y-B scale. 17% of the patients show a 66% recovery on the Y-B scale. Results remain unchanged through the follow-up period (4 to 26 months). One patient shows no benefit from the operation. Pre and postoperative neuropsychological testing disclosed no cognitive deficit. Depressive tendency recovered 50%. Complications were observed in 3 cases, transitory hallucinations, postoperative single epileptic seizure, and postoperative bifrontal swelling with permanent behavior impairment.

CONCLUSIONS: We conclude that bilateral anterior capsulotomy is a safe and effective procedure to ameliorate these severe OCD patients but for social reintegration the surgical alternative has to be considered earlier.

OBJECTIVES: Know the rationale and technique of bilateral anterior capsulotomy know the results of anterior capsulotomy in OCD future directions to improve results

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: STN DBS for Parkinson's disease: are we where we think we are?

AUTHORS: CLAUDIO POLLO, MD; RETO MEULI, MD,PhD; FRANCOIS VINGERHOETS, MD; JOSEPH GHIKA, MD; PHILIPPE MAEDER, MD; JEAN-GUY VILLEMURE, FRCS(C)

INTRODUCTION: The correlation between the position of the preoperative target and the actual position of the electrode should provide an anatomic contribution to improve our understanding on STN DBS for Parkinson's disease and is also a quality assessment of the targeting and surgical procedure.

METHODS: 28 parkinsonian patients selected for bilateral STN DBS were included. The whole procedure was performed stereotactically with MRI. The electrode (ACTIVA 3389) was implanted according to the preoperative target, intraoperative microrecording and macrostimulation. An inversion recovery T2 weighted (IR T2) coronal sequence acquired orthogonal to the AC-PC plane and crossing the anterior pole of the red nucleus was selected to place the target in the inferolateral portion of the subthalamic zone, limited superiorly by the thalamus, laterally by the internal capsule, inferiorly by the substantia nigra and medially by the midline. The localisation of the implanted electrodes was performed on a 3D T1-weighted gradient echo sequence and based on the in vitro study of the distortion artifact induced by the electrode.

RESULTS: The coordinates of 56 targets and distal contacts (C0) were obtained, related to the MCP. According to the Schaltenbrand and Wahren atlas, the mean target projects in the inferior and lateral portion of the STN. The mean distance between the preoperative target and C0 was AP =1.19mm (69% posterior to the target), LAT=1.09mm (79% medial to the target) and VERT=1.43mm (59% inferior to the target).

CONCLUSIONS: Identification of the inferolateral portion of the subthalamic zone provides a precise way to target the STN on MRI. Based on the knowledge of the relation between the artifact and C0, 3D T1-weighted MRI provides a precise way to control the position of the electrode contacts. As expected, C0 is more medial and posterior to the target in most cases. The lack of correlation along the VERT axis will be discussed.

OBJECTIVES: Perform a precise targeting of the STN according to visible anatomical landmarks on MRI. Perform a precise control of the implanted electrodes on a 3D T1-weighted MRI based on the knowledge of the relation between the distal MR artifact and the position of C0. Have a better understanding of the correlations found between the preoperative targets and the position of C0 and consequently the mechanisms underlying STN DBS according to the position of the electrodes.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Brain Metastases Radiosurgery: An Expanding Role in Cancer Management

AUTHORS: Ajay Niranjani, MBBS; L. Dade Lunsford, MD; Douglas Kondziolka, MD; John M Varlotto, MD; John C Flickinger, MD

INTRODUCTION: Metastatic tumors are the most common malignant tumors affecting the brain. Approximately 250,000 new cases are diagnosed every year in US. Traditionally neurosurgeons' role was limited to the craniotomy for occasional large tumors. Brain metastases are now emerging as one of the main indications of radiosurgery worldwide. We retrospectively analyzed the results and trends in brain metastases radiosurgery.

METHODS: During a 14-year interval a total of 1088 patients with solitary or multiple brain metastases were treated by gamma knife radiosurgery at the university of Pittsburgh. The median age of patients was 62 years (range, 35-85). Non-small cell lung cancer was the most common histology (one third). A median dose of 16 Gy (range, 11-22.5) was delivered to the tumor margin. Long-term survivors (median of 18 months) were evaluated for tumor control and long-term sequelae after radiosurgery.

RESULTS: Between 1987 and 2002, the annual percentage of patients with metastatic brain tumors selected for radiosurgery increased from < 5% to > 30%. Tumor histology and systemic disease control significantly impacted the survival after radiosurgery. For NSCLC, (N=273) overall median survival was 15 months and the effective local control was afforded in 84% of patients. Among the long-term survivors (N=135) local tumor control rate at five years was 63%. Post-radiosurgical sequelae developed in 11% of patients by five years, and correlated (multivariate analysis) with increasing tumor volume ($p < 0.01$).

CONCLUSIONS: Radiosurgery has greatly expanded the role of neurosurgeons in the management of metastatic brain cancers. It can account for up to one-third of an annual experience at busy radiosurgery centers. For small and medium sized tumors, radiosurgery offers a survival advantage and reduced long-term complications compared to fractionated radiation and craniotomy.

OBJECTIVES: To understand the scope of brain metastases radiosurgery. To review the results of brain metastases radiosurgery. To evaluate the expanding role of neurosurgeons in the management of brain metastases.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Outcome Analysis in fMRI-integrated Neuronavigation for Surgery in the Central Region

AUTHORS: Rene Krishna, MD; Hilal Yahya, MD; Andrea Szeleny, MD; Sabine Wagner, MD; Andreas Raabe, PhD; Volker Seifert, Prof

INTRODUCTION: Functional MRI is a widely available tool for preoperative evaluation of cortical activity. The integration of fMRI data into neuronavigation is a new concept for surgery in the central region. In this study the benefit of functional neuronavigation in terms of complete tumor resection and patient outcome was investigated.

METHODS: fMRI-integrated functional neuronavigation was used for surgery around the motor strip in 56 patients. During standardized paradigms for hand, foot and tongue movements EPI T2* BOLD sequences were acquired and processed with the BrainVoyager software. Neuronavigation was performed with the VectorVision2 system (BrainLAB, Heimstetten, Germany). For outcome analysis patient age, histology, size of lesion, distance to the fMRI areas, pre- and postoperative Karnofsky index, paresis and type of resection were analyzed.

RESULTS: In 47 patients a gross total resection (>95%), for 9 lesions (low grade glioma = 3, glioblastoma = 6) a subtotal resection (80-95%) was achieved. The neurological outcome improved in 16 patients (30%), was unchanged in 29 patients (53%) and deteriorated in 9 patients (17%). Significant predictors of a new neurological deficit were a lesion to activation distance < 5mm (p<0,01) and incomplete resection (p<0,05).

CONCLUSIONS: fMRI-integrated neuronavigation is a useful concept to improve resection grade and neurological outcome. Our data suggest that a lesion to activation distance < 5mm is associated with a higher risk for neurological deterioration. Within a 10 mm range cortical stimulation should be performed. For a lesion to activation distance > 10 mm a complete resection can be achieved safely. The visualization of fibre tracks is desirable to complete the representation of the motor system.

OBJECTIVES: discuss the limitations of f-MRI, understand the usefulness of the concept, discuss the integration of functional data in neuronavigation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Bilateral Nucleus Ventralis Intermedius stimulation for severe essential tremor in a patient with an internal cardiac pacemaker

AUTHORS: Olivier Van Damme, MD; Philip Bourgeois, MD; Marc Deruytter, MD

INTRODUCTION: Knowledge and experiences about the interaction between cardiac and neurostimulation devices, when both implanted in the same patient, is limited. We present our experience in 1 patient treated with bilateral Nucleus Ventralis Intermedius (VIM) stimulation for refractory essential tremor and a cardiac pacemaker for arrhythmia.

METHODS: A 51-year-old man with a history of familial essential tremor was referred to our department for bilateral VIM neurostimulation as a treatment for a severe bilateral tremor (Tolosa-Fahn score : 66). The patient had a history of anterior wall myocardial infarction and cardiac arrhythmias with 2 episodes of asystole, which necessitated the implantation of a dual chamber (DDD) pacemaker 1 year before his neurosurgical intervention. The stereotactic procedure was performed with a CRW frame, using computed tomography and iodoventriculography to localise both VIM nuclei, since the presence of the cardiac pacemaker prohibited a MRI scan. Perioperative macrostimulation resulted in a tremor arrest on both sides and after a trial stimulation period of 4 days the definitive itrel III (Medtronic) neurostimulators were implanted in the left infraclavicular and right inframammary region, 10 cm inferior to the pacemaker which was located in the right infraclavicular area.

RESULTS: During a 2 year period of cardiological and neurological followup the patient had one episode of ventricular tachycardia, which was successfully treated with antiarrhythmics and which was not provoked by pacemaker dysfunction. Bilateral neurostimulation reduced the tremor by 85% according to the Tolosa Fahn rating scale. Stimulation was bipolar to prevent spread of current and interference with the cardiac pacemaker. The neurostimulation parameters were : amplitude : 4 and 2,9 Volt ; pulse duration : 210 and 180 microseconds, respectively on the left and the right side. High frequency stimulation (130 Hertz) was used on both sides. No malfunction or interaction between the neurostimulators and the pacemaker has been recorded.

CONCLUSIONS: In our experience the implantation of a cardiac pacemaker and deep brain stimulation devices in the same patient is feasible. Neurostimulation should be performed in the bipolar mode.

OBJECTIVES: 1 possibility of combined simultaneous neurostimulation and cardiac pacing in one patient, without interactions 2 the use bipolar neurostimulation if the patient has a cardiac pacemaker. 3 Cardiological or neurological events should be recorded and the programming of both cardiac and neurostimulation devices should be frequently checked

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Phosphorus-32 Intracavitary Irradiation for Patients with Cystic Craniopharyngiomas

AUTHORS: Constantinos G Hadjipanayis, MD; Toshi Hasegawa, MD; Douglas Kondziolka, MD; L. Dade Lunsford, MD

INTRODUCTION: The long-term efficacy of stereotactic intracavitary irradiation using phosphorus-32 (32P) for patients with cystic craniopharyngiomas was assessed by determining survival, tumor control, and visual and endocrinological function before and after treatment.

METHODS: During a 16 year interval, 49 patients were treated with stereotactic 32P intracavitary irradiation. Twenty-five patients had no prior treatment (primary treatment), and 24 were treated for residual or recurrent tumor cysts. At the time of 32P intracavitary irradiation, 34 patients were adults, and 15 were children (<16 y.o.). The mean cyst volume was 13 ml. The radiation dose varied from 189 to 250 Gy to the cyst wall over five half-lives of the isotope (mean, 224 Gy). The average follow-up after diagnosis was seven years.

RESULTS: The actuarial five- and ten-year survival from diagnosis was 90% and 80%, respectively. The actuarial tumor cyst control rate was 77%. After treatment, nine (23%) of 40 patients with both preoperative and postoperative visual field tests had a delayed worsening of visual function, six from tumor progression and three attributed to the adverse effect of radiation. Nineteen patients (48%) had improved visual function. Twelve of 17 patients who had preoperative normal pituitary function had preserved function, but five had pituitary function deterioration. No complications were detected after intracavitary irradiation.

CONCLUSIONS: 32P intracavitary irradiation provided effective control of craniopharyngioma cysts, but not solid tumor components. The risk of early and late complications was low.

OBJECTIVES: 32P Intracavitary Treatment of Craniopharyngiomas Treatment of Cystic Craniopharyngiomas Stereotactic Technique for Intracavitary Irradiation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: CT-guided Stereotactic Microsurgical Removal of Intraventricular Lesions Assisted by Endoscopy

AUTHORS: Constantinos G Hadjipanayis, MD; Anthony E Harris, MD; L. Dade Lunsford, MD; Andrew K Lunsford, MD; Amin Kassam, MD

INTRODUCTION: To demonstrate the technique of stereotactic microsurgical endoscopic removal of intraventricular tumors or colloid cysts assisted by intraoperative computed tomography (CT).

METHODS: We adapted a tubular "ventriculoport" for stereotactic insertion of an endoscope into the ventricle. This facilitated microsurgical resection of 14 intraventricular tumors or colloid cysts using intraoperative CT.

RESULTS: Gross total resection was achieved in 12 patients and confirmed by intraoperative CT and postoperative magnetic resonance imaging (MRI). Patients with preoperative hydrocephalus had relief of their symptomatology. Perioperative morbidity was limited to mild headache associated with postoperative pneumocephalus. The average length of stay was 3.6 days. Twelve patients had significant improvement in their symptoms.

CONCLUSIONS: The combination of intraoperative CT-guided stereotactic technique and rigid endoscopy facilitated an accurate, minimally invasive, microsurgical removal of these intraventricular masses. This approach minimized retraction, provided optimal visualization, and reduced potential morbidity.

OBJECTIVES: Understand Endoscopic Resection of Intraventricular Lesions
Understand CT-guided Stereotactic Localization of Intraventricular Lesions
Understand Neuroendoscopy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic nucleus stimulations using a simplified anatomical clinical guided electrode implantation in patients with Parkinson disease

AUTHORS: Christian Raftopoulos, MD; Alexandra Collard, MD; Anne Jeanjean, MD; Bazel Abu Serieh, MD; Thierry Duprez, MD; Michel Guerit, MD; Guy Cosnard, MD

INTRODUCTION: High frequency stimulation (HFS) of the subthalamic nucleus (STN) has progressively become the surgical procedure to recommend for patients with drug-refractory Parkinson's disease (PD). The reference procedure for implantation use invasive procedures as ventriculography and microrecording on five parallel tracks. Our purpose was to analyze the effectiveness and safety of a less invasive implantation procedure.

METHODS: Sixteen patients (6 females & 10 man, mean age 62.9 \pm 7.8 years) with advanced idiopathic PD (Unified Parkinson Disease Rating Scale VI 4 \pm 1.1 in the off stage and 790 \pm 399 mg of levodopa) were treated. Fifteen showed levodopa-induced dyskinesias (LID). Our implantation procedure is characterized by a visual STN targeting on T1 3D SPGR-weighted MR imaging fused with a CT scan. The external half of substantia nigra and the anterior border of the red nucleus are used as guides to target the STN. One macroelectrode track at a time is explored analyzing clinical response and side effect.

RESULTS: The average number of tracks per patient was 1.3 \pm 0.7 on the left and 1.9 \pm 1.34 on the right. Complete arrest of medication was possible in 4 patients with disappearance of LID. On the Schwab-England scale, the pre off clinical state was 40.8 \pm 13.8 and the post off was 76.6 \pm 18.8. Side effects were limited at two cases of eye-lid apraxia and one of hypophonia. Two patients developed a material infection. No mortality or hematoma occurred.

CONCLUSIONS: These favorable results allow us to pursue with this simplified procedure.

OBJECTIVES: Make the DBS a more accessible therapeutic procedure

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Spinal cord stimulation (SCS) for the treatment of refractory unilateral limb pain syndrome (RULPS)

AUTHORS: Abbay Kumar, MD; Sam Eljamel, MD

INTRODUCTION: SCS is an established treatment for RULPS. The results of SCS depend on patient selection and how good the follow up is. We reviewed all patients who had had SCS surgery from Jan 1998 to Dec 2001 to find out the efficacy of SCS on reducing analgesic requirement, return to work and improving the quality of life and establish the reasons for revisions.

METHODS: Sixty consecutive patients were reviewed. The age range was 30 to 78 years. There were 33 males and 27 females. All patients had failed all other modalities of treatment for their pain and their pain was predominantly affecting one limb. Data were collected on the degree of response, reduction of analgesia, return to work, frequency of revisions and rate of complications.

RESULTS: Forty patients (83.4%) responded to the treatment, 53% the response was excellent, 17% was very good and in 15% it was mild effect. 8.3% had no response and 8.3% were uncertain. These results were at one year as all had initial very good response. 22 patients had SCS revision due to battery failure, lead migration or fracture or as a result of surgical complications which occurred in 6%.

CONCLUSIONS: SCS is a valuable treatment and cost effective in the rightly selected patient. The patient and the implanting surgeon must be committed to a long term maintenance program. Some patients may have an initial Placebo beneficial effect and the SCS response drops slightly in the long term.

OBJECTIVES: Learn the effect of Spinal Cord Stimulation in the long term.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Gamma Knife Radiosurgery in the Management of Brain Metastases from Lung Carcinoma: Factors Affecting Survival, Local Control and Freedom from New Brain Metastases

AUTHORS: Ajay Jawahar, MD; Ronnie E Matthew, BS; Deepti Shukla, MD; Brian K Willis, MD,FACS; Donald R Smith, MD; Federico Ampil, MD; Anil Nanda, MD,FACS

INTRODUCTION: This study analyzes the results of Gamma Knife stereotactic radiosurgery with respect to the treatment of 44 consecutive patients diagnoses with brain metastases from lung carcinoma.

METHODS: Between February 2000 and April 2002, 44 (23 males and 21 females) patients with 91 tumors received radiosurgery for metastatic brain disease from lung carcinoma. The mean patient age was 56 years. Twenty-two patients had solitary tumor while 22 had multiple tumors. Twenty-six patients (56 tumors) were newly diagnosed and 18 (35 tumors) had recurrence after previous surgery (n=5) or radiation (n=13). The tumor volume ranged from 1 to 30 cc (mean 9.61 cc). The mean prescription dose to the tumor margin was 15.35 Gy (range 11-22 Gy).

RESULTS: The follow-up period ranged from 4 to 30 months (median 19 months). At the last follow-up, 17 patients (38.6%) were alive while 27 had died. Ten deaths (22.7%) occurred due to brain disease (failure of local control or new metastases). At the last follow-up 36 patients (81.8%) were free from new brain metastases. Control of treated tumor(s) was achieved in 32/44 patients (72 tumors), 10 patients had treatment failure and 2 others died of lung disease without follow-up. The median overall survival was 7 months, median brain-disease-controlled time was 21 months and the median period of freedom from new brain metastases was 17 months (95% CI). The actuarial one year over all, brain-disease-controlled and freedom from new met survival times were, $24.9 \pm 0.8\%$, $66.8 \pm 0.1\%$ and $64.5 \pm 0.1\%$ respectively.

CONCLUSIONS: Gamma Knife stereotactic radiosurgery has significantly reduced mortality from brain disease by effectively accomplishing local tumor control in patients with metastatic lung cancer. Local control and freedom from new brain metastases is not influenced by prior XRT.

OBJECTIVES: 1. To analyze the efficacy of Gamma Knife radiosurgery in the treatment of lung carcinoma metastasizing to brain. 2. To assess the overall and brain disease free survival rates and their influencing factors in these patients. 3. To retrospectively assess the effectiveness of prior whole brain radiation therapy in preventing new brain metastases.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Therapeutic effect of simultaneous STN deep brain stimulation and subthalamotomy in advanced Parkinson's disease.

AUTHORS: Kyung Jin Lee, ; Seongrim Kim, MD

INTRODUCTION: Bilateral STN deep brain stimulation is effective therapeutic modality to improve the symptom in advanced Parkinson's disease. But it puts a severe strain on patients' finances. We report two cases of simultaneous unilateral STN deep brain stimulation and contralateral subthalamotomy in advanced parkinson's disease for the cost effectiveness.

METHODS: Two patients with advanced parkinson's disease were selected. One was a 61-year-old woman with 12 years' therapeutic history. Left pallidotomy was performed 3 years ago. 2 years after the operation, she presented aggravated rigidity and gait disturbance. The other was a 58-year-old man, with 10 years' therapeutic history, who presented tremor, dyskinesia, and on-off fluctuation. Surgical target was selected at the point of posterior 3 mm, lateral 11~12mm, inferior 4mm to the mid-commissural point in the preoperative MRI study. Physiological mapping was performed with electrical stimulation during the surgery. Settlement of the laterality depended on the severity of the symptom. DBS was chosed for the severe side. In the opposite side, lesioning was made with radiofrequency generator for 45 seconds in 75 degree Celcius. Postoperatively, location of the lesion and electrode was confirmed with MRI. 3 months after operation, H&Y scale and ADL score was measured.

RESULTS: In female patient, her condition had improved considerably. Preoperative H&Y scale was 2.5 on-stage and 4 off-stage. Postoperatively, it was 0 & 1 in each. ADL score was 30 on-stage and 80 off-stage in preoperative state, 90 and 100 in postoperative state. In male patient, H&Y scale was 1 on-stage and 3 off-stage preoperatively and 0 & 1 in each postoperatively. ADL score was 40 on-stage and 80 off-stage in preoperative state, 90 and 100 in postoperative state. Dosage of madopa was reduced to 875mg as compared with 1875mg in preoperative state.

CONCLUSIONS: Simultaneous STN deep brain stimulation and subthalamotomy was able to improve patient's condition without any serious complication and was cost-effective, but long-term follow-up is warranted.

OBJECTIVES: Effect and Complication of subthalamotomy Correlation of Hemiballismus and Lesion Size Comparison of STN DBS and Subthalamotomy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: From a Letterbox to a Keyhole Approach for resecting Intracranial Brain lesions.

AUTHORS: M Sam Eljamel, MD; Monica Hofner, MD

INTRODUCTION: Image guided neurosurgery (IGS) has been established as a standard of care in neurosurgery over the last three decades. This study is a prospective audit of 235 consecutive IGS procedures, which were compared to a 100 neurosurgical procedures without the IGS. In 1997 we established that IGS was cost effective and safe in our hands. The purpose of our study was to monitor the cost effectiveness and usefulness of the IGS in the long term.

METHODS: All patients undergoing IGS procedures were included in this study. Data were collected prospectively in an audit profoma. The data were stored on a database and analysed annually. Similarly data were collected on patients who had not had IGS as part of the operating room utilisation monitoring in the institution. By 2000, the IGS has replaced almost entirely free hand letterbox cranial surgery and therefore the number of patients who underwent conventional craniotomy had reduced very quickly.

RESULTS: The age range of the 235 patients was from 10 to 88 years (mean 50.42 years). 63% were females. 10% were meningiomas, 15% were schannomas, 18% were pituitary lesions, 14% were metastasis, 20% were gliomas and the rest consisted of temporal lobe resections for epilepsy, AVMs, Colloid & Epidemoid cysts. The size of the lesion varied markedly; 8.5% was < 2 ccm, 57% was 2-4 ccm and 34.5% was > 4 ccm. The overall application accuracy was 2 mm. The best application accuracy was in the skull base with a mean of 1 mm. There was no significant difference in operatin room utilisation between letterbox and keyhole surgery, but there was a trend of shorter operating time, less postoperative pain, lesser potoperative complications and a shorter stay in hospital (5 days vs 8 days) with keyhole surgery. The registration accuracy had aslo improved over time and the failure rate of the system was abolished over time.

CONCLUSIONS: IGS should be considered a standard of care and used in almost every cranial procedure. It should be available in every operating room. It provides valuable signifiacnt benifits to patients, surgeons and the health care system.

OBJECTIVES: The application of the IGS to neuropsurgical practice and its cost effectiveness.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Influence of stimulus pacing on language lateralization with fMRI using a semantic decision task: preliminary results

AUTHORS: Ann Tieleman, MD; Olivier Vandamme, MD; Karel Deblaere, MD; Jacques Caemaert, MD,PhD; Eric Achten, MD,PhD

INTRODUCTION: We examined the influence of stimulus pacing on the determination of global and regional hemispheric dominance for language using a semantic decision task in healthy subjects.

METHODS: 13 healthy volunteers participated in this study. Functional imaging was performed using a 1.5 Tesla Siemens symphony MR system with whole head multi slices echo-planner imaging. An anatomical 3D image was made for coregistration with the functional images. Two experiments, arranged as a conventional block design with 2 conditions, were performed. During the activation condition, the subjects had to decide with button presses whether a visually presented word was an animal or an object, while during the baseline condition they had to decide whether a string of letters consisted of uppercase or lowercase letters. During the fixed paced experiment a new stimulus was given every 3 seconds and during the self-paced a new stimulus appeared immediately after the subject had pressed a button. In which semantic categorization of words (animal or object) was contrasted with a non-semantic uppercase/lowercase discrimination. The words were visually presented and the decisions were made with button presses. Image postprocessing and statistical analysis was performed using SPM99. The individual results were thresholded at $p < 0.01$. Lateralization indices (LI) were calculated for the cerebral regions as a whole, and for two regions of interest: frontolateral convexity (FroLat); and the superior and middle temporal, supramarginal and angular gyrus (TemPar).

RESULTS: Determination of both frontolateral and temporoparietal LI resulted in more strongly left lateralized results for the self-paced task compared to the fixed-paced task. Global LI were unreliable and inconsistent during the fixed paced experiment; during the self-paced experiment global LI were more consistent, but less powerful because of more bilateral secondary and tertiary visual regions activated.

CONCLUSIONS: These preliminary results suggest that stimulus pacing can be of major influence in the assessment of language lateralization and localisation with fMRI.

OBJECTIVES: usefulness of fMRI, using a self-paced semantic decision task, in the assessment of both language lateralization and localization.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Anterior mesiotemporal lobe activation detected with fMRI :preliminary results

AUTHORS: Karel Deblaere, MD; Ann Tieleman, MD; Pieter Vandemaele, ; Kristel Vonck, MD; Guy Vingerhoets, PhD; Paul Boon, MD,PhD; Eric Achten, MD,PhD

INTRODUCTION: So far no study has reported reliable single subject hippocampal activation with fMRI. This would be very useful in the pre-surgical evaluation of patients with pharmacoresistant temporal lobe epilepsy (TLE). Recently, Moritz et al. suggested the use of a variable length block design to elicit single subject hippocampal activation. The purpose of this study was to assess the reproducibility of hippocampal activation in healthy subjects using this paradigm. Preliminary results in four TLE patients are also reported.

METHODS: So far, eight healthy subjects (2 male, 6 female) and four TLE patients (2 male) participated in this study. Before and during scanning of an anatomical scan, the subjects viewed 5 images of the picture set of Snodgrass and Vanderwart. Following the anatomical scan, two runs of 360 images were acquired while subjects viewed variable length blocks [2,3] of new images (NEW) mixed with variable blocks of the images seen before (OLD). Subjects made the decision OLD/NEW with button presses. The contrast OLD>NEW [1] was calculated using the software package SPM99 and individual statistical results were thresholded at $p < 0.05$.

RESULTS: All 8 healthy subjects had strong symmetrical activation foci in the anterior mesial temporal lobe. Hippocampal activation foci were present in all subjects, without clear lateralization. Two patients with left TLE showed clearly right lateralized mesiotemporal activation patterns, suggesting that only the non epileptic mesiotemporal lobe was active during the task. Wada test in one of these patients revealed that there was an asymmetry in memory function in favor of the non-epileptic side. The Wada test in the other patients was only performed at the non-epileptic side. Symmetrical fMRI activation patterns were found in the other two patients with right TLE, which was confirmed with the Wada test.

CONCLUSIONS: Both results in healthy subjects and TLE patients are very promising and larger subject and patient samples will assess the clinical value of this fMRI paradigm.

OBJECTIVES: fMRI holds great promise for replacing the wada-test in the presurgical evaluation of TLE.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Progressive Improvement of Generalized Dystonia after Pallidal Deep Brain Stimulation

AUTHORS: Michele Tagliati, MD; Jay Shils, PhD; Susan Bressman, MD; Joan Miravite, RNC; Ron L Alterman, MD

INTRODUCTION: Preliminary studies of Deep Brain Stimulation (DBS) of the Globus Pallidus Pars Internus (GPi) have shown promising results in selected cases of primary and secondary generalized dystonia. Several reports have described a variable time course of improvement.

METHODS: Retrospective analysis of bilateral GPi DBS in seven patients with medically intractable primary dystonia (4 females and 3 males, age range: 13-63 years) and one 18-year-old girl with secondary dystonia. Four patients with primary dystonia were DYT1+. STereotactic MRI and intraoperative microelectrode recordings were used to localize the GPi. All patients were videotaped and evaluated with the Burke-Fahn-Marsden Dystonia Rating Scale (BFMDRS) two weeks before and at several intervals after surgery. DBS settings were slowly and systematically increased to achieve best clinical effect. We used large pulse width (210-450microsec) and high frequency (130 Hz) stimulation. Percent changes of BFMDRS scores were calculated. All patients were followed for at least 6 months.

RESULTS: All patients with primary dystonia showed improvement of their BFMDRS scores (average best improvement 62.6%, range 32-97%). In all patients improvement was progressive over time. In seven patients with primary dystonia, we observed 23.9% average improvement at 1 month, 44% at 3 months, 48.3% at 6 months and 64.7% [5 patients] at 1 year. Clinically, muscle spasms and dyskinetic movements showed a more rapid improvement, while resolution of dystonic postures had a slower time course and was only partial in some cases. All muscle groups benefited on average from DBS treatment. The patient with secondary dystonia also showed a progressive improvement of BFMDRS score (up to 37.7%) over 12 months follow-up. In particular, she showed better motor control of her limbs. No major complications were reported in any of the patients included in this study.

CONCLUSIONS: Pallidal DBS is a safe and effective therapy in selected patients with medically intractable generalized dystonia. We observed near-complete resolution of symptoms in two patients and significant improvement in 6 out of 7 with primary dystonia. Clinical improvement was progressive and most evident 3-12 months after surgery. All muscle groups seemed to benefit from DBS therapy. Secondary dystonia showed less impressive but subjectively satisfactory results.

OBJECTIVES: Describe the benefits and risks of Bilateral GPi DBS for medically refractory Torsion Dystonia.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Standard Imaging Protocol for fMRI

AUTHORS: Samuel R Browd, MD,PhD; William T Couldwell, MD,PhD; James Lee, PhD

INTRODUCTION: Functional MRI has shown utility for both pre-operative planning and intra-operative guidance. The current limitation to routine implementation of the technique has been the labor intensive nature of data collection and image analysis.

METHODS: We describe a standardized imaging protocol for the evaluation of motor, sensory and language function. Currently the protocol is being evaluated in both adults and children and we are assessing methods of implementing the protocol in an automated fashion alleviating the need for skilled research associate participation at the time of image acquisition.

RESULTS: Preliminary results suggest that a standardized imaging protocol is feasible and provides adequate data for surgical planning and intra-operative guidance. Additional subjects are scheduled for imaging subsequent to abstract submission.

CONCLUSIONS: fMRI is a powerful technique for non-invasive evaluation and localization of eloquent cortex. It has utility in both pre-operative planning and intra-operative guidance. We discuss a standardized fMRI protocol that can be implemented by MRI technologists without the need for skilled research personnel. A description of fMRI tasks that can be routinely implemented for motor, sensory and language assessment will be discussed.

OBJECTIVES: 1) Understand how fMRI is performed 2) implement a standardized fMRI imaging protocol at their home institution 3) Critically assess different fMRI tasks for clinical utility

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Spinal Cord Stimulation for Cancer-Related Pain: A Neglected Indication?

AUTHORS: Ethan Taub, MD

INTRODUCTION: In recent years, neurosurgical procedures for cancer-related pain have largely been supplanted by high-dose opioid treatment, by the oral or parenteral route. For the minority of cases that do require neurosurgical treatment, the treatment is currently much more likely to involve the placement of an intrathecal medication pump than any of the neuroablative procedures that were once common. A further option, spinal cord stimulation (SCS), is widely used with good effect to treat pain of other kinds, but has attracted little attention for the treatment of cancer-related pain. Reports of its use to date have been few and inconsistent, though a consideration of the basic mechanisms of pain and its treatment by SCS suggests that it might provide substantial benefit. The advantages of SCS for the patient, compared to an implanted pump, are the following: (1) SCS is not sedating and has no side effects other than mild paresthesia; (2) SCS can be instantaneously titrated by the patient with a hand-held programming device; (3) the implant is less bulky and does not need to be refilled.

METHODS: The author reports two personal cases of patients with medically intractable pain due to inoperable malignancy who were treated with SCS.

RESULTS: Both patients derived substantial benefit from SCS in terms of subjective pain relief and decreased consumption of analgesics.

CONCLUSIONS: This small experience is discussed in the light of the relevant literature, which is not extensive. Further experience will be needed to determine whether the good results obtained in these two patients are generalizable, and which subgroups of patients stand to benefit most from SCS.

OBJECTIVES: At the end of this presentation, participants should be able to: (1) Discuss the status of SCS for cancer-related pain according to the current literature; (2) Understand the possible usefulness of SCS for cancer-related pain, in view of its mechanism of action; (3) Appreciate the need for further study to refine the indications for SCS.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Transplantation

TITLE: High Yield Differentiation of Neurons from Rat Neural Progenitor Cells

AUTHORS: Elizabeth C Tyler-Kabara, MD,PhD; Yongjian Liu, PhD; Glenn Gobbel, PhD; Kondziolka Douglas, MD,FACS,FRACS,MSc

INTRODUCTION: Stem cell research has created a potential for widespread use of cell transplantation in the brain and spinal cord. As our expertise in transplantation grows we may find that it is preferential to transplant cells enriched with oligodendrocyte precursors, neuronal precursors, or a balanced mix, depending on the disease process. We show that a high percentage of neurons can be generated from adult derived rat neural progenitor cells (rNSCs) when co-cultured with PA6 cells, a murine bone marrow derived cell line.

METHODS: The rNSCs were isolated from the subventricular zone of adult rats. They can be maintained in culture for greater than one year. These rNSCs stably express green fluorescent protein (GFP). For co-culturing experiments, PA6 cells were plated on Matrigel and grown to 90% confluence (7 days). The rNSCs were then plated on PA6 cells and fixed with formalin after 3-10 days. They were stained for GFP, beta-tubulin III, glial fibrillary acidic protein (GFAP), and CNPase. In subsequent experiments PA6 cells were fixed in formalin prior to plating rNSCs or rNSCs were plated on Matrigel alone and treated with PA6 conditioned media.

RESULTS: After differentiation, 10% of cells expressed GFAP, 22% expressed CNPase and only 4% expressed beta-tubulin. Differentiation in the presence of bFGF increased the neuronal yield to 35%. When rNSCs are grown on PA6 cells they develop distinct phenotypes more rapidly than controls. GFAP and CNPase, as well as beta-tubulin, positive cells are present. CNPase positive cells are often seen in clumps between PA6 cells. Beta-tubulin positive cells are dispersed throughout and are typically seen overlying PA6 cells. The average yield of beta-tubulin positive cells is 71%. When rNSCs are grown in conditioned media the yield of neuronal cells is reduced. In contrast, when rNSCs are grown on fixed PA6 cells the yield of cells with neuronal markers is similar to co-cultures.

CONCLUSIONS: Neural progenitor cells can be selectively differentiated into predominantly neuronal populations by co-culturing with PA6 cells. This appears to be mediated by factors on the surface of PA6 cells or embedded in the extracellular matrix.

OBJECTIVES: 1. Understand basic differentiation of neural progenitor cells. 2. Understand technique for generating enriched neuronal populations from neural progenitor cells. 3. Understand rationale for generating selectively enriched cell types from neural progenitor cells.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: The effect of Magnetic Stimulation of the Vagus in Treatment Refractory Epilepsy

AUTHORS: Abhay Kumar, MD; M Sam Eljamel, MD; Richard Roberts, MD

INTRODUCTION: Vagal nerve stimulation, (VNS) has been used in since 1988 to control treatment refractory epilepsy (TRE) with variable results depending upon patient selection criteria, length of follow up and how vigorous the postoperative assessment is. We collected data on all patients who underwent VNS for TRE and we present our findings in this paper with specific emphasis on the effect of magnetic stimulation to abort seizures.

METHODS: This is a Retrospective analysis of a prospectively collected data. All patients who had vagus nerve stimulator inserted since 1998 were included in the study. Information was obtained from the VNS database. All patients were followed up regularly by Consultant Neurologist. The frequencies of seizures were recorded in a monthly seizure count chart. Patients, relatives and carers view were also recorded. Patient's views about magnet-induced stimulation in aborting seizures were also recorded. The clinical details of these patients are summarized here; Sex 9 males 8 females Age Mean-33.4 years Range-12-57 years Duration of seizures Mean-22.6 years Range-12-42 years Follow up Mean-34 months Range -18 months-4 years Previous surgery Two had anterior temporal lobectomy, One had bilateral amygdectomy in 1969 One had left hippocampal sclerosis but failed WADA test Seizure type Complex partial seizures-4 Tonic-Clonic seizures-3 Both-10 Atonic seizures-3 Absence seizures-1

RESULTS: Twenty three % of patients had three or more antiepileptic medication reduced after VNS. Forty seven % had significant reduction in duration and severity of seizures. Postictal lethargy and confusion was decreased in thirty five % of patients. Sixty five % of them benefited from magnet induced stimulation. All patients tolerated the stimulation well except one. The side effects noted were Hoarseness of voice, coughing and tingling sensation in the throat. One patient gets severe pain in his gums on stimulation

CONCLUSIONS: VNS reduces seizures by 50% in 50% of patients with complex partial seizures and in 25% of patients with generalized tonic clonic seizures. VNS has significant effect in reducing the duration and severity of seizures and also in reducing postictal lethargy/confusion Magnet induced stimulation is effective in most. Considering the fact that these patients belong to the most refractory part of the epilepsy population, the results are regarded as promising. Since it is a simple procedure with few complications it should be considered in all patients with intractable epilepsy

OBJECTIVES: The effect of magnetic stimulation on abortion of seizures in TRE.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: History of the ASSFN

AUTHORS: Philip L. Gildenberg, MD, PhD; Patricia O. Franklin,

INTRODUCTION: The history of the ASSFN parallels the history of the fields of both stereotactic and functional neurosurgery. The founders and leaders in the Society were also the pioneers and developers of the science.

METHODS: The history of the Society was reviewed from several different perspectives. A review was made of prior scientific programs, seminal papers identified, topics summarized, and milestones noted -- each program is well represented in the Proceedings published in the official journal, originally "Confinia Neurologica", then "Applied Neurophysiology" and now "Stereotactic and Functional Neurosurgery". In addition, the minutes of prior Business Meetings were reviewed, and prior officers and activities elucidated. The relationship of the ASSFN to the WSSFN is reviewed.

RESULTS: The activities of the ASSFN accurately reflect the origin and development of the fields of stereotactic and functional neurosurgery. A perusal of past programs provides considerable insight into how the field has progressed both scientifically and clinically.

CONCLUSIONS: The ASSFN has been an important influence in the origin and development of Stereotactic and Functional Neurosurgery.

OBJECTIVES: 1. Know about the history of the ASSFN 2. Appreciate the history of development of stereotactic and functional neurosurgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Analysis of Iodine-125 implants in the primary treatment of malignant gliomas using of the RTOG recursive partitioning

AUTHORS: Lucia Zamorano, MD; Gregory M.M Videtic, MD; Laurie E Gaspar, MD; James Fontanesi, MD; Kenneth J Levin, MD; Qinghang Li, PhD

INTRODUCTION: To date, numerous retrospective studies have suggested that the addition of brachytherapy to the conventional treatment of malignant gliomas (MG) (surgical resection followed by radiotherapy \pm chemotherapy) leads to improvements in survival. Critics of retrospective reports have suggested that the improvement in patient survival is due to selection bias.

METHODS: From 1991 to 1998, 75 patients were treated with a combination of surgery, radiotherapy, and stereotactic I-125 implant as primary MG management. Forty-one (54.7%) were male; 34 (45.3%) female. Median age was 52 years (range 4-79). Twenty-two (29.3%) had anaplastic astrocytoma (AA); 53 (70.7%), glioblastoma multiforme (GBM). Seventy-two patients had data making them eligible for stratification into the 6 RTOG prognostic classes (I-VI). Median Karnofsky performance status (KPS) was 90 (range 50-100). There were 14, 0, 14, 31, 12, and 1 patients in Classes I to VI, respectively. Median follow-up time for AA, GBM, and any surviving patient was 29, 12.5, and 35 months, respectively.

RESULTS: At analysis, 29 (40.3%) patients were alive; 43 (59.7%), dead. For AA and GBM patients, 2-year and median survivals were: 58% and 40%; 38 and 17 months, respectively. For analysis purposes, Classes I and II, V and VI were merged. By class, the 2-year survival for implanted patients compared to the RTOG data base was: I/II68% vs. I76%; III74% vs. 35%; IV34% vs. 15%; V/VI29% vs. V6%. For implant patients, median survival by class was (in months): I/II37; III31; IV16; V/VI11.

CONCLUSIONS: When applied to MG patients receiving permanent I-125 implant, the criteria of the RTOG recursive partitioning analysis are a valid tool to define prognostically distinct survival groups. As reflected in the RTOG study, a downward survival trend for the implant patients is seen from "best to worse" class patients. Compared to the RTOG database, median survival achieved by the addition of implant is improved most demonstrably for the poorer prognostic classes. This would suggest that selection bias alone does not account for the survival benefit seen with I-125 implant and would contradict the notion that the patients most eligible for implant are those gaining the most benefit from the treatment.

OBJECTIVES: Using RTOG RPA can help to understand the outcomes of the patient with malignant gliomas treated by I-125 implants.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: DEEP BRAIN STIMULATION IN THE TREATMENT OF MOVEMENT DISORDERS

AUTHORS: Jose A Nasser, MD; Asdrubal Falavigna, MD; Armando Alaminos, PhD; M-rício Bezerra, MD; Fernando Ferraz, MD; Helenice Charchat, PhD

INTRODUCTION: The authors present their results with deep brain stimulation (DBS) of subthalamic nucleus in patients with Parkinson's disease; of VIM thalamic nucleus in patients with tremor and Gpi nucleus in generalized dystonia patients.

METHODS: Between October 1999 until February 2002, eight patients with Parkinson's disease presenting more than 5 years of symptoms, with all cardinal symptoms, which are: tremor, bradykinesia, rigidity, dyskinesias, despite the best combinations of drugs were referred to Subthalamic DBS implantation. Those were tested with UPDRS and Schwab & England scales. Six patients with symptomatic tremor, 4 essentials and 2 caused by multiple sclerosis underwent VIM stimulation. 3 patients with generalized dystonia (one Dyt1-positive) received bilateral Gpi implantation.

RESULTS: The results at 6 months showed significant improvement in UPDRS and daily life Schwab & England scores in Parkinson's Disease patients. Patients with essential tremor did better than those with tremor caused by multiple sclerosis showed in CRST score. Patients with dystonia, specially one with DYT1 positive did better than those with secondary dystonia.

CONCLUSIONS: The results show that DBS can help patient with movement disorders such as Parkinson's Disease, Tremor and Dystonia. There are some advantages when one compare ablations versus stimulation specially the reversibility, the possibility of been bilateral. The cost of the equipment is the major restriction to the population.

OBJECTIVES: - Dbs for Parkinson's patients - STN - Dbs for tremor - VIM - DBs for dystonia - GPi

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Bilateral Anterior Capsulotomy to Obsessive Compulsive Disorder

AUTHORS: JosÈ A Nasser, MD; Asdrubal Falavigna, MD; Fernando Ferraz, MD; Armando Alaminos, PhD; Helenice Charchat, PhD

INTRODUCTION: Obsessive compulsive disorder (OCD) is a complex disease, characterized by obsessions, anxiety and compulsions. The authors analyze prospectively 12 patients referred to anterior capsulotomy

METHODS: Between 1998 until 2001, 12 patients were selected to be treated with anterior capsulotomy. Those patients were evaluated by a group of psychiatry specialized in surgical indication. The procedure was done with general anesthesia. It was used fused imaging, MRI and stereotactic CT . The stereotactic system is Micromar-Diadema- S,,o Paulo. The lesions were performed by radiofrequency and were bilateral. The target was 2mm below the anterior commissure and extending 15mm up. Every patient had a MRI postoperatively and some cases it was performed fMRI as well.

RESULTS: The mean improvement was 70%. There is a better result with patients with obsession as the main symptom. There were no complications regarding this procedure in those cases. Rehabilitation with behavior psychotherapy seems to be important. There are some patients who present a transient depression especially in the first month.

CONCLUSIONS: Bilateral anterior capsulotomy for OCD is a safe procedure, has efficacy, once well indicated by an expert team.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: The Response of Specific PD Symptoms to Subthalamic Deep Brain Stimulation is Anatomically Discrete

AUTHORS: Aubrey Okpaku, MD; Jay Shils, PhD; Michele Tagliati, MD; Joan Miravite, RNC; Ron L Alterman, MD

INTRODUCTION: While it is widely accepted that Subthalamic DBS improves all of the cardinal features of Parkinson's disease(PD), it is unclear whether these symptoms respond best to activation of the same or different DBS electrodes.

METHODS: Retrospective analysis of clinical data derived from the initial DBS programming visit of 25 patients with advanced PD who underwent successful bilateral STN DBS surgery. All 50 leads were implanted by the same surgical team using stereotactic MRI, microelectrode recording and macro-stimulation. The deepest contact(0) was consistently positioned at the physiologically defined base of the STN. Final electrode position was confirmed using intraoperative fluoroscopy and post-operative MRI. During the initial programming visit, the "off-medication state" response of each PD symptom to monopolar activation of each contact was recorded. Patients returned two weeks later, while on medications, in order to determine which contact(s) best controlled levodopa-induced dyskinesiae.

RESULTS: Patients exhibited improved motor function post-operatively, as evidenced by improvements in their Unified Parkinson's Disease Rating Scale motor subscores (UPDRSIII), which ranged from 9.0 -90.1% (mean: 48.7%). Tremor (items 20-21)improved 65.0%; rigidity (item 22)improved 42.1%; bradykinesia (items 23-27 and 31)improved 51.7%; and dyskinesiae (items 32-34 UPDRS IV) improved 90.6%. Eighteen of 22 (81%) patients with tremor responded best to stimulation of deeper contacts (0,1). Twenty-one of 22 patients (95%) with rigidity and 15 of 17 (88%) patients with bradykinesia responded preferentially to stimulation of more dorsally located contacts (1,2,3). Eight of nine (88%) patients with visible dyskinesiae at the second visit responded preferentially to stimulation of the most dorsal contacts (2,3).

CONCLUSIONS: The symptomatic response of PD to Subthalamic DBS may be anatomically discrete. The anatomic and physiological relevance of this data needs to be studied further.

OBJECTIVES: Discuss the response of PD symptoms to activation of DBS lead contacts at varied anatomical positions.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Unilateral Ablative Lesions of the Subthalamic Nucleus in Advanced Parkinson Disease

AUTHORS:

INTRODUCTION:

METHODS:

RESULTS:

CONCLUSIONS:

OBJECTIVES:

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Microvascular decompression surgery (MVD) in the United States, 1996-2000: mortality, morbidity, and the effect of hospital and surgeon volume

AUTHORS: Steven N Kalkanis, MD; Emad Eskandar, MD; Bob S. Carter, MD, PhD; Fred G Barker II, MD

INTRODUCTION: MVD has low mortality and morbidity at specialized centers. Many MVDs are performed outside such centers. We studied short-term endpoints (mortality, morbidity) in a national hospital discharge database sample.

METHODS: Retrospective cohort study using the Nationwide Inpatient Sample, 1996-2000.

RESULTS: The sample included 1326 MVDs for trigeminal neuralgia (TN), 237 for hemifacial spasm (HFS), and 27 for glossopharyngeal neuralgia (GPN) performed at 305 hospitals by 277 identified surgeons. Mortality was 0.3%; discharge other than to home was 3.8%. The sample codes neurological complications as occurring in 1.7%, hematomas in 0.5%, and facial palsies in 0.6%; 0.4% required ventriculostomies and 0.7% needed postoperative ventilation. Median annual caseloads were 5 per-hospital (range 1-195) and 3 per-surgeon (range 1-107). Trigeminal nerve section was also coded in 3.3% of TN patients, more commonly in older patients ($P=0.05$), females ($P=0.004$) and at teaching hospitals ($P=0.01$). Adjusted for age, sex, race, primary insurance, procedure (TN/HFS), geographic region, admission type and source, and medical comorbidities, outcomes at discharge were superior at higher-volume hospitals ($P=0.006$) and after surgery by higher-volume surgeons ($P=0.02$). Complications were less frequent after surgery at high-volume hospitals ($P=0.04$) or by high-volume surgeons ($P=0.01$). Discharge other than to home was 5.1% in the lowest-volume quartile, vs. 1.6% in the highest-volume quartile. Three of the four total deaths occurred in cases performed by surgeons who had done only one MVD that year. While length of stay and hospital volume were unrelated, hospital charges were slightly higher at high-volume centers ($P=0.004$).

CONCLUSIONS: Most US MVDs are performed at low-volume centers, and mortality remains low (0.3%). However, morbidity is significantly lower at high-volume hospitals and with high-volume surgeons.

OBJECTIVES: 1. Discuss effects of provider (hospital and surgeon) volume on short term outcome for microvascular decompression surgery, based on the Nationwide Inpatient Sample; 2. Describe the characteristics of hospitals and surgeons performing MVD surgery in the US. 3. Discuss morbidity and mortality data for microvascular decompression surgery and potential relationships with hospital and surgeon volume and demographics.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Use of Multichannel Auditory Brainstem Implant for Deafness in Neurofibromatosis Type II

AUTHORS: Marc S. Schwartz, MD; Steven R. Otto, MA; Derald E. Brackmann, MD; William E. Hitselberger, MD; Robert V. Shannon, PhD

INTRODUCTION: Neurofibromatosis Type II (NF2) has typically resulted in deafness related to natural history of the disease or after the removal of bilateral acoustic neuromas. Because of anatomic disruption of the cochlear nerve, peripheral devices such as cochlear implants are generally ineffective in these patients. Auditory brainstem implants (ABIs), for direct stimulation of the cochlear nucleus, have been used to provide auditory stimulation in this group of patients.

METHODS: The first single channel ABI was implanted in 1979, and since 1992 an advanced multichannel device has been used. Currently, 141 patients have been implanted at our institution. A new multichannel device, with electrodes designed to penetrate the brainstem, thus with improved tonotopic organization related to the cochlear nucleus, is now in development.

RESULTS: Several weeks after implantation, the ABI is activated, and the optimal stimulus pattern is determined. Stimulus pattern is highly individualized depending on anatomic considerations and exact electrode placement. In order to assess the efficacy of the currently implanted multichannel device, a comprehensive battery of psychophysical and speech perception tests is utilized. These tests demonstrate that the multichannel ABI provides useful auditory sensation and allows detection of environmental sounds in most patients. Furthermore, the device improves patients' ability to communicate compared to lip-reading only, and, in selected patients, communication is possible with sound input alone.

CONCLUSIONS: Indications for ABI use and technical considerations for its implantation and programming will be discussed in this presentation. The battery of tests used to assess ABI performance will be described, along with results of these tests. Development of the new brainstem-penetrating electrode will also be discussed.

OBJECTIVES: At the completion of the session or demonstration, participants should be able to understand the design and stimulation parameters of the ABI. At the completion of the session or demonstration, participants should be able to understand the diagnostic tests used to assess the function of the ABI. At the completion of the session or demonstration, participants should be able to appreciate the benefit and limitations of the ABI.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Unilateral Ablative Lesions of the Subthalamic Nucleus in Advanced Parkinson Disease: Long-term Follow-up

AUTHORS: Orhan Barlas, MD; Hasmet Hanagasi, MD; Murat Emre, MD

INTRODUCTION: We undertook a study to assess if benefits similar to those observed with subthalamic nucleus (STN) stimulation could be obtained with STN lesions.

METHODS: Eleven patients (eight male, three female) with advanced advanced PD who had normal magnetic resonance imaging studies and normal cognition were selected to undergo subthalamotomy. All patients had a H&Y stage of 3 or 4 in off-drug condition. Evaluations were performed preoperatively, on the day of surgery and at staged intervals thereafter. The follow-up time ranged from 0.5 to 34 months, mean 14 ± 9 months. STN was identified through CT and MRI scans and small lesions were performed unilaterally.

RESULTS: Subthalamotomy induced a marked contralateral motor improvement. Mean on-phase total Unified Parkinson's Disease Rating Scale (UPDRS) and motor scores decreased from 61.7 ± 19.2 to 35.4 ± 14.3 ($p=0.001$) and from 26.1 ± 11.1 to 18 ± 12.1 ($p=0.02$), respectively. Nine patients had disabling bilateral dyskinesia and six of these patients improved significantly (mean 40 % in UPDRS part IV). Total on time increased by 25 % in three patients but not in the others. Compared to presurgical levels, levodopa equivalent dose was reduced in eight patients. Notably, ten out of 11 patients with unilateral ablations of the STN did not develop abnormal involuntary movements or other adverse effects during the follow-up period. In only one patient hemiballistic movements appeared immediately after ablation and ameliorated under treatment with valproate within two weeks after surgery.

CONCLUSIONS: We conclude that unilateral subthalamotomy is a safe and effective treatment for advanced PD, when DBS is not feasible.

OBJECTIVES: Assess the clinical benefits of subthalamotomy, Discuss the feasibility of subthalamotomy.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Intracerebral hemorrhage following 1,5 year after interstitial irradiation with stereotactically implanted Iodine-125 for the treatment of low grade glioma

AUTHORS: A. Korenkov, MD; R. Lehrke, MD; J. Voges, PhD; V. Sturm, PhD; R. Harre, MD

INTRODUCTION: Interstitial irradiation with stereotactically implanted Iodine-125 for the treatment of low grade glioma is a therapy of choice. In this case, we reported about development of intracerebral hemorrhage 1,5 year after continuous interstitial irradiation.

METHODS: A 56 year-old female presented with a history of seizures. CT scan showed a low density lesion in the right frontal lobe. MRI demonstrated a homogeneous low intense mass on T 1 WI and a homogeneous high intense mass on T2 WI in the same site. No abnormal contrast enhancement was observed. CT-guided stereotactic biopsy was performed. Histological diagnosis was astrocytoma grade I. She received continuous interstitial irradiation of 50 Gy (Iodine-125). The patient tolerated the brachytherapy very well without any postoperative neurological deficits. An MR imaging showed no recurrent tumor or radiation necrosis.

RESULTS: 1,5 year later she presented with headache, confusion and memory disturbance. CT showed right frontal and lateral interventricular acute hematomas. Angiography demonstrated no aneurysmas or malformations. The operative therapy was not necessary. After the 14 day the neurological symptoms gradually improved, and she leaves the hospital.

CONCLUSIONS: We suggested that destruction of the intima of small vessels through irradiation or bleeding from tumor are possible causes the intracerebral hemorrhage in this case.

OBJECTIVES: poster

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Permanent Iodine-125 Interstitial Radiation Therapy in the Treatment of Non-GBM High-Grade Gliomas

AUTHORS: Lucia Zamorano, MD; James Fontanesi, MD; Kenneth Levin, MD; Qinghang Li, MD; Fernando Diaz, MD

INTRODUCTION: This study evaluates prognostic factors influencing survival outcomes in 50 patients with permanent 125I implants in the primary treatment of non-glioblastoma multiforme (GBM) high-grade gliomas.

METHODS: Stereotactic treatment planning aimed to encompass the contrast-enhancing rim of the tumor visualized on CT scanning, with an initial dose rate of 0.05 Gy/hour with 125I, delivering 100 Gy at 1 year and 103.68 Gy at infinity. Survival was evaluated using the Kaplan-Meier method for univariate analysis and the Cox regression method for multivariate analysis. In addition to the implant, 31 patients underwent external-beam radiation therapy (EBRT) (5000–6000 cGy) before the implant; 10 patients underwent implantation without additional EBRT, and nine patients underwent EBRT before implant placement.

RESULTS: With a mean follow up of 40.76 months (range 3.47–87 months); 1-, 3-, and 5-year survival were 78.5% ($p > 0.05$), 58.7% ($p=0.07$), and 56.2% ($p=0.07$), respectively. Because 56.2% of the patients were alive at 5 years, median survival has not been reached yet. Second surgery was performed following the implant in 19 patients. Findings were tumor recurrence in 11 patients (22.5%), radiation necrosis in seven patients (14.3%), and brain abscess in one patient (2%). Age, sex, tumor location, side of brain, tumor volume, Karnofsky Performance Scale (KPS) score, and neurological status were correlated with survival outcome. Favorable prognostic factors were age younger than 45 years, superficial tumor location, and preoperative KPS score greater than 70.

CONCLUSIONS: Surgical treatment of patients with non-GBM high-grade gliomas combined with EBRT and permanent 125I implants represent a valuable alternative for the treatment with malignant gliomas, allowing patients good quality of life and long survival.

OBJECTIVES: To understand the outcomes of patients with non-GBM high-grade gliomas treated surgery combined with EBRT and permanent 125I implants.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Non-invasive Stimulating Lead and Extension Fault Localization Technique

AUTHORS: Jay Shils, PhD; Michele Tagliati, MD; Joan Miravite, RNC; Ron L Alterman, MD

INTRODUCTION: Employing standard EMG electrodes, one can observe the electrical impulses conducted along an implanted stimulating system and thereby evaluate the integrity of the conduction pathway. We have adapted this concept to localize faults within the lead or extension of malfunctioning neural stimulating systems, noninvasively.

METHODS: Standard EMG electrodes are placed two inches apart overlying a given segment of the implanted system. The ground is placed over the pulse generator. The EMG machine (Nicolet Viking II) is set in 'free running' mode (frequency range: 0.5 Hz-3000 Hz). Four wave morphologies can be observed: (1) a capacitive square wave indicating a normal conducting pathway; (2) a very short pulse width on either side of the biphasic pulse indicating a single lead failure; (3) no signal indicating a complete rupture between two conductors; or (4) impulse type waves indicating a short circuit.

RESULTS: Five sub-cortical stimulators and one spinal cord stimulator were studied using this technique. Failures were properly localized in 4 of the 5 patients. In one instance the pulse generator was completely depleted due to a short in the extension cable, making it impossible to localize the site of the short with this technique.

CONCLUSIONS: When standard device interrogation techniques and X-rays cannot localize problems within a neural stimulation system, surface EMG techniques can be easily used to localize the fault.

OBJECTIVES: Employ EMG techniques to localize faults within implanted neural stimulating systems, non-invasively.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: New Instrumentation for Electrophysiologically-Guided Delivery of Microvolumes of Therapeutic

AUTHORS: Miles G Cunningham, MD,PhD; Hayrunnisa Bolay, MD,PhD; Douglas Jacoby, PhD; Michael Moskowitz, PhD; Charles Scouten, PhD; Christopher Moore, PhD

INTRODUCTION: With advancing knowledge and technology, restorative interventions are being actively developed. Future therapeutics may include neurotrophic factors, neuroactive molecules, chemotherapeutics, antioxidants, vectors transferring genes, and cell suspensions. The delivery systems used today, however, are unable to deposit very small, precise volumes; and most are unable to disseminate three-dimensional arrays of injections unless multiple penetrations are made through the brain, thus increasing surgical risk.

METHODS: An intracerebral microinjection instrument (IMI) was designed to a) allow multiple injections to be placed in three-dimensional space within a target structure from a single proximal brain penetration, b) incur minimal injury at the site of injection, c) enable accurate injections of volumes in the nL to mL range, and d) permit electrophysiologic recording during the injection procedure. Adult male rats received injections of fluorescent microspheres or suspensions of labeled cells to test instrument function and level of induced trauma. A rodent model of stroke was used to test the instrument's ability to record electrocorticograms (ECoGs) or somatosensory evoked potentials (SEPs) from normal and damaged tissue.

RESULTS: Microliter volumes of fluorescent microspheres were accurately placed at predetermined sites within the rat striatum. Reactive gliosis was shown to be markedly reduced using the IMI when compared to standard injection cannulas. This may be a surrogate marker for improved neural graft survival. In a stroke model, electrophysiologic recording allowed discrimination between ischemic and viable tissue, and function of pathways or circuits was assessed using evoked potentials. Embryonic stem cells grafted immediately after electrophysiologic recordings demonstrated robust long-term survival.

CONCLUSIONS: The IMI enables electrophysiologically-guided microinjection of therapeutics to target areas with exquisite accuracy while incurring minimal local trauma and reactive gliosis. The instrument also permits multiple injections to be disseminated in three-dimensional space within the target region from a single proximal penetration of the brain.

OBJECTIVES: 1) Appreciate the precision advantages of electrophysiologically-guided placement of therapeutic. 2) Understand the effects of trauma of the microenvironment on the efficacy of a therapeutic. 3) Appreciate the advantages of indirect, stealth targeting and dissemination of therapeutic within the target structure.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Gamma knife radiosurgery treatment of renal cell carcinoma brain metastases

AUTHORS: Lucia Zamorano, MD; Laura Hernandez, MD; Andrews Sloan, MD; Kenneth Levin, MD; James Fontanesi, MD; Qinghang Li, MD; Fernando Diaz, MD

INTRODUCTION: Renal cell carcinoma [RCC] commonly metastasized to the central nervous system, and are radioresistant lesions. Because RCC patients are more likely to be long-term survivors of their primary disease, they are at greater risk of neurologic disability or death. An accessible single metastasis is amenable to surgical excision, but the disease may recur despite conventional radiotherapy. Gamma Knife [GK] radiosurgery offers an alternative treatment often effective for "radio-resistant" lesions. The Detroit Medical Center's 5-year experience using GK radiosurgery to treat brain metastases from varied primary histologies was reviewed to evaluate local response and duration and quality of survival among patients with RCC CNS metastases.

METHODS: A consecutive series of 30 patients suffering CNS metastases from primary Renal Cell Carcinoma treated by GK radiosurgery between 1996 and 2001 was retrospectively analyzed. At diagnosis, 18 patients had single and 12 had multiple metastases lesions. These 30 patients (19 male, 11 female) presented with a total of 114 lesions at diagnosis.

RESULTS: Median tumor volume was 2.55cm³ (range: 1.2-4.1 cm³). Median age was 63 years (range: 44-81 years), and all patients convention radiotherapy prior to GK treatment, as all had progressive CNS disease. A median marginal dose of 18 Gy (range: 15-20 Gy) typically prescribed to the 50% isodose line. Local response was assessed by review of serial MRI studies. Duration of survival was defined from the time of initial GK treatment. Quality of survival was assessed by serial Karnofsky Performance Scores.

CONCLUSIONS: Outpatient GK radiosurgery was well tolerated, safe, and effective, controlling local tumor progression. Duration and character of survival will be discussed.

OBJECTIVES: To understand the outcomes of patients with renal cell carcinoma brain metastases treated with gammaknife.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Experience with 3 Tesla MRI and Stereotactic procedures

AUTHORS: Roberto Neurosurgeon Martínez-Alvarez, MD,PhD; German Physics Rey, PhD; Juan Radiologist Linera, MD; Juan Neurosurgeon Burzaco, MD,PhD; Nuria Oncologist Martínez-Moreno, MD; Jorge Physics Gutierrez, MSc; Jose Radiologists Escribano, MD; Gonzalo Neurosurge

INTRODUCTION: To obtain information about the usefulness of 3 tesla MRI in stereotactic procedures, the authors describe their experience with 3 tesla MRI in distortion check up and with 20 patients treated for functional procedures, stereotactic biopsies and radiosurgery with Gamma Knife.

METHODS: We began in April 2002 using the 3 tesla MRI. We have checked up the distortion using an original phantom and the images have been processed with Gamma Plan and Stereoplan. The Radiology Department has developed MRI protocols for localization of thalamic nuclei (T2 sequences) and anatomical targets (3DT1 series). In every case, stereotactic MRI examinations have been done both in 1.5 tesla and 3 tesla MRI.

RESULTS: Stereotactic accuracy of the system resulted in 0.3 mm (similar to 1.5 tesla examinations). Better anatomical definition has been observed in 3 tesla MRI, including subthalamic nucleus and risk structures in radiosurgical procedures such as the cranial nerves. Stereotactic angio MRI with flair sequences is not available yet. Artifacts due to titanium screws and aluminum posts are more frequent.

CONCLUSIONS: Stereotactic procedures based on 3 tesla MRI can be done without distortion. It is indicated in selected cases in whom anatomical localization of different structures is important. Specific software is necessary to increase the number of cases suitable for this procedure.

OBJECTIVES: - Feasibility of stereotactic procedures based on 3 tesla MRI - How to use the 3 tesla MRI for stereotactic operations - Indications of 3 tesla MRI in stereotaxy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Deep Brain Stimulation Induces Immediate Relief of Levodopa-Induced Dyskinesiae

AUTHORS: Jay Shils, PhD; Michele Tagliati, MD; Neng Heung, MD; Joan Miravite, RNC; Brendan Sullivan, PA-C; Ron Alterman, MD

INTRODUCTION: Reduced levodopa-induced dyskinesiae (LID) following subthalamic deep brain stimulation (DBS) are largely attributed to post-operative reductions in dopaminergic medications. We report clinical observations that contradict this supposition.

METHODS: We reviewed standardized videotapes of seven Parkinson's disease patients (5 males, 2 female) with a history of severe peak-dose LID who underwent bilateral subthalamic DBS surgery. The AIMS dyskinesia rating scale was used to rate the severity of LID in two states: 1) On medications/ Stimulators off; and 2) On medications/Stimulator on.

RESULTS: The mean daily levodopa dose was 978 mg (STD: 351.8). The time interval from surgery to assessment ranged from 4 to 16 months. Stimulation parameters were optimized for each patient. The mean dyskinesia scores were 7.2 +/- 4.9 at baseline (ON meds/OFF stim) 1.2 +/- 1.3 immediately after the stimulators were turned ON. Real-time video of dyskinesia cessation following commencement of stimulation will be shown.

CONCLUSIONS: These findings suggest that the reductions in LID following subthalamic DBS surgery may be a direct effect of stimulation and not a consequence of dopaminergic medication reductions.

OBJECTIVES: Understand the independent effect subthalamic DBS on levodopa-induced dyskinesiae in Parkinson's disease patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Experience with 3 Tesla MRI and Stereotactic procedures

AUTHORS: Roberto Martínez-Alvarez, MD,PhD; German Rey, PhD; Juan Linera, MD; Juan Burzaco, MD,PhD; Nuria Martínez-Moreno, MD; Jorge Gutierrez, MSc; Jose Escribano, MD; Gonzalo Bravo, MD,PhD

INTRODUCTION: To obtain information about the usefulness of 3 tesla MRI in stereotactic procedures, the authors describe their experience with 3 tesla MRI in distortion check up and with 20 patients treated for functional procedures, stereotactic biopsies and radiosurgery with Gamma Knife.

METHODS: We began in April 2002 using the 3 tesla MRI. We have checked up the distortion using an original phantom and the images have been processed with Gamma Plan and Stereoplan. The Radiology Department has developed MRI protocols for localization of thalamic nuclei (T2 sequences) and anatomical targets (3DT1 series). In every case, stereotactic MRI examinations have been done both in 1.5 tesla and 3 tesla MRI.

RESULTS: Stereotactic accuracy of the system resulted in 0.3 mm (similar to 1.5 tesla examinations). Better anatomical definition has been observed in 3 tesla MRI, including subthalamic nucleus and risk structures in radiosurgical procedures such as the cranial nerves. Stereotactic angio MRI with flair sequences is not available yet. Artifacts due to titanium screws and aluminum posts are more frequent.

CONCLUSIONS: Stereotactic procedures based on 3 tesla MRI can be done without distortion. It is indicated in selected cases in whom anatomical localization of different structures is important. Specific software is necessary to increase the number of cases suitable for this procedure.

OBJECTIVES: - Feasibility of stereotactic procedures based on 3 tesla MRI - How to use the 3 tesla MRI for stereotactic operations - Indications of 3 tesla MRI in stereotaxy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Unilateral Deep Brain Stimulation of the Subthalamic Nucleus

AUTHORS: Roy A E Bakay, MD; Leo Verhagen, MD; Jean Arzbaeher, CNRN,MS,RN; Diane Sierens, MD; Brian Myre, MD; Niek Verwey, MD

INTRODUCTION: Bilateral STN DBS can improve all cardinal features of PD. While a bilateral procedure for a bilateral disease is appropriate, a unilateral procedure may proffer sufficient benefit in this asymmetric disease with a potentially improved side effect profile. If, in particular, ipsilateral and axial symptoms respond to unilateral STN DBS, the need for a second procedure may be postponed or even eliminated in a subgroup of patients.

METHODS: 25 consecutive PD patients were evaluated 1-3 weeks before and 3-6 months after surgery in the defined "off" and "on" conditions by the same rater. Stimulation "on" and stimulation "off" was evaluated in randomized order under double-blind conditions. The evaluations included UPDRS-III; UPDRS-III items 23-25 and timed motor tests according to CAPIT protocol. Self reported quality of life measures (PDQ-39) were evaluated before and 3-6 months after surgery (N=23).

RESULTS: In the "off" state, median UPDRS-III scores for the 3 visits (Baseline, Stimulation Off, Stimulation On) were 40, 33 and 26.5, respectively ($p < 0.00001$). Median % improvement in UPDRS-III from Baseline to Stimulation On was 31%. Significant improvements were observed in median contralateral UPDRS-item 23-25 scores ($p < 0.001$), median contralateral timed tests in the "off" state (pronation/supination: hand/arm; Perdue pegboard) ($p < 0.001$), and the stand/walk/sit tes ($p < 0.0001$). Corresponding ipsilateral results demonstrated non-significant changes. The mean PDQ-39 scores improved from 36.3 to 26.5 ($p < 0.01$) as well as 5 of 8 dimensions.

CONCLUSIONS: Unilateral STN DBS was associated with a clinically meaningful improvement in motor and quality of life measures. The effect on upper extremity tasks was mainly contralateral. The stand/walk/sit test showed remarkable improvement in gait. These results suggest that unilateral STN DBS may be a viable alternative to a bilateral procedure, at least initially, for those advanced PD patients in whom asymmetry of symptoms is maintained.

OBJECTIVES: Discuss the advantages of unilateral STN DBS. Discuss the disadvantages of unilateral STN DBS. Discuss the Parkinson's quality of life score (PDQ-39).

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Longterm Outcome of Spinal Cord Stimulation and Hardware Complications

AUTHORS : David G Quigley, FRCS,MBBS; Jonathan Arnold, ; Paul R Eldridge, FRCS,MBBS; Heather Cameron, BSc; Kate McIvor, BSc; John B Miles, FRCS,MBBS; Thelkat R.K. Varma, FRCS,MBBS

INTRODUCTION: Spinal cord stimulation is used as a treatment modality for medically intractable pain. A recent publication reviewed the long-term results and highlighted the incidence of revisions (1). We have repeated this study at a second centre in a larger cohort of patients to compare the results.

METHODS: A retrospective review of medical/surgical records along with a postal questionnaire. The subjects were 120 (57 male 45 female) patients with severe medically intractable chronic pain , who underwent SCS implantation at The Walton Centre.

RESULTS: There were 64 revision operations carried out on 35 patients. These comprised electrode replacement/repositioning (29), generator replacement (23), cable failure (3) and implant removal (5). The infection rate was 4.9% and 2 of these infections necessitated system removal. These results are similar to those in the earlier study, with the exception of the number of battery revisions performed in the Kay et al study. This may be explained by the relatively small number of IPG systems implanted in the early stages of our study. Clinician reported pain relief was substantial in 69 (68%) of patients. Patient reported pain relief was substantial in 51 (76%) of the 67 replies.

CONCLUSIONS: The majority of patients in both series undergoing SCS derive significant benefits in terms of pain relief. However both studies confirm that surgical revisions remain commonplace due to technical and biological factors and that a dedicated team approach is required for optimum utilisation of these devices. Reference :
1. Kay AD, McIntyre MD, Macrae WA, Varma TRK. Spinal cord stimulation-a longterm evaluation in patients with chronic pain. British Journal of Neurosurgery 2001; 15(4): 335-341

OBJECTIVES: Understand the potential indications for spinal cord stimulation.Be aware of the need for a team approach to utilise these devices.Be aware of the possible need for revision surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Clinical Implementation of an Automated Planning System for Gamma Knife Radiosurgery

AUTHORS: Lawrence S Chin, MD; David M Shepard, PhD; Steven J DiBiase, MD; Shahid A Naqvi, PhD; Jinho Lim, PhD; Michael C Ferris, PhD

INTRODUCTION: Creating the optimal treatment for radiosurgery can be time consuming and difficult particularly with large or irregularly shaped lesions. We have developed an automated treatment planning system that optimizes shot number, size, location, and weighting.

METHODS: We assessed the clinical significance of the automated system by comparing an optimized plan with a manual plan for ten consecutive patients. Each treatment plan was analyzed using dose volume histograms in conjunction with the conformity index, the minimum target dose, and the integral normal tissue dose.

RESULTS: The quality of the treatment plan produced by the inverse planning tool consistently matched or surpassed the corresponding plan created by an experienced physician. The optimized plan was typically produced in less than 10 minutes. Examples of specific cases will be shown.

CONCLUSIONS: The automated planning system reduces the time required for Gamma Knife treatment planning while improving the quality of the dose distribution. In selected cases, we preferentially use the plan created by the automated program.

OBJECTIVES: 1. Understand the inverse-planning algorithm. 2. Describe the parameters used to evaluate radiosurgery treatment plans. 3. Describe the advantages of the automated treatment planning program over conventional planning.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Localization of Subcortical Targets with a Near-Infrared Probe: the "Stereotactic Periscope"

AUTHORS: cole a giller, MD,PhD; Dwight C German, PhD; Hanli Liu, PhD

INTRODUCTION: We developed a stereotactic probe using near-infrared (NIR) light to measure the optical properties of tissue at its tip. The ability of these measurements to distinguish gray matter from white matter has been validated in animals and humans. We now report the use of this probe to localize structures such as the subthalamic nucleus (STN), and report early experience with a modification that directs light perpendicular to the probe axis to allow a periscopic "look to the side" in any direction.

METHODS: An NIR probe interrogated 81 tracks in 53 procedures (32 STN implantations and 21 thalamic implantations). Measurements were obtained every 0.5 mm from the cortical surface to the target. Each track required 2 to 5 minutes for interrogation. Comparison was made to postoperative MRI in all cases and to microelectrode recording in 7 cases. The side-looking probe has been used in 9 cases.

RESULTS: There was no morbidity associated with the NIR probe (total of 124 insertions to date). The substantia nigra, marking the floor of the STN, was identified as a sharp fall in the NIR signal in 88% of the STN implantations, and Forel's field could be identified as an NIR peak in 47%. The thalamic floor was identified in 75% of the thalamic implantations, and the white matter of the thalamic roof was identified in 85%. NIR signals also reliably identified ventricles, cortical sulci, and the caudate nucleus. The side-looking probe could identify the boundary of the internal capsule both anterior and lateral to the STN without requiring additional tracks in those directions.

CONCLUSIONS: Localization of subcortical structures can be achieved quickly and safely with the NIR probe. The side-looking probe, acting as a "stereotactic periscope", allows interrogation of nearby tissue and may reduce the need for multiple tracks.

OBJECTIVES: 1. Be familiar with optical properties of cerebral tissue. 2. Discuss the use of near-infrared probes for stereotactic localization. 3. Discuss the advantages and disadvantages of optical localization.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Effects of Pallidotomy on the Parkinsonian Subthalamic Nucleus

AUTHORS: Vasilios A Zerris, MD,MSc; Jeff Arle, MD,PhD; Jay Shils, PhD; Ron Alterman, MD

INTRODUCTION: A increasing number of patients undergoing implantation of subthalamic nucleus (STN) stimulators have previously undergone stereotactic ablative procedures. The effects of previous surgery on the efficacy of STN stimulation and the electrophysiologic parameters of the STN have not been studied in depth.

METHODS: We present fourteen patients who underwent implantation of bilateral STN stimulators following previous unilateral pallidotomy. The patients are the combined experience of two functional neurosurgery centers, who use the same neurophysiologist. Patient demographic data, clinical data, and intraoperative electrophysiologic data were collected via a retrospective chart review. Clinical improvement was monitored using the Hoehn-Yahr (H&Y) scale and the Unified Parkinson Disease Rating Scale. Preoperative data was collected in both the OFF and ON medication state. Patients were brought into the hospital after being OFF their medication for at least 12 hours. Postoperative data collection was performed in the following conditions: (1) OFF (medication)/ OFF (stimulator); (2) OFF/ON; (3) ON/OFF; (4) ON/ON. Electrophysiologic comparisons of STN firing patterns were made between the unlesioned side and lesioned side and to data collected from patients who had not undergone any previous movement disorder surgery.

RESULTS: All of the patients showed improvement in their UPDRS III (motor), UPDRS II (ADL), and H&Y scores following STN electrode placement. All post-operative tests were performed at least three months post surgery. A significantly lower variance in the firing frequency was noted in the STN on the lesioned side compared to the contralateral hemisphere. There is a trend toward the GPi lesioned side to having a lower stimulation energy than the non-lesioned side, but that data is not statistically significant.

CONCLUSIONS: Previous pallidotomy demonstrates significant effects on the electrophysiologic characteristics of the parkinsonian STN. The decrease in the firing rate variability of the STN is not easily explained by the feed-forward mechanisms described in the direct and indirect pathway model and underlines the complexity of the basal ganglia circuitry.

OBJECTIVES: 1.Understand the electrophysiologic alterations in the parkinsonian STN following pallidotomy. 2.Understand the effects of pallidotomy on the efficacy of bilateral STN stimulation in parkinson disease. 3.Further their understanding of the complexity of the basal ganglia circuitry.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Hemorrhagic complications of microelectrode-guided DBS

AUTHORS: Devin K. Binder, MD,PhD; Philip A. Starr, MD,PhD

INTRODUCTION: The incidence of intracranial hematoma occurring during microelectrode-guided implantation of deep brain stimulators (DBS) for movement disorders has not been well defined. We report the incidence of both symptomatic and asymptomatic hemorrhage, in a large series of DBS implants into the subthalamic nucleus (STN), thalamus (VIM), and internal globus pallidus (GPi).

METHODS: All DBS procedures performed by a single surgeon (PAS) between June 1998 and October 2002 were included in this study. All patients had postoperative imaging (MRI or CT) 4-24 hours following surgery. All hematomas > 0.2 cc in volume were noted and logged into a database. Hematomas were scored as symptomatic (associated with any new neurologic deficit lasting > 24 hours) or asymptomatic. Statistical correlation of the risk of hematoma formation with # of microelectrode recording (MER) penetrations, patient age, and brain target was assessed using logistical regression analysis.

RESULTS: The total number of lead implants was 267. The total number of MER penetrations was 740. There were five symptomatic hematomas and six asymptomatic hematomas. All hematomas were intraparenchymal. Of the five symptomatic hematomas, two resulted in permanent new neurologic deficit. The relative risk of hematoma (any type) per lead implant was 4.1%. The incidence of hematoma by target site was 3.8% per lead for STN-DBS, 9.1% for GPi-DBS, and 0% for VIM-DBS. In this data set, there was not a statistically significant relationship between risk of hematoma and # MER penetrations or patient age. There was a significant effect of brain target ($p=0.02$), with no hemorrhages detected following VIM DBS.

CONCLUSIONS: The overall risk of intraoperative or early postoperative symptomatic hemorrhage for microelectrode-guided DBS, over all targets, was 1.9% per lead implant. Brain target had a significant effect on risk of hemorrhage.

OBJECTIVES: 1. Discuss observed incidence of brain hemorrhage following DBS implantation. 2. Discuss target target dependence of hemorrhage. 3. Discuss effect of age and # of MER penetrations on risk of hemorrhage.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Variability in position of the subthalamic nucleus targeted by magnetic resonance imaging and microelectrode recordings as compared to atlas co-ordinates.

AUTHORS: Patricia Littlechild, FRCS; Thelekat R K Varma, FRCS; Paul R Eldridge, FRCS; Susan Fox, MD; Alan Forster, MD; Nick Fletcher, MD; Malcolm Steiger, MD; Patricia Byrne, RN; Kath Tyler, MSc; Sally Flintham, BSc

INTRODUCTION: With the advances in magnetic resonance imaging, it is now possible to directly visualise the target nuclei for deep brain stimulation of the subthalamic nucleus (STN). Concerns about image distortion have previously inhibited the sole use of MRI to obtain target co-ordinates. Using axially obtained MR datasets the STN was directly targeted and the position verified with microelectrode recordings. The position of the STN was found to show significant individual variation in relation to the inter-commissural line.

METHODS: With a skull fiducial system in place the patients were imaged on a 1.5T MRI scanner using an axial T2 spin echo sequence. The images were reformatted and the STN targeted directly. Surgery was performed using a neurosurgical robot in frameless mode with microelectrode recording and macrostimulation. Postoperatively the most effective contact was identified for each patient, and its position calculated in relation to the mid-commissural point. All patients underwent assessment of the UPDRS before surgery and at six months.

RESULTS: 34 electrodes were inserted in 17 patients. The target position varied considerably in relation to the mid-commissural point, with a spread of 4 -7 mm in each plane. 85% of electrodes were inserted within 3 mm of initial target position. Only a single microelectrode trajectory was required in 77% of electrode placements. The mean effective contact position was found to lie just dorsal and lateral to the location of the STN as shown in standard brain atlases. Post-operative results were good with 52% reduction in UPDRS öoff medicationí motor scores.

CONCLUSIONS: The STN can be satisfactorily targeted from axially acquired MR data. There is significant variation in the position of the nucleus and the ideal site for stimulation appeared to be above the position of the STN as indicated in standard atlases.

OBJECTIVES: Targeting of the STN, Variability in position of the STN, Outcomes of STN-DBS.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Complications and Outcome in 1428 Surgical Procedures for Epilepsy. A Comprehensive Review of Contemporary Epilepsy Surgery from One Epilepsy Center

AUTHORS: Werner K Doyle, MD

INTRODUCTION: A retrospective review of a large contemporary surgical series from a single center by one surgeon is presented. The series spans 8 years. Demographics, outcome, efficacy, complications, patient selection criteria, general surgical technical descriptions, and surgical philosophy are discussed.

METHODS: Data is from 944 craniotomies, 88 bilateral invasive surveys, 69 1-stage resections, 369 2-stage procedures, 42 3-stage procedures, 296 vagus nerve stimulator operations, and 38 stereotactic procedures. 695 unique patients underwent 480 craniotomies. Average age for patients with craniotomy was 31 +/- 12 years. 47 percent were female. Outcome reporting uses minimally modified Engle scores.

RESULTS: 1-stage resections (primarily anterior medial temporal lobectomy with hippocampectomy) when stratified by Engle scores 1/2/3/4 respectively comprised 91/6/4/0% of the entire group, with 76% follow up. 2-stage procedures, involving invasive VEEG prior to resection, had respective outcome scores 64/14/14/8% with 81% follow up. 3-stage procedures yielded outcome stratification 50/19/28/3% with 76% follow up. 1, 2, and 3 stage operations were associated with decreases of 3 full Engle grades between pre-op and post-op states in 83%, 53%, and 41% respectively. Demographics of the patient group without outcome statistics because of outstanding follow up data are not different from demographics of reported outcome group. Demographics and complications are reported for all patients. The majority of follow data is over 2 years out from surgery. In this entire series there was no mortality and important morbidity were infrequent. The entire cranial series had 15 infections and 9 hemorrhages representing respective relative risk of 1.0% / 1.8% for hemorrhage and 1.6% / 3.1% risk for infection per craniotomy / per patient. Other common morbidities are subdural hygromas, hydrocephalus, memory deficits and 3rd nerve injury with respective incidence of 0.4% / 0.8%, 0.1% / 0.2%, 0.5% / 1.0% and >0.1% / >0.1%. Bone resorption requiring cranioplasty occurred in 3 patients. No vascular injury with symptomatic or functional results occurred.

CONCLUSIONS: There was no mortality in this entire series and important morbidity and complications were infrequent. The most common morbidity is hemorrhage and infection. Single and multi-stage procedures have acceptable risks and excellent to good seizure control.

OBJECTIVES: Risks and benefits of contemporary Epilepsy Surgery, including temporal lobectomy, seizure focus resection, and multistage procedures utilizing invasive VEEG and extra-operative functional mapping.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Surgically Remediable Catastrophic Epileptic Encephalopathy of Temporal Lobe Origin

AUTHORS: Bartolome Oliver, MD,PhD; Antonio Russi, MD; Emilio Ayats, MD

INTRODUCTION: Epileptic encephalopathies in children and Lennox-Gastaut Syndrome have not been related to temporal lobe epilepsy (TLE). Non-lesional TLE is rare in children epilepsy surgery series. We present a previously not well recognized temporal lobe catastrophic epileptic encephalopathy in three patients.

METHODS: Since 1987 to 2001, 250 epilepsy surgery operations have been performed in our epilepsy program. All surgical candidates had long-term video-EEG monitoring with computerized EEG signal treatment programs. Neuropsychology evaluation and 1.5 Tesla MRI since its introduction. PET scan and invasive recording were used in 30% of the cases. All three patients of the present report had PET and invasive EEG studies prior to cortical resection.

RESULTS: Three children with generalized EEG epileptiform activity, very frequent seizures (several every day) and cognitive and behavior deterioration, previously diagnosed as generalized epilepsies of the Lennox-Gastaut syndrome type, were found to have a temporal lobe origin of the seizures after presurgical evaluation including video-EEG monitoring, RM, PET, and invasive EEG studies. Anterior temporal lobe resection eliminates the seizures in all three cases and patients experience a regression of the cognitive and behavior deterioration. Minimum follow-up is one year and all three remained seizure-free.

CONCLUSIONS: Epileptic encephalopathies in children have to be intensively evaluated and in selected patients an invasive EEG evaluation can disclose a TLE surgically remediable.

OBJECTIVES: Bring attention to a group of catastrophic epilepsies of temporal lobe origin. Show the criteria used to select these patients for surgical resection. Stress the reversibility of cognitive and behavior deterioration in these patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Complications and Outcome in 296 Vagus Nerve Stimulator Procedures for Epilepsy

AUTHORS: Werner K Doyle, MD

INTRODUCTION: A retrospective review of all surgical procedures at a single center for treatment of epilepsy yielded 296 for vagus nerve stimulation (VNS) operations. The consecutive series spans 5 years beginning in 1997 when VNS received FDA approval. Demographics, outcome and efficacy, complications, patient selection criteria, and general surgical technical descriptions are discussed.

METHODS: Inclusion criteria was VNS surgery for epilepsy, for which at least one year follow up was available. This yielded 296 (24%) operations out of 1221 consecutive epilepsy procedures. The author performed all the procedures. 159 (54%) patients had only VNS surgery and 138 had other kinds of epilepsy surgery such as craniotomy or burr holes. Average age at time of surgery was 27.1 years (+/- 14.7 years, max = 73 years, min = 1 year). 145 patients were female. 28 patients had at one, 24 had two, 4 had three, and 12 had 5 or more of other epilepsy procedures.

RESULTS: 248 were first time implants and 48 revisions that included 30 replacements for battery depletion and 19 removals without replacement. Complications included: 5 infections, 2 wire lead erosion through skin, 1 wire lead failure in a "tiddler", and 1 explant for side effect intolerance. Two patients experienced vocal cord paralysis from vagus nerve injury, both injuries resolving after 5 months. Two other patients sustained vagus nerve injury during electrode removal in setting of infection; one permanent. Two other patients developed a partial vagus nerve injury beginning 48 hours after implant which resolved by 4 weeks, thought due to edema. 75% of implanted patients had complete outcome information. For these patients the average Engel score pre and post implant was 3.89 (s.d. = 0.40) and 2.96 (s.d. = 0.80) respectively. Pre and post VNS Engle score of 1/2/3/4 were 0.7/1.3/6/92% and 7/12/58/23% respectively. Changes in score of -1/-2/-3/-4 were represented by 62/11/1/2% of patients. Seven patients experienced worsening (increase) in scores.

CONCLUSIONS: Our data is consistent with accepted efficacy and relative safety of VNS therapy for medically refractory Epilepsy, and provides guide lines for expected outcome and complications. Surgery nuances and risk avoidance is discussed.

OBJECTIVES: Efficacy and complications of vagus nerve stimulation, technical issues of VNS implantation, patient selection criteria

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Peri-lenticular Nucleus Hemispherotomy

AUTHORS: Bartolome Oliver, MD,PhD; Antonio Russi, MD; Emilio Ayats, MD

INTRODUCTION: Villemure and Mascott defined hemispherotomy as the surgical procedure that requires the smallest brain volume removal to accomplish a complete hemispheric disconnection. The Delalande et al. approach is performed through a parasagittal craniotomy and a posterior frontal topectomy sectioning the hemisphere through the basal ganglia, and Villemure and Mascott procedure needs a supra and infrainsular windows. We develop a variant of these techniques that is the purpose of this presentation.

METHODS: Five hemispherical disconnection procedures has been performed in the epilepsy surgery program of Teknon Medical Center. There were 4 male and 1 female patients. Ages ranged from to years. The causes of hemispherical pathology were, meningitis in one, perinatal brain damage in two, Rasmussenís syndrome in one and cortical dysplasia in one. One patient with cortical dysplasia had two previous surgical procedures in another institution, corpus callosotomy and peri-rolandic cortical excision. The surgical steps are; the approach and the disconnection procedure itself. Fronto-rolandic opercular topectomy. Transventricular corpus callosotomy, Subfrontal section with the pericallosal arteries as a guide, Peri-lenticular nucleus extreme capsule leucotomy until the temporal horn, Amygdalectomy radically performed, Within the ventricular atrium, recognition of the fimbria severing its union to the fornix. Radical resection of the splenium of the corpus callosum identification of the tentorial incisura subpially and to assure complete disconnection section of the medial floor of the atrium until the tentorium.

RESULTS: Four seizure-free patients, one some seizures every year. Peri-lenticular hemispherotomy preserve as much of the anatomy of the operated hemisphere as possible, permit removal of insular cortex, small cortical exposure is required and less arachnoid resorption area loss, avoid sectioning the basal ganglia. In our variation of the hemispherotomy technique there is no interference with the arterial or venous drainage in the sylvian fissure. The opposite of what happens in Villemure technique. The technique is congruent with the logical principle of a disconnection procedure that runs through white mater with a minimum resection of cortex in an avascular or rather avascular layer.

CONCLUSIONS: Peri-lenticular nucleus hemispherotomy has become the standard procedure for hemispherical disconnection in our institution

OBJECTIVES: Technical principles of the technique. Related surgical anatomy. Results obtained in the first 5 cases.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: The Significance of Tumor Location in Gamma Knife Treatment for Meningiomas

AUTHORS: Thomas F Mindermann, MD; Olivier de Rougement,

INTRODUCTION: Tumor location influences the outcome of surgery for meningiomas. To evaluate its influence on the outcome of gamma knife treatment (GKT), we retrospectively reviewed patient charts.

METHODS: Patient charts of patients treated for meningioma at the Gamma Knife Center Zurich from January 1995 until August 2001 were reviewed. MRIs following GKT were done at 6 months, 12 months, and then in yearly intervals.

RESULTS: Of the 95 patients, 8 had multiple meningiomas. Of the remaining 87 patients, 81 had a follow up of more than 6 months. Of the 81 (100%) patients, 50 (62%) had a skull base meningioma (SBM), 19 (23%) had a parasagittal or convexity meningioma (PCM), and 12 (15%) had a posterior fossa meningioma (PFM). Tumor volumes were 6.2 ml in SBM, 7.4 ml in PCM, 3.4 ml in PFM. Prescription doses were 13.8 Gy in SBM, 15.0 Gy in PCM, and 14.6 Gy in PFM. Tumor control was achieved in 92% of SBM, 95% of PCM, and 100% of PFM. Neurological deficits were present in 62% of patients with SBM prior to GKT and in 46% of patients with SBM following GKT. Neurological deficits were present in 5% of patients with PCM prior to and following GKT and in 17% of patients with PFM prior to and following GKT. Surgery following GKT was necessary in 2/22 (9.1%) patients with PCM following GKT due to an increase in tumor volume. No other patients required surgery following GKT.

CONCLUSIONS: Tumor location matters in the outcome following GKT for meningiomas. Deep tumor location and small tumor size seem to be associated with better tumor control and less complications. Neurological deficits seem to improve more often than they worsen; they do not seem to occur de novo following GKT.

OBJECTIVES: better evaluate indications for gamma knife treatment of meningiomas understand the impact of tumor location on outcome understand that there is a very low risk for the development of new neurological deficits following gamma knife treatment understand that neurological deficits more often improve following gamma knife treatment than that they worsen

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Transplantation

TITLE: Differentiation of human embryonic stem cell-derived neural precursors following transplantation into the immunodeficient mouse brain

AUTHORS: Daniel J Guillaume, MD; Su-Chun Zhang, MD, PhD

INTRODUCTION: Transplantation of neural progenitor cells offers promise for many neurodegenerative conditions. Use of fetal brain-derived cells is problematic due to limited supply of donor tissue. Human embryonic stem (hES) cells, established from the inner cell mass of the pre-implantation embryo, provide an unlimited source of many cell types. This study characterizes these cells' ability to survive, migrate and differentiate following transplantation into the immunodeficient mouse brain.

METHODS: Human neural precursors, grown as free-floating neurospheres, were induced and isolated from hES cell line H9, transduced with the gene for green fluorescent protein (GFP) by lentiviral infection, and transplanted into the lateral ventricle of neonatal SCID mice. Each month following transplantation, the recipients were perfused with 4% formaldehyde, brains were removed and sliced into 30 um sections. Migration of grafted cells was evaluated. Immunohistochemistry was performed to characterize GFP-positive cell differentiation. Staining was visualized with fluorescence and confocal laser microscopy.

RESULTS: At one month, most implanted cells remained within the ventricular system, predominantly at the implantation site and through the tract created by injection. Other GFP-positive cells were detected within the third and fourth ventricles. Implanted cells at this stage positively stained with nestin, BIII-tubulin and MAP-2 antibodies. By five months, isolated GFP-positive cells were noted throughout the ventricular system, including the contralateral hemisphere, cerebellum and spinal cord. Individual cells extended from the lateral and third ventricles into the parenchyma where they expressed MAP-2 and BIII-tubulin. Many cells remained nestin-positive throughout the time-points studied, and some began to express GFAP.

CONCLUSIONS: Human ES cell-derived neural precursors survive, migrate, and differentiate into various neural cells following transplantation into the neonatal SCID mouse brain. Further studies will determine if these cells can establish connections and restore function in neurological disease models.

OBJECTIVES: At the completion of the session, participants should be familiar with neurotransplantation strategies to date and should understand the rationale for implanting hES cells in animal models of neurological disease.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Precision and Accuracy of a new Robot designed for Neurosurgery

AUTHORS: Rene Krishna, MD; Michael Zimmermann, PhD; Andreas Raabe, PhD; Volker Seifert, Prof

INTRODUCTION: Computer-based surgical techniques are substructures for robotic neurosurgery. To increase quality of interventions high precision manipulators were developed. The precision kinematic "Evolution" (Universal Robot Systems, Schwerin, Germany) is a new robotic tool especially designed for neurosurgery. This study demonstrates the reposition accuracy after more than six hours of uninterrupted use.

METHODS: A 5 mm crosshair fixed to a skull-base model was visualized with a robot-mounted Storz endoscope. The robot was programmed to reach in and out of the simulated operating field 300 times, performing a complex three dimensional movement. Every active axis of the Stewart platform was used. A cycle completed in 75 seconds, the trial, documented on VHS video, lasted for 385 minutes. Sequences of the beginning and end were digitalized and coloured with a graphic program on a standard PC. Single frames of corresponding target positions were superimposed on each other and scanned for breaks in the contours of prominent edges.

RESULTS: The program executed without failure, no technical problems were encountered. The pixel size in the captured images was calculated with 10 micro-meter. After superimposing the images of the beginning and end of the test no breaks in the contours were detected. The reposition accuracy was found in the range of 10 micro-meter.

CONCLUSIONS: After more than six hours of continuous and complex movement of every single active axis the robot returned precisely to the target point with an inaccuracy not detectable for the human eye. This accuracy can not be reached by a surgeons hand.

OBJECTIVES: assess robotic technology for medical applications, discuss the potential clinical use of robots, understand the superior precision of positioning of a robotic device

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Prognostic Factor Analysis for Melanoma Brain Metastases Treated with Radiosurgery

AUTHORS: Lucia Zamorano, MD; Jorge Gonzalez-Martinez, MD; Andrews Sloan, MD; James Fontanesi, MD; Kenneth Levin, MD; Qinghang Li, PhD; Fernando Diaz, MD

INTRODUCTION: This study provides data from a clinical experience with radiosurgery in the treatment of melanoma brain metastases and identifies parameters that may be helpful in the selection and therapy of these patients.

METHODS: We have studied 27 patients with the diagnosis of melanoma brain metastases who were treated with Radiosurgery in the department of Neurosurgery and in the Radiation Oncology Center at Wayne State University since August, 1993. The mean age was 62.1 years, 15 patients had Karnofsky index higher than 90 at the time of the radiosurgical procedure. 72.4% of the patients had systemic disease. The mean time between the diagnosis and the brain metastases was 33 months. The mean volume of the lesions was 1.71cc. The dose of radiation used for the radiosurgery treatment varied between 14Gy and 21Gy (mean: 17Gy). 22 patients(75.9%) were treated with external beam radiation, 20 patients(74%) received chemotherapy and 10 patients(37%) immunotherapy.

RESULTS: The mean survival was 4.7months after the radiosurgical procedure. The univariate and multivariate analyses showed no statistical difference in terms of survival between the groups that received external radiation or chemotherapy. An statistical difference ($p < .05$) in the mean survival was obtained between the group that received immunotherapy. The Karnofsky index higher than 90 was associated with a better survival (5.81 months).

CONCLUSIONS: In conclusion, the treatment with immunotherapy and the Karnofsky index higher than 90 were the factors associated with better prognosis in our patients, with statistical significance when compared with other groups.

OBJECTIVES: To understand the outcomes of the patient with melanoma brain metastases treated with gamma knife radiosurgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Stereotactic radiosurgery of skull base meningiomas - Tumour metabolism as predictive parameter

AUTHORS: Peter Warnke, MD; Danny Fritzsche, MD; Ekkehard Kasper, MD,PhD; Christoph B Ostertag, MD

INTRODUCTION: In order to establish parameters predictive for volume reduction after radio-surgery we performed a prospective controlled study in 56 skull base meningiomas.

METHODS: All tumours were metabolically characterised before, and every three months after, radiosurgery for up to two years. 38 patients have completed the two-year follow-up yet median tumour volume was 6.5 ml. All patients underwent F-18 deoxyglucose SPECT imaging and thallium-201 SPECT before and after radiosurgery.

RESULTS: Clinically in 97% of patients tumour control could be achieved. In 3% a complete response could be seen and in 42% a partial response, meaning a more than 50% reduction of tumour volume. Correlation of metabolic and volumetric data showed that tumours responding by volume reduction had a significantly lower thallium-201 uptake ($p < 0.05$). Six months after radiosurgery a significant drop occurred in thallium uptake in responders vs non-responders ($p < 0.01$) which preceded MR-visible volume reduction. The median thallium-201 uptake in the responder group was 1.34 ± 0.15 compared to 1.68 ± 0.51 in non-responders. The glucose-utilisation pre-radiosurgery did not correlate to volumetric response of the tumours. Still three months after radiosurgery responders showed a significantly lower glucose-uptake ratio (1.04 ± 0.23) as compared to non-responders (1.075 ± 0.14).

CONCLUSIONS: Qualitative metabolic characterisation of skull base meningiomas using thallium-201 uptake correctly predicts the volumetric response of the tumours which also correlated significantly with the improval of cranial nerve deficits. Metabolic changes both using thallium-201 and glucose utilisation predicted the tumour response after radiosurgery before MRI changes became visible.

OBJECTIVES: Understand radiobiology of meningiomas Value the role of metabolic imaging Identify indications for radiosurgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Stereotactic interstitial radiosurgery in hypothalamic hamartomas - Functional outcome

AUTHORS: Peter C Warnke, MD; Peter C Warnke, MD; Brian Tedman, MD; David Chadwick, MD; Volker Homberg, MD; Andreas Schulze-Bonhage, MD; Christoph Ostertag, MD

INTRODUCTION: Gelastic epilepsy is almost exclusively caused by hypothalamic hamartomas. As this type of epilepsy is refractory to pharmacotherapy and microsurgery bears a significant risk in terms of endocrinological and neuropsychological deficits radiosurgery has been used in the past to treat these lesions with mixed outcome data. As external beam radiosurgery is limited in terms of applicable doses due to the eloquent surrounding structures, especially the visual tract, interstitial radiosurgery is an interesting alternative using point sources as this allows to give much higher doses in a hyperfractionated fashion. Also the dose gradient due to the low energy irradiation is much more favourable than high energy photon external radiosurgery.

METHODS: We have studied 10 patients in a prospective controlled study who all underwent serial biopsy for histological confirmation. Patients also underwent MR spectroscopy before and after interstitial radiosurgery and depth electrode recordings to clearly identify the epileptic focus. Also FDG-PET and iomazenil SPECT was performed. Interstitial radiosurgery was performed using iodine-125 with a reference dose of 60Gy to the lesion margin and a median dose of 10.7cGy per hour.

RESULTS: With a median follow-up of 12.8 months, 8 out of 10 patients are seizure free (Engel class I). The outcome in terms of Engel class I could be predicted by the rapid evolution of radionecrosis as determined by the change in the lactate/lipid ratio from MR spectroscopy already at the time of seed explantation ($R=0.81$ $p<.01$). In 6 patients the neuropsychological performance score was significantly improved at the time of follow-up after interstitial stereotactic radiosurgery. Both benzodiazepine receptor, SPECT and FDG-PET showed significant differences in temporal glucose utilisation ratio in patients suffering from gelastic epilepsy vs those with gelastic epilepsy and complex partial seizures ($p<.001$ and $p<.05$ respectively). No neurological or endocrinological morbidity has been seen during the follow-up.

CONCLUSIONS: Stereotactic interstitial radiosurgery is a potent therapeutic alternative to external beam stereotactic radiosurgery in the treatment of gelastic epilepsy caused by hypothalamic hamartomas. Though being invasive it renders a portion of 80% of patients seizure free and using functional imaging especially MR-spectroscopy and glucose PET outcome in terms of Engel classification could be predicted.

OBJECTIVES: To use radiosurgery for hamartomas To validate functional imaging in epilepsy To appreciate radiobiology of hamartomas

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: High-frequency stimulation of the Nucleus Subthalamicus for Parkinson's disease : technique and results in 54 implantations.

AUTHORS: Olivier Van Damme, MD; Philip Bourgeois, MD; Marc Deruytter, MD

INTRODUCTION: Deep brain stimulation is becoming a valid therapeutic option in severe parkinson's disease, especially in case of disabling dopa-induced dyskinesias and motor fluctuations. Technique and results of 46 parkinson patients treated with Nucleus Subthalamicus stimulation are reported.

METHODS: Between 1996 and 2002 54 STN stimulations were performed in 46 parkinson patients. 38 were treated bilaterally and 7 unilaterally. The mean age was 64 years 3 months. 5 patients underwent previously an unilateral pallidotomy because of dyskinesias. Unified Parkinson Disease Rating Scale (UPDRS), age, neuropsychological testing, dopamine response (on/off ratio) and MRI findings were recorded in all patients. The mean UPDRS III motor score with medication, measured in the "on" phase was 22,2 and in the "off" phase 48. All patients showed severe motor fluctuations and dyskinesias. Iodoventriculography, image fusion and a stereotactic atlas were used for target localisation. Semi- microelectrode or microelectrode registration were employed for functional targeting.

RESULTS: 54 electrodes in STN were implanted in 45 patients. The mean time of follow up was 12 months. STN stimulation improved the UPDRS III motor score by 66 % in the off-medication on-stimulation status in comparison to the preoperative off-medication situation. STN stimulation resulted in an 58 % levodopa dose reduction (preoperative 713 mg/ day, postoperative 300 mg/day). After stimulation the daily amount of time in the on phase without dyskinesias was tripled (preoperative 24 % versus postoperative 73 %). Intracerebral hemorrhage, resulting in a permanent hemiplegia was encountered in 1 patient. Transient perioperative psychosis was noted in 1 patient. 3 patients experienced a temporary confusion in the immediate postoperative period. Infection required the removal of 5 electrodes. Stimulation induced side effects were : transient dyskinesias (n = 3), dysarthria (n = 7) and eyelid apraxia (n = 2).

CONCLUSIONS: Our results confirm that bilateral STN high-frequency stimulation provides a significant improvement of motor function severe parkinson's disease, when disabling dopamine-induced dyskinesias and motor fluctuations are prominent. A mean levodopa dose reduction of 50 % can be obtained with STN stimulation. Patients can be held in a nearly continuous on phase during daytime.

OBJECTIVES: 1. the value of STN stimulation in parkinson's disease 2. Levodopa reduction with STN stimulation 3. significant motor improvement

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Selective Amygdalo-hippocampectomy in Temporal Lobe Epilepsy: Results in 200 Patients

AUTHORS: AndrÈ Olivier, MD,PhD; AndrÈ Olivier, MD,PhD; F. Andermann, MD; F. Dubeau, MD; Aviva Abosch, MD; N. Poulin, MD; W. Boling, MD

INTRODUCTION: Numerous studies of the electrophysiology and neuropathology of temporal lobe epilepsy have demonstrated the mesial temporal structures to be the site of seizure origin in the majority of cases. This is the rationale for a selective amygdalo-hippocampectomy approach first introduced by Niemeyer in the fifties.

METHODS: We present a series of 200 consecutive patients operated for mesial temporal epilepsy diagnosed by clinical patterns, the presence of mesial inter ictal and ictal discharges on EEG and the demonstration of hippocampal sclerosis and atrophy on MRI. The image guided technique developed at the MNI uses a transcortical approach and consists in a strictly endopial resection of the hippocampal formation and amygdala.

RESULTS: Eighty-one percent of patients who underwent selective amygdalo-hippocampectomy at the MNI have become seizure free. Poor results are seen in instances of neocortical, multifocal and bitemporal epilepsy. Neurological complications consist in 1 case of transient 3rd nerve paresis and 3 cases of transient dysphasia. Results are excellent on seizure tendency with minimal risks.

CONCLUSIONS: Selective amygdalo-hippocampectomy is in our experience the procedure of choice for mesial temporal epilepsy in well selected patients.

OBJECTIVES: understand 1) the technique of amygdalohippocampectomy 2) results of the procedure 3) advantages over other such methods.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Electrode Placement in Deep Brain Stimulation by Functional Identification of the Targets: Macro- vs. Microrecording

AUTHORS: Jan Vesper, MD; Fabian Klostermann, MD; Mario Brock, MD

INTRODUCTION: The intraoperative determination of final electrode position in Deep Brain Stimulation (DBS) is commonly realized by indirect imaging techniques. The value of both microrecording and macrorecording techniques for target setting is still uncertain. Somatosensory evoked potentials might provide an easily obtainable information which is robust toward electrical noisy surroundings, status of analgesia and intraoperative compliance of the patient.

METHODS: Median nerve SEP were recorded from the final stimulation electrode (Medtronic 3389) and spontaneous discharges were recorded using semimicroelectrodes (Inomed, Germany) in 38 surgical procedures of 23 patients (targets: 12 STN, 11 VIM). Accuracy of target setting was determined by recalculation of the predefined target coordinates in comparison to the exact position of the final active contact using image fusion technique. SEP recordings were performed in the calculated target and 1 cm and 2 cm above along the trajectory. Microrecordings were performed in 1 mm steps starting 1 cm above the target.

RESULTS: Differences between the calculated and the final targets in VG and CT ranged from 0,75 to 2,08 mm (mean 1,8 mm). Thalamic SEP macrorecording revealed specific patterns along the trajectory for STN (positive peaking around 18 ms) and VIM (negative peaking) electrode placement. In the VIM a phase-reversal of the SEP was observed in all cases. Therefore three mislocalized electrodes were detected, after corrections typical SEP were obtained. Microrecordings were inconstant with large differences between the patients. If recordings were successful, the points of maximal discharge revealed a sufficient clinical result with 130 Hz stimulation, especially in the STN.

CONCLUSIONS: VIM and STN could be distinguished by SEP criterias. Microrecordings were inconstant and ? until now - with a limited importance for setting of final electrode. Intraoperative image fusion was helpful in order to improve the accuracy of target setting.

OBJECTIVES: Participants should be able to learn about basic principles of micro- and macrorecording and about target setting techniques in DBS.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Radiosurgical Treatment of Incompletely Obliterated AVM After LINAC and GAMMA KNIFE Surgery

AUTHORS: Clara Raquel Epstein, MD; Lucia Zamorano, MD; Harry Kim, MD; Fernando Diaz, MD; Kenneth Levin, MD; James Fontanesi, MD; Emily Ducharme, MD

INTRODUCTION: To follow.

METHODS: To follow.

RESULTS: To follow.

CONCLUSIONS: To Follow.

OBJECTIVES: Participant will understand the following three learning objectives: 1. 2. 3.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Aggressive Treatment of Cerebellar Brain Metastases Improves Outcome

AUTHORS: Andrew A Kanner, MD; Vitaly Siomin, MD; Gene H Barnett, MD; Shih-Yuan Lee, MHSA; John H Suh, MD; Michael A Vogelbaum, MD, PhD

INTRODUCTION: Brain metastases are a leading cause of mortality in patients with systemic malignancies. Infratentorial location has been considered to be a negative prognostic factor for patients with brain metastasis. In this retrospective study we have compared the outcomes of patients with cerebellar metastasis to those having supratentorial brain metastases. Furthermore we have evaluated the effectiveness of stereotactic radiosurgery (SRS) alone or in combination and the Radiation Therapy Oncology Group recursive partitioning analysis (RPA) for patients with infratentorial brain metastases.

METHODS: We retrospectively analyzed medical records of 89 patients with cerebellar metastasis who were identified in our brain tumor database and treated between 1995 and 2001. Univariate and multivariate analyses were performed to evaluate the effects of age, primary cancer type, control of extracranial disease, interval to development of brain metastases, number of brain metastases, Karnofsky performance status, treatment of brain metastases, and RPA class on overall survival. Treatment regimes included surgical resection, SRS and WBRT alone or in combination.

RESULTS: Twenty-seven patients presented with a single infratentorial lesion. The remaining 62 had more than one infratentorial and/or additional supratentorial lesions. The median survival was 12.9 months for patients who were RPA class I, 11 months for class II and 8 months for class III ($p = 0.03$). Multivariate analysis showed that RPA class was an important predictor for overall survival. However, SRS with WBRT or surgery with WBRT was more favorable than surgery or SRS alone within the same RPA class ($p = 0.0009$).

CONCLUSIONS: In this study, the survival of patients with cerebellar brain metastasis is comparable to that reported in patients with supratentorial brain metastasis. Aggressive multi-modality therapy including SRS has a favorable impact on overall survival. Infratentorial location, at least in the cerebellum, seems not to be associated with a worse outcome than pure supratentorial metastasis.

OBJECTIVES: 1. Survival of patients with cerebellar brain metastasis is comparable to that reported in patients with supratentorial brain metastasis. 2. Aggressive multi-modality therapy including SRS has a favorable impact on overall survival. 3. Infratentorial location, at least in the cerebellum, seems not to be associated with a worse prognosis than pure supratentorial metastasis.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Automated Marker Detection for Patient Registration in Image Guided Neurosurgery

AUTHORS: Rene Krishna, MD; Elvis Hermann, MD; Andreas Raabe, PhD; Volker Seifert, Prof

INTRODUCTION: Fiducial marker registration within preoperative data is often left to the surgeon, who has to identify and tag the center of all markers, which is time consuming and a potential source of error. For this reason an automated procedure was developed. In this study, we investigated the accuracy of this algorithm in detecting markers within navigation data.

METHODS: We used the software VVplanning1.3 (BrainLAB, Heimstetten, Germany) to detect a total of 591 applied fiducial markers in 100 consecutive MP-RAGE MRI data sets of patients scheduled for image guided surgery. Adjustable parameters for size and grey-level were altered. Threshold describes the grey-level, above which the algorithm starts searching for pixel clusters. It was stepwise changed on the basis of a constant accuracy value. The size of a marker (accuracy) in y-direction was stepwise changed on the basis of that threshold value, which detected all markers correctly.

RESULTS: Time for detection varied between 12 and 25 seconds. An optimum accuracy value was found for 1,1 mm with 8 (1,35%) undetected markers and 7 (1,18%) additional detected structures. The average grey level (threshold) for correct marker detection was 248,9. For a high threshold the rate of missed markers was low (1,86%). Starting the algorithm at lower grey levels decreased the rate of missed markers (0,17%) but the rate of additional detected structures raised up to 27,92%.

CONCLUSIONS: The automatic marker detection algorithm is a robust, fast and objective instrument for reliable fiducial marker registration. Specificity and sensitivity is high when optimum settings for threshold and accuracy are used.

OBJECTIVES: understand the methodology of an automated marker detection algorithm, discuss its clinical benefit, understand the preposition of a registration for navigation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: History of Neuronavigation

AUTHORS: Joshua M Rosenow, MD; Ashwini D Sharan, MD; Ali R Rezai, MD; Jaimie M Henderson, MD

INTRODUCTION: Neuronavigation has become an indispensable component of the neurosurgical armamentarium.

METHODS: A search on PubMed and the internet on neuronavigation and related terms provided the basis of this historical report.

RESULTS: Its beginnings can be traced to the idea by Spiegel and Wycis when they combined their stereotactic device with Dandy's contrast ventriculography using the pineal gland as a reference point to compensate for the variability in the relationship between skull landmarks and subcortical structures. Moniz's development of positive contrast angiography in 1927 was improved upon by Talairach, who introduced stereotactic angiography to guide cortical mapping and catheter placement. The modern era was heralded by Hounsfield's 1973 publication of a method for computerized axial tomography. Its promise for neuronavigation was hinted at in 1976 by Bergstrom and Greitz who obtained stereotactic coordinates directly from a CT scan. MRI was demonstrated by Damadian in principle in 1971 and practically in 1977. Kelly spearheaded the evolution of volumetric, rather than point-based, image guidance. Bucholz helped pioneer the leap to frameless neuronavigation. Further advances have included the development of techniques to navigate using any surgical instrument and the coupling of image guidance systems with the operating microscope. Intraoperative imaging has added a real-time dimension to neuronavigation. Various tracking methods are also discussed (arm-bases, sonic, LED, magnetic).

CONCLUSIONS: Neuronavigation has an extensive history and continues to evolve.

OBJECTIVES: Allow the reader to understand the development of current neuronavigation technology.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Dorsal Relocation of Previously Implanted Subthalamic DBS Electrode Yields Superior Control of Dyskinesiae

AUTHORS: Ron L Alterman, MD; Michele Tagliati, MD; Jay Shils, PhD

INTRODUCTION: We report superior control of levodopa-induced dyskinesiae (LID) in a woman with advanced Idiopathic Parkinson's Disease (PD) when we withdrew 3 mm a previously implanted subthalamic nucleus (STN) deep brain stimulation (DBS) electrode.

METHODS: This 68 year-old woman with advanced, medically refractory PD had undergone successful bilateral STN DBS surgery at another institution approximately 18 months before presenting to our clinic. Medtronic Model 3389 DBS leads had been implanted under microelectrode guidance and an MRI confirmed excellent anatomical localization of the leads. The patient reported significant improvements in tremor, rigidity, and bradykinesia; however, severe LID of the right leg persisted and remained disabling. Numerous attempts to reprogram the patient's devices failed to control the right-sided LID adequately. We withdrew the left STN lead 3 mm. There were no surgical complications.

RESULTS: Within one week of surgery, the patient's right-sided LID were fully abated employing contacts 2 and 3 in monopolar stimulating mode (Parameters: 0/0/-/-/case +; 3V, 120usec, 135 Hz). Control of the LID has persisted for 2 months as of the writing of this abstract. Dopaminergic medications are unchanged.

CONCLUSIONS: Levodopa induced dyskinesiae may best be treated via electrical stimulation in the subthalamic region, dorsal to the STN itself. Through its restricted anatomical coverage, use of the Model 3389 lead may limit the therapeutic potential of subthalamic DBS surgery

OBJECTIVES: Discuss the potential limitations of using the Medtronic Model 3389 DBS lead for Subthalamic DBS Surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Laser Surface Scanning for Patient Registration in Neuronavigation

AUTHORS: RenÈ Krishnan, MD; Andreas Raabe, PhD; Volker Seifert, Prof

INTRODUCTION: From the beginning of image guided neurosurgery it has always been attractive to register the patients intraoperative position without placing multiple external fiducial markers. However current high-end systems still require this procedure before acquisition of MRI or CT data sets for neuronavigation. The purpose of this study was to prospectively measure both the calculated registration error and the application accuracy when using laser surface registration for intracranial image guided surgery in a routine clinical setting.

METHODS: 139 consecutive patients with different intracranial pathologies were scheduled for intracranial image guided surgery utilizing a passive infrared surgical navigation system (z-touch, BrainLAB, Heimstetten, Germany). Surface registration was performed using a class I laser device that emits a visible laser beam. The polaris camera system detects the skin reflections of the laser which the software uses to generate a virtual 3D matrix of the individual anatomy of the patient. An advanced surface-matching algorithm then matches this virtual 3D matrix to the 3-dimensional MRT data set. Application accuracy was assessed using the localization error for three distant anatomical landmarks.

RESULTS: Laser surface registration was successful in all patients. As shown in an earlier study application accuracy for the surgical field was 2.4 +/- 1.7 mm (range 1-9 mm). Application accuracy was higher for the surgical field of frontally located lesions (mean 1.8 +/- 0.8 mm, n=13) compared to temporal, parietal, occipital and infratentorial lesions (mean 2.8 +/- 2.1 mm, n=21).

CONCLUSIONS: In this clinical study laser scanning for surface registration was an accurate, robust and easy to use method of patient registration for image guided surgery. We now use this registration method in our daily routine. The method is time effective and avoids problems with marker displacement or loss.

OBJECTIVES: understand an alternative registration method, understand registration accuracy with laser scanning, discuss its clinical benefit

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Mesial Temporal Sclerosis: Age-related surgical outcomes and medication weaning

AUTHORS: Evan M Packer, MD; Fernando L Vale, MD

INTRODUCTION: Epilepsy is a significant burden on society which, as the population ages, is more frequently seen in older patients. Complex partial seizures due to mesial temporal sclerosis are eminently treatable via temporal lobectomy, with the ultimate goal of being seizure-free and off of medication. This study seeks to stratify by age those patients who have undergone temporal lobectomy, to determine if this is a significant factor with respect to seizure-free progression off medication.

METHODS: Patients undergoing temporal lobectomy at the University of South Florida were evaluated between 1999 and 2000. The epilepsy team consisted of one neurosurgeon and two epileptologists. After two year follow up was completed, a chart review was performed, and patients were divided into two separate groups: those patients less than 35 years of age, and those patients older than 35 years of age. Within this stratification, patients were evaluated for initial number of anti-epileptic drugs, and number of medications at two year follow up.

RESULTS: A total of 31 patients underwent temporal lobectomy by single surgeon between 1999 and 2000. Of these patients, 14 were less than 35 years old, and 17 were greater than 35. All patients had Engel's Class I surgical outcomes. Those patients younger than 35 were on an average of 1.8 anti-epileptic medications preoperatively, while the older group had an average of 2.1 medications. At two years follow up, all patients remained Engel Class I; however, there was a significant difference in medication usage. In the younger group, 79% of patients were seizure-free and off medications, in comparison to 35% of the older group.

CONCLUSIONS: Surgery for mesial temporal sclerosis can safely be performed in a diverse age group, however patients younger than 35 years of age have a significantly better chance of seizure-free progression off of medication than do patients older than 35.

OBJECTIVES: 1. Appreciate the benefits of temporal lobectomy for mesial temporal sclerosis 2. Understand the age-related outcomes of temporal lobectomy for mesial temporal sclerosis. 3. Be aware that older patients undergoing temporal lobectomy for mesial temporal sclerosis may be harder to wean from anti-epileptic medications.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Thalamic stimulation recalls drug-like euphoria in a patient with a deep brain stimulator

AUTHORS: Zelma HT Kiss, MD,PhD; Hermano Tavares, MD,PhD; Karen Hunka, RN; Dolen D Kirstein, BSc; William G Campbell, MD; Shawn S Currie, PhD; Oksana Suchowersky, MD; Bin Hu, MD,PhD

INTRODUCTION: Whereas previous drug-use is critical in developing addiction and craving, the physiological content of such memories and its mechanism of recall are unknown. This report describes a patient with a thalamic deep brain stimulator (DBS) in whom we were able to reproduce a typical set of drug-induced feelings: hyperarousal and euphoria followed by extreme fatigue.

METHODS: The patient, who is a 35-year-old male with essential myoclonus, was addicted to alcohol and marijuana 8 years ago. A quadripolar DBS electrode was placed into the region of his left ventro-intermedius thalamus to suppress the tremor component of his condition.

RESULTS: During DBS programming it was found that monopolar stimulation (60 μ s square pulse, 185 Hz, 2.2 V for 1-2 min, via electrode 1), elicited a state of happiness and uncontrollable laughter. This response was captured on video and will be demonstrated. The best electrode pole for reducing his tremor was electrode pole 0, and no other poles elicited this euphoric response. Because mirthful laughter has been reported with subthalamic DBS and following thalamotomy, our patient underwent a combined psychological and psychiatric examination by addiction specialists. He described his experiences exactly like a "low cocaine high": at peace, intense happiness, humorous, losing control, with all his senses feeling sharper than usual. He demonstrated no persistent cravings for drugs or alcohol 6 months after this stimulation-induced experience.

CONCLUSIONS: These data show that previous drug-use experience can be transiently recalled and re-experienced with thalamic electrical stimulation. Because it is known that non-lemniscal posterior thalamus transmits environmental cues that lead to self-stimulation, reward or emotional arousal, we postulate that our stimulation may have activated the axonal pathways arising from adjacent associative posterior and/or intralaminar nuclei, leading to the "retrieval" of past drug experiences.

OBJECTIVES: describe the pathways involved in addiction, cueing and craving stimulate interest in modulation of these pathways and potential therapies

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: MR Safety in Patients with Implanted Neurostimulators: Update and Future implications

AUTHORS: Ashwini D Sharan, MD; Ali R Rezai, MD; Greg Hrdlicka, MBA,MSc; John Nyhenuis, PhD; Jean Tkach, PhD; Paul Ruggieri, MD; Ken Baker, PhD; Mike Phillips, MD

INTRODUCTION: Although major safety concern exists regarding the potential for excessive heating secondary to radiofrequency induced electrical currents, patients with implanted neurostimulation systems commonly undergo MRI examinations. In vitro evaluation of current neurostimulation systems suggests that guidelines can be established to ensure MR safety.

METHODS: We have performed a comprehensive safety evaluation of the most commonly used neurostimulation devices. With a head transmit/receive (t/r) coil in a 1.5T Seimens (Seimens Medical System, Iselin, NJ) MR machine and clinically relevant electrode and neural pulse generator positioning for deep brain (DBS), spinal cord (SCS), and motor cortex (MCS) stimulation system were tested. The neurostimulation systems were tested in a phantom model, immersed in gel, and temperatures were measured with a fiberoptic thermometry system with attention to the specific absorption rates (SAR). Movement of the devices were tested with a custom design force and torque device.

RESULTS: The results revealed a linear relationship with SAR and resultant heating at the distal electrode tips. Heating ranged from 0.1 to 7.1 $^{\circ}\text{C}^{\text{TM}}\text{C}$ for DBS, from 0.1 to 9 $^{\circ}\text{C}^{\text{TM}}\text{C}$ for SCS, and from 0.1 to 11.9 $^{\circ}\text{C}^{\text{TM}}\text{C}$ for MCS. Additionally, the maximal torque was measured for the maximal force for the Itrel 7424 at 0.89.

CONCLUSIONS: Our results reveal that SAR related parameters for the tested scenarios can be established which will result in minimal electrode heating and detail recommendations will be provided. Additionally, the heating profile can significantly vary with the use body t/r coils, landmarking, electrode routing configurations, 3T MR systems, percutaneous systems, functional MRI as well as other scenarios. The safety for MR scanning using these various scenarios will be discussed. Caution must be adhered to before generalizing these findings to scenarios which were not specifically tested.

OBJECTIVES: Educate the physician on issues of MR Safety in patients with implanted neurostimulation systems

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Surgical Complications of DBS Surgery: The Beth Israel Experience

AUTHORS: David Poulad, MD; Jay Shils, PhD; Michele Tagliati, MD; Brendan Sullivan, PA-C; Ron Alterman, MD

INTRODUCTION: Deep Brain Stimulation surgery is being performed with greater frequency throughout the United States; however, the surgical and stimulation-related complications of these interventions have not been characterized fully.

METHODS: Retrospective analysis of 180 DBS electrode implants performed in 99 patients (STN: 137 electrodes/70 patients; VIM: 20/17; GPi: 23/12). Surgeries were performed for the following diagnoses: Parkinson's disease- 75 patients; Essential Tremor- 9 patients; Dystonia- 8 patients; Multiple Sclerosis- 4 patients; Neuropathic Pain - 1 patient; Multi-System Atrophy- 2 patients.

RESULTS: There were a total of 26 surgical/hardware complications (14.3%) in 22 patients (22.2%). These break down as follows: Intracerebral hemorrhage-2; Post-operative confusion-4; Poorly placed DBS leads- 2; Infections-6; Extension malfunctions-4; ; Wound erosion-4;IPG Malfunctions- 2; Lead fractures-1; Panic Attack/Seizures-1. Only 4 patients (4.0%) suffered significant adverse outcomes. There were 17 (9.4%) stimulation-related complications in 17 patients (17.2%). All of these were related to speech (slurring and hypophonia)and 15 are of minimal consequence.

CONCLUSIONS: The surgical/hardware complication rate for DBS is substantial; however, the majority of complications are easily corrected and are of little long-term consequence. Stimulation related complications predominantly affect speech.

OBJECTIVES: Discuss the surgical and stimulation-related complications of DBS surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Complications of epilepsy surgery in patients over 50

AUTHORS: Evan M Packer, MD; Fernando L Vale, MD

INTRODUCTION: As the population ages, epileptologists and neurosurgeons are seeing an older population of patients with epilepsy. While the benefits of epilepsy surgery for younger patients are well-established, a dearth of literature exists regarding epilepsy surgery for patients over 50. It is unclear as to whether they are at higher risk for surgical complications. We review our experience with temporal lobectomy for mesial temporal sclerosis in those patients greater than 50 years of age.

METHODS: Between 1999 and 2001, 13 patients greater than 50 years of age underwent epilepsy surgery at the University of South Florida by a single surgeon. All patients had temporal lobectomies for the treatment of seizures secondary to mesial temporal lobe sclerosis. A chart review was initiated to determine the surgical morbidity of this procedure in patients older than 50.

RESULTS: All 13 patients who underwent temporal lobectomy had Engel's Class I outcomes at two years follow up. In this group of patients, there were no deaths, and one surgical complication of a lacunar stroke. The affected patient had a history of hypertension, and was wheelchair-bound secondary to intractable back pain. Postoperatively, the patient developed a left upper extremity paresis, which has since improved.

CONCLUSIONS: Patients over 50 are fast becoming a larger percentage of the epilepsy population. If correctly selected, these patients can successfully be treated surgically with relatively low morbidity.

OBJECTIVES: 1. Appreciate that the portion of older patients with epilepsy is increasing. 2. Understand that epilepsy surgery can effectively be performed on patients older than 50. 3. Realize that epilepsy surgery in patients older than 50 carries fairly low morbidity.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Pallidal Deep Brain Stimulation in Cervical Dystonia: Clinical Outcome in 4 cases.

AUTHORS: Hazem A Eltahawy, MD,FRCS; Andres M Lozano, MD,PhD,FRCS(C)

INTRODUCTION: We report the clinical results following bilateral globus pallidus interna deep brain stimulation in 4 patients with severe cervical dystonia . The mean age was 48 years (range 37-67) with one female and 3 males.

METHODS: All 4 patients had failed extensive medical and botulinum toxin treatment. The mean duration of the disease was 9 years (range 4-15 years). All patients were assessed pre and post operatively using the Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS). Pre-operatively, the mean TWSTRS total score was 43.2 (range 28-60.5). Microelectrode guided bilateral posteroventral pallidal deep brain stimulators were inserted. Mean follow up was 11.7 months (3 patients had 15 m and one 2 m follow up).

RESULTS: Mean reduction in the TWSTRS total scores was 68.3 % (range 61- 85 %). Improvement started by absence of pain in patients who had pre-operative pain within 2 months of the operation followed by gradual motor improvement. Frequent adjustment in the stimulation parameters was necessary.

CONCLUSIONS: Bilateral pallidal stimulation is effective in management of selected cases of intractable cervical dystonia

OBJECTIVES: Understand:1- that pallidum is an effective target for management of cervical dystonia/2- the pattern of clinical improvement after pallidal DBS in cervical dystonia/ 3- appreciate the need for repeated adjustment in stimulator output to reach optimum result

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: A Multi-Center Prospective Trial Evaluating a Miniature X-ray Device for Interstitial Radiosurgery of Brain Metastases

AUTHORS: Rees Cosgrove, MD,FRCS(C); David Porter, MD; Felix Senanayke, MD; Mark Bilsky, MD; Peter Black, MD,PhD; Jay Loeffler, MD; Nicholas Zervas, MD

INTRODUCTION: To establish the efficacy and toxicity of a miniature X-ray generator in the treatment of metastatic brain tumors.

METHODS: An international multi-center prospective trial was undertaken of two patient groups with cerebral metastases. In Trial A, patients with recurrent intracerebral metastatic disease despite prior WBRT were treated with the device. In Trial B, patients with multiple cerebral metastases or a solitary unresectable lesion at initial presentation were randomized to PRS and WBRT or WBRT alone. Serial follow-up studies included clinical and radiological evaluations at 1.5 - 3 month intervals. Primary end-points were median survival time and local control. Secondary end-points included maintenance of independent lifestyle including KPS, MMS and SF-36 assessments.

RESULTS: Thirty-eight patients (22M, 16F; age 38-80; mean 59 years) were enrolled. Trial A patients had a median survival of 8.4 months (range 0.4-22 mos) adjusted to 11.4 months if only neoplastic disease related deaths were taken into account. One-year survival was 29%. Trial B patients treated with PRS and WBRT had a median survival of 7 months (range 1.7-15 mo). Median survival in the WBRT only group was 2.4 month (range 0.3-9.3 mo). Local control was achieved in 87% of Trial A tumors treated. In Trial B, patient's treated with the PRS and WBRT had 100% local control in all PRS treated lesions while metastases treated by WBRT alone achieved local control in 75% of cases.

CONCLUSIONS: In patients presenting with advanced metastatic disease, a surgically inaccessible tumor or multiple lesions with an accompanying poor prognosis, stereotactic biopsy and interstitial radiosurgery followed by adjuvant whole brain radiotherapy may be an effective alternative treatment strategy.

OBJECTIVES: To understand the role of interstitial radiosurgery in the treatment of braion metastases

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Microvascular Decompression for Trigeminal Neuralgia in Patients with Multiple Sclerosis

AUTHORS: Mohsen Javadpour, FRCS; Patricia Littlechild, FRCS; Ajay K Sinha, FRCS; Paul R Eldridge, FRCS; Telekath R Varma, FRCS

INTRODUCTION: Magnetic resonance tomoangiography (MRTA) can reliably demonstrate the presence of neurovascular compression in patients with trigeminal neuralgia, thus predicting those who may benefit from microvascular decompression (MVD). Patients with trigeminal neuralgia related to multiple sclerosis (MS) have traditionally not been regarded as good candidates for MVD. Studies of MVD in MS patients give conflicting results in terms of long-term pain relief, although all show good initial results. We report the outcome of MVD for TN in a group of patients with MS.

METHODS: Retrospective chart review of all patients with MS undergoing posterior fossa exploration with a view to MVD in this institution between 1993-2001. All patients had undergone preoperative MRTA demonstrating definite or probable vascular compression.

RESULTS: 9 patients with MS underwent posterior fossa surgery for TN. 7 patients had MVD alone; in 2 patients the presence of vascular compression was thought not to be significant at the time of operation, and partial rhizotomy was performed in addition to MVD. All patients had initial total pain relief. At follow up, 6 MVD patients, and 1 of the 2 partial rhizotomy patients had a recurrence of pain. Pain recurred at a median of 12 months postoperatively (range 2-50 months).

CONCLUSIONS: MVD provided good initial pain relief in MS patients with TN, but the recurrence rate was much higher than in patients with 'primary' TN. Despite the use of MRTA to select patients with neurovascular compression, MVD did not provide long term pain relief in patients with MS. Further study is required to compare the outcome of MVD with other treatment modalities for TN in MS patients.

OBJECTIVES: To determine the outcome of microvascular decompression for trigeminal neuralgia in patients with multiple sclerosis.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Synaptic mechanism of deep brain stimulation in thalamus

AUTHORS: Trent Anderson, PhD; Bin Hu, MD,PhD; Zelma HT Kiss, MD,PhD

INTRODUCTION: The mechanism of deep brain stimulation (DBS) is unknown. Some groups have reported excitation and others inhibition of neuronal firing. We have recently shown that thalamocortical neurons subjected to simulated DBS in slices, depolarize in a frequency- and amplitude- dependent manner. In some cases the depolarization leads to repetitive firing which desynchronizes the rhythmic tremor-like firing and in other cases depolarization blockade occurs. The AIM of this project was to determine if this depolarization is synaptically-mediated.

METHODS: Intracellular recordings were obtained using sharp glass electrodes in rat ventral thalamic slices. Simulated DBS was applied with bipolar electrodes at 0.06 ms pulse width, varying the amplitude (0.5-10 mA) or frequency (2-300 Hz) applied. The sensitivities of the evoked responses to Na⁺-channel blocker, tetrodotoxin (TTX, 0.1 μ M), or the non-specific glutamate receptor antagonist kynureate (2 mM) were then tested.

RESULTS: Membrane depolarization of 21 to 41 mV was induced by simulated DBS in all neurons studied (n=9). No membrane hyperpolarization was seen. In the presence of TTX, simulated DBS resulted in an initial depolarization coincident with the onset of stimulation. However, the sustained depolarization was reduced by 75% . Bath application of kynureate for 10 minutes eliminated the initial depolarization induced by simulated DBS, and reduced the sustained depolarization by 61%. This concentration of kynureate was sufficient to prevent depolarization induced by 5 μ M AMPA.

CONCLUSIONS: We conclude that the local effects of simulated DBS in the thalamus appear to be primarily mediated by pre-synaptic release of glutamate that then acts to depolarize the post-synaptic neurons. Therefore further modelling of therapeutic DBS must take into account this pre-synaptic release of neurotransmitters in the target nuclei.

OBJECTIVES: understand the cellular basis of high frequency stimulation applied in the brain slice model

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Possible Radiosurgery-Induced Glioma

AUTHORS: Jon I McIver, MD; Bruce E Pollock, MD

INTRODUCTION: Radiation-induced neoplasms are an extremely rare complication after stereotactic radiosurgery. To date, only three cases meet Cahan's criteria in the world literature. We present what may be a fourth case of a radiation-induced neoplasm arising after radiosurgery.

METHODS: Our patient is a 43 year-old woman who presented with a right cerebellar anaplastic astrocytoma 5 1/2 years after radiosurgery for metastatic melanoma. Initially, three brain metastases involving the inferior right temporal (two tumors) and right frontal regions were treated. Twenty-two months later, a second radiosurgical procedure was performed for a recurrent right temporal lobe metastasis. The area of cerebellum in which the glioma developed received a maximum of 7.7 Gy and 1.5 Gy of radiation during the two radiosurgical procedures, respectively. The case is complicated by the fact that the patient also underwent whole brain radiotherapy (37.5 Gy) immediately after her first radiosurgery.

RESULTS: Support for a causative effect of the radiosurgery is the location in which the tumor developed.

CONCLUSIONS: Late complications after radiosurgery are rare. In an effort to better define the incidence of radiation-induced neoplasms after radiosurgery, all potential cases should be presented and discussed.

OBJECTIVES: 1. Understand the concept of radiation-induced tumors as defined by Cahan's criteria. 2. Gain increased awareness of the extremely rare possibility of radiosurgery-induced oncogenesis.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: The Role of MRI and Proton MRS in Directing "Leading Edge" Boost Gamma Knife Radiosurgery for Recurrent Glioblastoma Multiforme

AUTHORS: Christopher M Duma, MD; Michael Brant-Zawadzki, MD; Michael Shea, MD; Jay Tassin, MD; Mackintosh Ralph, PhD; Plunkett Marianne, BSc; Sharp Shari, PA-C

INTRODUCTION: Glioblastoma multiforme (GBM) defies any therapy because the tumor cannot be effectively treated locally. White matter infiltration of tumor cells, beyond gadolinium-enhancing tumor mass is the rule. Studies have suggested that FLAIR sequences are most sensitive to tumor, and that Proton MRS improves specificity of tumor detection within, and even beyond FLAIR-positive zones. When conventional involved field radiation therapy is used survival times historically are approximately 6 mo. for patients with recurrent disease. We targeted "leading edge" zones defined by FLAIR and MRS with boost stereotactic radiosurgery to determine its effect on survival.

METHODS: Seventeen consecutive patients with recurrent GBM amenable to "leading edge" Gamma Knife radiosurgery (GKRS) were treated over a 4-year interval using MRS- and/or FLAIR-directed isodose planning. Patient age ranged from 21-77, median: 49. Treatment isodose plans were prescribed to include either MR Spect or FLAIR signal abnormalities. Treatment volumes averaged 26 cc (3.7 cm average diameter.) Median minimum target dose was 12 Gy at the 50% isodose line. Infratentorial, basal ganglia or brainstem tumors were excluded. All patients had undergone involved-field radiation therapy before GKRS treatment. Twelve patients received immunotherapy as part of an ongoing trial, and 7 patients received chemotherapy.

RESULTS: The median follow-up interval was 13 mos. Median survival for patients with recurrent disease from time of GKRS boost was 15 mos. Survivals ranged from 0.25 to 29+ mos. Neither chemotherapy nor immunotherapy appeared to affect results. Seven patients (26%) had treatable radiosurgery-induced edema, MRS proving useful in differentiating necrosis from tumor in these cases.

CONCLUSIONS: Considering patients in this series were negatively selected (most patients had evidence of tumor crossing into or across the corpus callosum) there appears to be a survival advantage using FLAIR- or MR Spect-directed "leading edge" GKRS for patients with recurrent GBM.

OBJECTIVES: Understand the radiosurgical treatment of glioblastoma multiforme. Understand the rationale and mechanism of using MR spectroscopy and MR FLAIR sequences to plan radiosurgical treatment of GBM. Know the complications of "leading edge" radiosurgical treatment of GBM.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Spasticity

TITLE: The Paraspinous, Transmuscular Approach for Placement of the Intrathecal Catheter for a Baclofen Pump

AUTHORS: Mei Y Wong, MD; Robert J Plunkett, MD

INTRODUCTION: The traditional method of inserting a catheter for chronic intrathecal delivery of baclofen is via the midline, interspinous approach. Neurosurgeons are readily acquainted with this approach, as it is used with frequency during percutaneous lumbar punctures. However, this approach is not without its problems. The catheter is fastened and subsequently tethered to the dorsolumbar fascia along the midline via a connector. This makes the segment of the catheter immediately distal to this point of tethering susceptible to breakage, as it is exposed to stretch forces over the spinous processes, particularly in a mobile spine. We describe here a case study of K.K., a 37 yo with paraplegia and spasticity secondary to a traumatic spinal cord injury. She had had multiple breakages of spinal catheters that were placed via the traditional approach. It was felt that the mobility in her spine caused stretch forces on the catheter as it entered interspinously, leading to repeated fractures. This was confirmed intraoperatively, as the site of fracture was within the interspinous ligament. Subsequently, a new catheter was placed via a paraspinous, transmuscular approach.

METHODS: With the aid of intraoperative fluoroscopy, the Tuohy needle skin entrance point is made approximately 1 cm lateral to midline, and at the level of the caudal end of the lower spinous process. The trajectory of the Tuohy is initially perpendicular to the long axis of the spine. Once dorsolumbar fascia is encountered, the needle is aimed 10-15 degrees medial and 10-15 degrees cephalad. A good AP view of the spine can assist in directing the needle towards the interlaminar space, where ligamentum flavum followed by dura will be encountered. Once entrance into the intrathecal space is confirmed by CSF return, the procedure continues as traditionally performed.

RESULTS: At 1 year post-surgery with this new approach, the patient has had no further problems with catheter fractures.

CONCLUSIONS: The paraspinous, transmuscular approach for placement of an intrathecal catheter for chronic delivery of baclofen is a viable alternative to the traditional midline, interspinous approach.

OBJECTIVES: 1. Review lumbar spinal anatomy 2. Identify catheter fracture risk with the interspinous approach 3. Learn the paraspinous, transmuscular approach to spinal catheter placement

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: MER or no MER in movement disorder surgery, that is the question

AUTHORS: M Sam Eljamel, MD; Veer Caussy, MD; Mark Tulley, BSc; Kate Spillane, MD; Robert Swingler, MD; Jim Crosby, BA; Trudy McLay, BSc; Sandra Donaldson, BSc

INTRODUCTION: The question of Micro Electrode Recording (MER) has been debated for many years among surgeons of movement disorders (MD). The opinion differs from using up to 5 simultaneous MER to using none. Those who use as many MER believe that the larger the number of MER the better the final placement and response to surgery. Those who do not perform MER believe that they achieve similar results with less side effects. This study compares the accuracy of targeting using CT, direct targeting using MRI, direct targeting using stereotactic atlas and targeting using a combination of the above and refined by MER of 3 trajectories.

METHODS: We collected prospective data on 41 targets for movement disorders in 25 patients using CT, MR, Atlas and MER co-ordinates. 16 targets in 12 PD patients, 16 targets in 8 MS patients and 9 targets in 5 essential tremor patients. 11 were females and 32 were DBS & 9 lesions. 41 had a CT, 40 had MRI and 41 had atlas correlation and all had MER. The one patient who had had no MRI had previous aneurysm clipping precluding him from MRI. The target coordinates were calculated for each method using ZD frame and STP4 software.

RESULTS: The mean deviation from the final lead/lesion position in the X coordinate was 0.7 mm using CT, 0.4 mm for MRI, 0.7mm for the atlas and 0.5 mm for the hybrid methods. The mean deviation from the final lead/lesion position in the Y coordinate was 1.2 mm using CT, 0.6 mm for MRI, 1.4 mm for the atlas and 0.7 mm for the hybrid methods. The mean deviation from the final lead/lesion position in the Z coordinate was 5.9 mm using CT, 5.6 mm for MRI, 5.8 mm for the atlas and 5.3 mm for the hybrid methods. Using 3 microelectrodes was associated with 1 intraventricular haemorrhage and 2 seizures.

CONCLUSIONS: Neurophysiological mapping of the anatomical target is essential in movement disorder surgery for optimum lead/lesion placement and can be performed by a fewer number of trajectories safely as the main deviation is in the Z- axis.

OBJECTIVES: The importance of MER in optimising movement disorder surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: A Quick, and Universal Method for Stereotactic Visualization of the Subthalamic Nucleus Before and After Implantation of Deep Brain Stimulation Electrodes

AUTHORS: Marwan I. Hariz, MD,PhD,Prof; Paul Krack, MD,PhD; Roger Melvill, MD; Jan V. Jorgensen, MD; Wolfgang Hamel, MD; Hidehiro Hirabayashi, MD,PhD; Mathieu Lenders, MD; Nils Wesslen, MD,PhD; Magnus Tengvar, MD; Tarek Yousry, MD,PhD,Prof

INTRODUCTION: When performing deep brain stimulation (DBS) on the subthalamic nucleus (STN), most workers determine the position of the target in relation to the landmarks of the third ventricle, even when a stereotactic magnetic resonance imaging (MRI) is used. We describe a fast acquisition MRI technique enabling direct visualization and targeting of the STN without reformatting images, as well as postoperative visualization of both STN and DBS electrodes.

METHODS: The imaging method described here has been implemented in 10 centers in 8 countries on different brands of MRI machines, and using different stereotactic frames. T2 sequences were used with the following parameters that could vary between the machines: 2 mm (axial and coronal) or 3 mm (coronal) slices without gap, TR 3000-5000, TE 85. Acquisition time varied between 4 and 10 minutes. Scans were obtained, preoperatively with stereotactic frame attached to the head (in all but one center), and postoperatively with or without frame. In all centers but one, surgery was performed without microelectrodes.

RESULTS: The STN could almost always be visualized on the axial scans with more or less sharp contours depending on the MRI machine used and probably depending also on the iron contents of the STN. The STN was often also visualized on the coronal images. In general, Siemens 1.5 Tesla MRI machines provided better and sharper images of the STN than other machines. Postoperatively, electrode contacts were visualized without disturbing artifact and without significantly influencing visualization of the STN proper. Electrode positions were randomly scattered in (and around) the STN, irrespective of use or not of microelectrodes during surgery.

CONCLUSIONS: Provided eventual distortion of the MRI machine are known and accounted for, a direct targeting of the individually visualized STN may be more accurate than determining its position in relation to the ventricular landmarks and the Atlas. This may contribute to decrease the number of exploratory electrode tracks, and hence, the risks of surgery. Postoperatively, this imaging technique provides confirmation of the anatomical position of the DBS leads in relation to the targeted nucleus. Whether this technique provides better long-term results than other targeting methods remains to be evaluated.

OBJECTIVES: To present a straight forward method for direct visualization of the STN as well as visualization of the DBS electrodes within the STN. To analyse the advantages

and disadvantages of using direct targeting of STN irrespective of the classical ventricular landmarks. To discuss the potential of this technique in providing more accurate targeting and in enabling the use of less exploratory tracks during DBS procedures aiming at the STN.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Surgery for Parkinson Disease in the United States, 1996-2000: practice patterns, short-term outcomes, and hospital charges in a nationwide sample

AUTHORS: Emad N Eskandar, MD; Rees G Cosgrove, MD; Barker G Fred, MD

INTRODUCTION: Surgery for Parkinson disease has undergone a dramatic change, from stereotactic ablative procedures towards deep brain stimulators (DBS). We studied this process by investigating practice patterns, mortality, morbidity, and hospital charges in a representative sample of United States hospitals, during 1996 to 2000.

METHODS: Retrospective cohort study using Nationwide Inpatient Sample data.

RESULTS: 1761 operations at 71 hospitals were studied. Projected to the United States population, there were 1650 inpatient procedures performed per year (pallidotomies, thalamotomies, DBS), with no significant change in annual number of procedures during the study period. In-hospital mortality was 0.2%, discharge not to home 8.1%, and neurological complications 1.8%, with no difference between procedures. Hematomas were more common after thalamotomies (2.6%) than after other procedures (0.4%, $P = 0.01$). In multivariate analyses, hospitals with larger annual caseloads had lower mortality ($P = 0.002$) and better outcome at hospital discharge ($P = 0.007$). Deep brain stimulators comprised 0% of operations in 1996 and 88% of operations in 2000. Factors predicting DBS placement in analyses corrected for year of surgery included younger age, white race, private insurance, residence in higher-income areas, hospital teaching status, and smaller annual hospital caseload. In multivariate analysis, total hospital charges were 2.2 times higher for DBS (median \$36,000 vs. \$12,000, $P < 0.001$). Charges were lower at higher-volume hospitals ($P < 0.001$).

CONCLUSIONS: Surgical treatment of Parkinson disease in the United States changed significantly between 1996 and 2000. Larger-volume hospitals had superior short-term outcomes and lower charges. Future studies should address long-term functional endpoints, cost-benefit comparisons, and inequities in access to care.

OBJECTIVES: Understand changes in practice patterns, differences in costs, and differences in access in regard to Parkinson disease surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Role of the Basal Ganglia in Movement Initiation and Suppression

AUTHORS: Emad N Eskandar, MD; John A Assad, PhD

INTRODUCTION: Understanding the role of the basal ganglia (BG) in movement control is critical to improving therapies for Parkinson's disease (PD) and other movement disorders. Current controversies revolve around the role of the BG in movement initiation and movement suppression.

METHODS: Single unit recordings were made from the putamen and pallidum of awake behaving rhesus monkeys trained to use a joystick to guide a stimulus toward a target. On half the trials, the animals were instructed to make a movement toward one of eight targets – a command trial. In the other half of the trials, the animals had to suppress a planned movement toward the initial target and instead move toward the target in the opposite direction – a countermand trial.

RESULTS: A total of 102 cells were recorded, 37 from the putamen and 65 from the globus pallidus. Two-way ANOVA ($p < 0.05$) was used to analyze the effects of movement direction and trial type on the responses. The response epoch was divided into pre-movement and peri-movement responses. In the pre-movement period, 28 (76%) of the putaminal cells and 43 (64%) of the pallidal cells were modulated by the planned movement or the trial type. In the majority of pallidal neurons (41/65, 63%), the pre-movement activity was greater during countermand trials where the animals had to actively suppress a planned movement. In the peri-movement period, 35 (95%) putaminal and 56 (86%) pallidal neurons were modulated by trial type or movement direction. During this epoch the majority of pallidal neurons (41/65, 63%) exhibited decreased activity during countermand trials

CONCLUSIONS: These results suggest that, contrary to current belief, the BG may be involved in movement selection or initiation. Furthermore pallidal neurons appear to be involved in suppressing unwanted movements. Loss of this function might be expressed clinically as dyskinesia or ballism.

OBJECTIVES: understand the potential roles of the putamen and globus pallidus in movement initiation and movement suppression and how these roles may relate to clinical disorders.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Quantification of intra-operative shift of cortical and subcortical structures in stereotactic surgery

AUTHORS: Fredrick Junn, MD

INTRODUCTION: The therapeutic efficacy of deep brain stimulation as a surgical treatment of medically refractory Parkinson's disease has been firmly established. Accurate lead placement is paramount in optimization of that benefit. To achieve that accuracy of lead placement both anatomical and physiological localization methods employed. Microelectrode recording and stimulation are most often used physiological localization methods. During this process, it has been assumed that there is very little shift in the subcortical structures.

METHODS: Patients undergoing stereotactic deep brain stimulation insertion were studied prospectively. All patients underwent pre-operative MRI and CT and immediate postoperative MRI scans of the head in Leksell stereotactic frame. Stereotactic coordinates of the anterior and posterior commissures, the subthalamic nucleus, the frontal cortical surface at the level of anterior and posterior plane were measured on both pre and postoperative 1 mm SPGR MRI sequence. The differences in the stereotactic coordinates were analyzed.

RESULTS: The greatest shift between pre and post-operative images occurred at the cortical surface ranging from 2 to 12 mm posteriorly. The location shift of the anterior and posterior commissures were small, less than 2 mm, posteriorly and caudally. The anterior commissure tends to move more often than the posterior commissure. The degree shift of subthalamic target was similar to that of posterior commissure. No DBS trajectory violated the ventricles.

CONCLUSIONS: The assumption that the deep cortical structures do not shift during the stereotactic functional surgery appears to be true, provided that the lateral ventricles are not violated. The tendency to shift during mapping appears to be greatest for the structures at the cortical surface and anterior than posterior subcortical structures.

OBJECTIVES: 1. To appreciate degree intra-operative shift of cortical and subcortical structures. 2. To measure subcortical targets in 3-dimensional space using Leksell stereotactic frame. 3. To localize the subthalamic nucleus using MRI.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Stereotactic Image-guided Surgery with Intra-operative Portable CT

AUTHORS: William D Tobler MD, MD

INTRODUCTION: The stereotactic accuracy of image-guided surgery using MRI and CT scans obtained before the patient is brought to the operating room is degraded by intra-operative brain shift and segmental motion of the spine in the positioning process for surgery. Intra-operative MRI (iMRI) and ultrasound have been promoted as a solution for brain shift but have minimal application in spinal surgery. In the operating room high-field iMRI is prohibitively expensive and low-field iMRI compromises image quality. We report our results using a high resolution portable CT(iCT) combined with a radiolucent table and cranial stabilization device as a solution for both cranial and spinal stereotactic image-guided surgery. This efficient, low cost system permits accurate and precise cranial and spinal image-guided stereotaxis with the capability of intra-operative image update.

METHODS: Using an optical image-guided system and portable iCT 16 cranial and 12 spinal procedures were carried out in 28 patients. iCT scans can be acquired anytime and as often as needed based on the requirements of each case. Scan acquisition in the surgical position facilitates stereotactic accuracy especially in spine. For cranial stereotaxis accurate targeting was achieved using a non-invasive headrest and the Pelorus stereotactic ring

RESULTS: Of the 16 cranial procedures there were 8 tumor resections, 6 stereotactic biopsies and 2 stereotactic hematoma aspirations. Among 12 spine procedures 4 were for image-guided placement of thoracic and lumbar pedicle screws, the remaining were for assessment of the adequacy of cervical corpectomy. There were no complications in any of the cases, and diagnostic tissue was obtained in all biopsies

CONCLUSIONS: Stereotactic image-guided iCT offers the neurosurgeon an accurate and precise methodology for cranial and spinal stereotaxis and has the capability of intra-operative image updating. This efficient, low cost system presents an alternative to stereotactic frames and iMRI thus eliminating their inherent limitations.

OBJECTIVES: describe the indications for iCT, understand the versatility of a stereotactic iCT system for both cranial and spinal applications, understand the technical improvements in Image-guided surgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Thalamic stimulation for essential tremor: Relation of lead location to outcome

AUTHORS: Efstathios Papavassiliou, MD; Nicholas Barbaro, MD; Paul Larson, MD; Aviva Abosch, MD,PhD; William Marks Jr, MD; Kathleen Lambourn, PhD; Heidi Clay, RN; Susan Heath, CNRN,MS,RN; Philip Starr, MD,PhD

INTRODUCTION: Thalamic stimulation for essential tremor (ET) is widely performed, yet optimal lead location within the thalamus has not been defined. In 39 thalamic implants for ET, we analyzed the relation of clinical outcome to lead location, as documented by postoperative magnetic resonance imaging (MRI).

METHODS: To maximize the variability in lead location, this study included patients whose leads were placed by several surgeons who used different surgical methods. Lead locations were measured on volumetric gradient-echo MRIs that were computationally reformatted to be parallel to the intercommissural line. Clinical outcomes were measured, after optimization of stimulation parameters for best tremor control and fewest adverse effects, using the Fahn-Marín-Tolosa tremor rating scale. Mean follow-up time was 25 months. Outcome was correlated with lead location using analysis of variance with a significance threshold of .05.

RESULTS: Mean lead locations at a vertical coordinate =0 (with respect to the axial plane passing through the AC and PC) were $7^{\circ} \pm 1.3$ mm anterior to the PC and $9.5^{\circ} \pm 1.9$ mm lateral to the third ventricle wall. Mean tremor score improved from 19.2/28 with the stimulator off to a mean of 7.9/28 with the stimulator on. For patients whose outcome was graded as excellent (defined as on-stimulation total tremor score of ≤ 5) the mean lead location (at vertical=0) was 6.8 mm anterior to the PC and 10.3 mm lateral to the third ventricle wall. The lateral coordinate was a statistically significant predictor of the percent improvement in tremor.

CONCLUSIONS: The mean electrode location for optimally located leads was similar to lesion locations reported for thalamotomy. Over the range of lead locations represented in this sample, the lateral coordinate was a significant predictor of outcome.

OBJECTIVES: 1.Understand and be able to use Tremor Rating Scales 2.Understand the use of MRI to document DBS lead locations 3.Understand that DBS lead location affects outcome

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Nucleus Stimulation in Two Cases of Multiple System Atrophy

AUTHORS: Michele Tagliati, MD; Jay L Shils, PhD; Joan Miravite-Ingram, RNC; Kyra Blatt-Beshears, MD; Rachel Saunders-Pullman, MD; John Rogers, MD; David Eidelberg, MD; Ron L Alterman, MD

INTRODUCTION: Multiple system atrophy (MSA) is a neurodegenerative disease marked by variable combination of parkinsonism, orthostatic hypotension and cerebellar dysfunction. Pharmacotherapeutic options are very limited for MSA, but some response to levodopa can be observed. Deep Brain Stimulation (DBS) is well established for advanced levodopa-responsive idiopathic Parkinson's disease (PD).

METHODS: We successfully implanted bilateral DBS leads in the subthalamic nucleus (STN) of two MSA patients with severe medically refractory parkinsonism. Patient 1 is a 64-year-old woman with a 9-year history of progressive rigidity, focal dystonia (blepharospasm), orthostatic hypotension, gait and balance abnormalities resulting in frequent falls. She initially received some benefit from levodopa, which deteriorated over time. Patient 2 is a 63-year-old woman with a 4-year history of rapidly progressive bradykinesia, rigidity, orthostatic hypotension and prominent balance and gait abnormalities, causing frequent falls. She was initially diagnosed as PD and responded sufficiently well to levodopa. However, over time levodopa became progressively less efficacious. In both cases, pre-operative glucose PET scan was consistent with the diagnosis of MSA. Intraoperative microelectrode recordings, fluoroscopy and MRI were used to locate final target. Patients were videotaped and evaluated with the UPDRS before and after surgery. DBS settings were slowly and systematically adjusted to achieve best clinical effect. Follow-up was at least 3 months.

RESULTS: Both patients showed mild but subjectively satisfactory improvement of their parkinsonism. Patient 1 reported reduced fluctuation of her symptoms when 'on' or 'off' levodopa. However, her speech was negatively affected and gait was progressively worse. Persistent blepharospasm needed treatment with periodic injections of botulinum toxin. Patient 2 reported improved posture and gait two months after STN DBS, but her speech was slightly slurred. The 'OFF' medications motor UPDRS (part III) showed a 29% improvement. Stimulation parameters were not different from those routinely used for patients with idiopathic PD. Daily doses of levodopa were not significantly affected by STN DBS.

CONCLUSIONS: Subthalamic DBS is potentially effective in selected patients with medically intractable atypical parkinsonism who have a history of beneficial response to levodopa. Dysarthria may be observed more frequently as a side effect of DBS in this subgroup of patients.

OBJECTIVES: appreciate the effects of DBS therapy on atypical parkinsonism

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Radiation and Regeneration: Behavioral Improvement and GDNF Expression after Gamma Knife Radiosurgery in the 6-OHDA Model of Hemi-Parkinsonism

AUTHORS: Vasilios A Zerris, MD; Zhen Zheng, PhD; George Noren, MD; Arno Sungarian, MD; Gerhard Friehs, MD

INTRODUCTION: Recent research has demonstrated that the adult mammalian CNS is capable of regeneration. This regeneration is often initiated as a response to thermal, chemical, or mechanical injury. The effects of radiation on the mammalian CNS have also been found to aid in certain regeneration processes.

METHODS: In our project we examined the potential therapeutic value of radiation induced regeneration of the diseased rat CNS. Eleven 6-OHDA hemi-parkinsonian rats were treated in the Leksell Gamma Knife using a single 4 mm collimator shot targeted to the ipsilateral (Parkinsonian) caudate-putamen complex. A maximum dose of 140 Gy was used. Animals were tested behaviorally using the apomorphine-induced rotational model before and up to six months after surgery. Histochemical analysis for Glial Derived Neurotrophic Factor (GDNF) was performed at 2 weeks, 1 month and 4 months post treatment.

RESULTS: The rotational behavior for 11/11 animals (100%) was found to initially worsen at 2 weeks and 4 weeks after radiosurgery before a statistically highly significant reduction in apomorphine induced rotations was observed at 2, 3, 4, and 6 months post surgery (83% reduction by month 4, $p < 0.0001$). For 2/11 animals the rotational behavior almost disappeared indicating near-abolition of parkinsonian behavior. On histological sections the lesions were clearly identified as areas of necrosis about 4 mm in diameter. The region immediately adjacent to the lesion was found to have highly positive expression of GDNF indicating high activity in dopamine-regenerative processes.

CONCLUSIONS: In this preliminary study we demonstrated that radiosurgical lesioning with the Gamma Knife of the striatum of hemi-parkinsonian animals resulted in a significant behavioral improvement of signs of parkinsonism. Since GDNF expression is tightly linked to the dopaminergic system, we conclude that focused radiation is potentially capable of inducing regeneration of dopaminergic pathways in the adult CNS. Further studies with dose escalation and molecular biological characterization of the regeneration cascades are necessary to gain access to the potential clinical value of our observations.

OBJECTIVES: 1. Realize that radiation injury may induce regeneration in the adult CNS 2. Understand the role of GDNF in the dopaminergic system 3. Predict the potential clinical application of our observations

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Longevity of batteries in internal pulse generators used for deep brain stimulation

AUTHORS: Mohammed S. Bin-Mahfoodh, MBBS; Clement Hamani, MD,PhD; Elspeth Sime, RN; Andres M. Lozano, MD,PhD,FRCS(C)

INTRODUCTION: The longevity of batteries in internal pulse generators (IPGs) used clinically for deep brain stimulation is not known. We conducted a study to assess the life span of these batteries.

METHODS: From 1993 to 2000, 163 single channel batteries (Itrel 2 and Itrel 3) have been surgically implanted to power deep brain stimulation electrodes in our institution. There were 89 patients with movement disorders, 6 with epilepsy and 14 had pain syndromes. The electrical settings (voltage, frequency, pulse widths, and impedance) utilized in these patients were assessed and the total electrical energy delivered (TEED) was calculated and correlated with battery longevity.

RESULTS: Fourteen IPGs had battery failure requiring replacement. In the patients that needed replacement, the mean lifetime of the batteries was 44.0 +/- 13.7 months, ranging from 17-70 months. Batteries with high-energy consumption as assessed by TEED had reduced life ($p < 0.02$). Certain patients with essential tremor developed tolerance to thalamic DBS and required higher stimulation settings. Battery failures were over-represented in this group.

CONCLUSIONS: Battery longevity in the clinical setting of DBS varies with stimulation parameters. Knowledge of battery life is important in the management of DBS patients.

OBJECTIVES: Batteries with high-energy consumption have reduced life. Knowledge of the battery life is important in the management of DBS patients. The total electrical energy delivered is an important parameter in the assessment of battery life span.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: MRI-guided Stereotactic Cingulotomy as Treatment for Intractable Pain in Metastatic Musculoskeletal Cancer : Cases Report

AUTHORS: DA-TONG JU, MD; SHINN-ZONG LIN, MD,PhD

INTRODUCTION: Cingulotomy as a treatment for chronic pain syndrome has been controversial for many years. However, with the improvement of radiological imaging technology and advances in stereotactic techniques, neurosurgeons can perform the operation more accurately and safely than before.

METHODS: Here we describe the cases of two patients with metastatic musculoskeletal cancer pain which was refractory to treatment with analgesic drugs. Using MRI guidance, these patients both received stereotactic cingulotomy under local anesthesia. The targets were coagulated with a 2 mm probe at 85 deg C for 90 seconds and then the probe was withdrawn 5 mm to perform the second point coagulation. A total of four points were coagulated to form a permanent lesion tract about 18 mm in length and 10 mm in diameter on each side of the cingulate gyrus.

RESULTS: Postoperative pain scores showed an average of fifty percent improvement. Neither of the patients developed major postoperative complications and the patients and their families were all satisfied with the surgical results.

CONCLUSIONS: The outcomes of treatment in these two cases suggest that cingulotomy may be an effective treatment for chronic pain syndrome in patients with metastatic cancer that causes intractable pain

OBJECTIVES: 1. MRI-guided localization enables us direct visualization and accurate calculation of the target coordinates. 2. Cingulotomy has beneficial effects about treatment of patients with intractable chronic pain syndrome. 3. The analog pain scores for patient self-outcome assessment is an effective method.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Nucleus Deep Brain Stimulation(DBS) Implantation with Cross-Hair Intraoperative Guiding

AUTHORS: YUAN-HAO CHEN, MD; SHINN-ZONG LIN, MD,PhD

INTRODUCTION: Stereotactic surgery is an effective therapeutic maneuver in the management of dystonia and advanced Parkinson's disease. It had been well known that electrical stimulation of selected target interferes intraoperatively with major symptoms of the Parkinson's disease. Previous reports revealed that VIM DBS implantation greatly relieved the severe tremor; GPI DBS greatly relieved the dyskinesia and only STN DBS could relieve the patient's motor fluctuation and reduction of the on-off phenomenon. The aim of the presentation is to report the results obtained in a series of Parkinson's patients who underwent DBS implantation in STN and we also used the cross-hair intraoperative guiding to correct the target of stimulation.

METHODS: There were 7 patients (3 men and 4 women; mean age is 66 y/o) with 2 to 10 years' history of the Parkinson's disease (mean duration of the disease is 6 years) receiving the STN DBS implantation. All patients received bilateral implantation except one patient received one side implantation. Evaluation with UPDRS scores in 2 months' to one year's following up were obtained.

RESULTS: Control of on-off phenomenon was obtained in about 70% (5/7) patients. The 55% improvement in UPDRS score was obtained. One patient died in post-operative bleeding.

CONCLUSIONS: Neurostimulation permitted treatment of the major Parkinson's symptoms and levodopa-related phenomenon. We also used cross-hair guiding to correct the target intraoperatively to get more effective results.

OBJECTIVES: 1. STN DBS may relieve the motor fluctuation and reduction of the on-off phenomenon. 2. Cross-hair guidance can help us to get more accuracy in localization and effective results.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Ventrointermediate nucleus(VIM) Thalamotomy in Addition to Posteriorventral Pallidotomy for Generalized Dystonia

AUTHORS: GUANN-JUH CHEN, MD; SHINN-ZONG LIN, MD,PhD

INTRODUCTION: We have preciously reported that posteriorventral pallidotomy(PVP) is beneficial for idiopathic generalized dystonia. However the improvement is only prominent for oromandibular and cervical dystonia. For further improving in their limb function, we performed unilateral VIM thalamotomy in 8 patients suffering from intractable generalized dystonia.

METHODS: The 8 patients are 6 males and 2 females, aged from 14-31 years old. Four had previously bilateral PVP and the others received a right PVP before. Burke-Fahn-Marsden Evaluation Scale for dystonia was used for pre- and post-operative objective assessment. The right ventrointermediate(VIM) nucleus of the thalamus was localized with MRI, and thermocoagulated with a bipolar probe.

RESULTS: After the right VIM thalamotomy, there was a remarkable, immediate reduction in muscular hypertonus of all patients left extremities, leading to a functional improvement by more than 30% and lasted for more than one year.

CONCLUSIONS: VIM thalamotomy had addictive effect for treating idiopathic generalized dystonia after pallidotomy.

OBJECTIVES: 1. Posterioventral pallidotomy is beneficial for idiopathic generalized dystonia. 2. VIM thalamotomy has addictive effect for treating idiopathic generalized dystonia after pallidotomy. 3. MRI guidance has more accurately and safely in localization during operation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Beneficial Effect of Moderate Volume Reduction in Hematoma by Stereotactic Aspiration in Spontaneous Thalamic Hemorrhage

AUTHORS: CHUNG-CHING HSIA, MD; SHINN-ZONG LIN, MD,PhD

INTRODUCTION: We reviewed our preliminary result of patients with spontaneous thalamic hematoma treated by computed tomographic guided stereotactic aspiration. The safety of the procedure and patient's outcome were presented here.

METHODS: From January 1996 to January 1998, there were 22 cases (12 males and 10 females) matched the criteria for stereotactic aspiration but only received medical treatment. From February 1998 to June 2002, there were 32 patients (9 males and 23 females) who had thalamic hemorrhage and matched the criteria of stereotactic aspiration. The criteria for the stereotactic aspiration of hematoma were (1) the existence of neurological deficits, (2) ICH volume more than 10 c.c. on brain CT scan, (3) no coagulopathy, and (4) pre-stroke Karnofsky scale more than 40. Patients with rapid neurological deterioration, GCS less than 4, hemorrhage from vascular abnormality, or brain tumor were excluded. The volume of hematoma was measured on each slice and summed using a computerized planimetry. The primary end point was the 3-month Glasgow Outcome Scale (GOS).

RESULTS: The decompressed volume of hematomas by stereotactic aspiration was around 35 to 83% of the size of pre-operative hematomas. In comparison with non-operative group, obvious improvement of GOS, motor function and aphasia were found in the operated group. There was a significant difference in the results of motor function, aphasia and GOS between the operative and non-operative groups.

CONCLUSIONS: Under moderate decompression of the hematoma volume, the stereotactic aspiration for deep seated ICH not only ameliorated the symptoms of neurological deterioration but also reduced the postoperative morbidity and mortality.

OBJECTIVES: 1. Stereotactic aspiration of spontaneous hematoma may reduce the morbidity and mortality and improve the motor function. 2. Decompressed volume of hematoma around 60% is more effective in neurological deficit improvement. 3. Under local anesthesia to perform the stereotactic aspiration method may reduce the morbidity during operation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Nucleus Lesioning for Parkinson's Disease: Recurrence-related Factors

AUTHORS: Osvaldo Vilela Filho, MD; Delson J. Silva, MD; Fernando A. P. Ferraz, MD, PhD; JosÈ Edison S. Cavalcante, MD, PhD

INTRODUCTION: From August 1999 to September 2002 we performed subthalamic nucleus (STN) lesioning for the treatment of Parkinson's disease (PD) in 38 patients. The recurrence rate was 7.9% (3 out of 38 patients), occurring within the first postoperative month in all patients. In this paper, the authors try to determine findings that could be related with the recurrence.

METHODS: The patients were divided into two groups (S: stable improvement and R: recurrence) and compared regarding the following parameters: radiofrequency lesioning parameters, lesion diameters (transversal and vertical), lesion aspect in the early postoperative MRI and STN territory involved by the lesion (lateral, medial, mixed and central). Among the patients with recurrence, two refused another operation and one was reoperated.

RESULTS: Lesioning parameters were similar in both groups (S: 60-75o/60i (60o/60i in 6 patients); R: 60o/60i in two patients and 60o/50i with early current fall off in the other). The lesion diameters were also similar (S: vertical diameter = 2.0-7.5 mm and transversal diameter = 2.0-8.7 mm; R: vertical diameter = 5.3-6.2 mm and transversal diameter = 4.5-7.0 mm). Lesion aspect: hyperintense lesion in all patients with recurrence and three-concentric-zone lesion in the majority of patients with stable results, none of them with the hyperintense type. STN territory involved: central in all patients of R and varied (lateral, medial and mixed, but not central) in the patients of S. The unique patient reoperated derived excellent result from the 2nd surgery (75o/60i, vertical diameter = 5.7 mm, transversal diameter = 6.5 mm, mixed territory involvement and a three-concentric-zone lesion), which remains stable after a follow-up of three months.

CONCLUSIONS: Hyperintense lesion in the early postoperative MRI and central territory involvement of STN occurred exclusively and in all patients with recurrence and should probably be regarded as poor prognostic factors.

OBJECTIVES: 1- Identify the different types of STN radiofrequency lesions; 2- Determine the STN territory involved by the lesion; and 3- Recognize the recurrence-related factors following STN lesioning for Parkinson's disease

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Combination of Frameless Navigation and Intraoperative Neurophysiology for Motor Cortex Stimulator Implantation

AUTHORS: Konstantin V. Slavin, MD; Konstantin V. Slavin, MD; Thulborn Keith, MD, PhD; Fino J John, MS

INTRODUCTION: Among few available options for management of central deafferentation pain syndromes the motor cortex stimulation (MCS) is perhaps the most promising and least invasive modality. Described several decades ago for the treatment of thalamic and trigeminal pain syndromes, this non-destructive procedure is gradually becoming more widely accepted among neurosurgeons and pain specialists.

METHODS: Recently, we used a combination of intraoperative computer-guided navigation and intraoperative electrophysiological monitoring for localization of the motor cortex in a patient with medically intractable pain following a large cerebral infarction. The pain involved the side of body contralateral to the infarction; the patient did not respond to medical management including a trial of intrathecal opioids.

RESULTS: The motor cortex was identified using functional MRI on 3-Tesla scanner. Imaging data were used during intraoperative computer-aided navigation with CBYON frameless guidance system. To verify the motor cortex position, we used epidural recording of somatosensory evoked potentials through a small craniotomy under GA. Reversal of N20 peak polarity indicated location of Rolandic sulcus. The quadripolar electrode (Medtronic) was then positioned over the motor cortex. During the trial, pain relief was obtained with bipolar stimulation below the motor stimulation threshold. There were no stimulation-induced paresthesias; pain relief from the stimulation was almost immediate and lasted for few minutes after the stimulation was stopped. After a weeklong trial the electrode was internalized.

CONCLUSIONS: Using this combination of functional MRI, image-guided computer navigation, and intraoperative electrophysiological testing, we were able to precisely localize the primary motor cortex and subsequently achieve excellent pain relief in a patient with medically intractable central post-stroke pain. We present technical details, report an illustrative case and discuss general aspects of MCS procedure. MCS may be an option for patients with chronic pain syndromes due to strokes, destructive surgical procedures and other deafferentative processes.

OBJECTIVES: 1. Describe indications for motor cortex stimulation. 2. Discuss usefulness of frameless guidance and intraoperative physiological testing in localization of motor cortex. 3. Define technical details and risks associated with motor cortex stimulation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Frameless Stereotactic Apparatus for Placement of Multiple Intracranial Electrodes for Epilepsies

AUTHORS: Andr  Olivier, MD,PhD; Andr  Olivier, MD,PhD; B. Hynes, MD; W. Boling, MD; L. Soualmi, MD

INTRODUCTION: The replace of the stereotactic frame by a frameless apparatus has been a slow and progressive process related to the difficulty of devising an apparatus that could provide easy access to multiple targets through percutaneous twist drill while providing strong immobilization to the skull.

METHODS: A compact frameless stereotactic apparatus for use with image guidance is described. It consists of an articulated arm to which is affixed a plate equipped with two twin chucks. One chuck is used to stabilize the apparatus to the skull. The other receives an optical pointer and is used to select the trajectory, to calculate the distance to the target and to perform the transcutaneous trephination. The whole procedure is carried out with MRI image guidance, 3D reconstruction and blood vessel visualization with double dose of gadolinium. The "double chuck" system fulfils two essential prerequisites for this type of surgery 1: solid fixation to the skull to prevent plunging with the instruments and movement of the platform that would cause errors in trajectory and 2: easy selection of targets and trajectories as well as calculation of distances with image guidance.

RESULTS: So far, the apparatus has been used to insert over 1,665 multiple intracranial electrodes in 111 patients. Originally devised for placement of multiple intracranial electrodes in epilepsy, the apparatus has also been used for cyst aspiration, and tumour biopsies. A description of the apparatus will be presented as well as an illustration of its role in the placement of multiple intracranial electrodes in intractable epilepsies.

CONCLUSIONS: A small compact stereotactic frameless apparatus was devised for insertion of multiple intracranial electrodes. Its use has brought a significant decrease in time, cost and discomfort to patients.

OBJECTIVES: understand 1) technique of depth electrode insertion 2) use of surgical navigation for insertion 3) the MNI method for insertion

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Automatic Microelectrode Recording Analysis and Visualization for Improved Target Localization

AUTHORS: Jon H Falkenburg, MD; James McNames, PhD; Kim J Burchiel, MD

INTRODUCTION: Although signal processing and time series analysis tools have been employed by surgeons to help analyze microelectrode recording signals, none of these techniques produces an automatic, objective and intuitive display of the target versus depth of the electrode. This study investigates novel and intuitive visualization methods to improve the ease of optimal and objective placement of deep brain stimulation electrodes in Parkinson's disease patients during stereotactic surgery.

METHODS: Our approach applies characterizations and visualization of rank energy, marginal probability density function and power spectral density of the microelectrode recordings. These methods are able to distinguish adjacent brain structures and the characteristics within the structures even when spike detection is impossible. Specifically, estimates of burstiness, tremor and how the signal energy varies at different electrode depths can be visualized.

RESULTS: Microelectrode recordings were acquired by using the NeuroTrek system (AlphaOmega, Israel) during stereotactic surgery. Since 2001, the first 11 consecutive Parkinson's disease patients that underwent implantation of chronic deep brain stimulation in the subthalamic nucleus were included in this study.

CONCLUSIONS: A total of 17 microelectrode trajectories were recorded and postoperatively analyzed.

OBJECTIVES: understand the statistical analysis of microelectrode recordings; appreciate the utility of this analysis; understand the limitations of single MER recordings.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Experience using Frameless Navigation in 646 Epilepsy Surgery Cases

AUTHORS: Werner K Doyle, MD

INTRODUCTION: The author describes his experience using frameless stereotactic computer navigation in 646 contemporary epilepsy surgery cases. Procedures included single and multistage craniotomies, burr holes for subdural electrode surveys, combined frame and frameless cases where depth and subdural strips were used, depth electrode placement during craniotomy to augment subdural electrodes, temporal lobectomies, amygdalo-hippocampectomies, lesionectomies, functional hemispherectomies and lobectomies, callosotomies, awake procedures without head fixation, and pediatric procedures.

METHODS: The average age of this surgical population is 30.0 years (s.d. 12.6) ranging from 0.5 to 64 years. There were 320 males and 326 females. In 30 operations (5%) a tumor was defined preoperatively.

RESULTS: The surgical navigation system was used for designing less invasive craniotomies and used with custom subdural electrode designs to facilitate their placement through small craniotomies. The system was important for placing depth electrodes along with subdural electrode arrays in multistage procedures. Variations and additions made to optimize the navigational system to epilepsy surgery are discussed along with how navigation was used to advantage in placing electrodes and performing surgical resections or disconnections. Related technical issues are discussed. Case studies presented include standard and tailored temporal lobectomy, en bloc hippocampectomy, functional lobectomy, and other lesionectomies. The various surgical procedures used in epilepsy surgery are described along with how the navigational system was used; especially what particular advantage it offers.

CONCLUSIONS: Analysis of physiological data fused to anatomic information was facilitated by the system's visualization software that is used off line for pre-operative planning. Though the navigational system is of variable utility during different types of cases, there was no operation where it wasn't useful to some degree. As experience using the device grew, set up and preparation time wasn't significant. Localization systems used were non-cumbersome and didn't interfere with traditional methods and tools. Interactive surgical navigation lends itself well to Epilepsy surgery's localization, trajectory defining, and image fusion needs during pre-operative planning and post-operative analysis of the epilepsy surgery. Case examples are discussed showing how the system was used to advantage by the Epileptologist, Neuropsychologist, and Epilepsy Surgeon.

OBJECTIVES: Using frameless navigation for epilepsy surgery, optimizing intraoperative navigation for epilepsy surgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Combined magnetic resonance (MR)- and positron emission tomography (PET)-guided radiosurgery for brain tumors: experience of 46 cases treated with Leksell Gamma Knife (LGK)

AUTHORS: Marc Levivier, MD,PhD; Nicolas Massager, MD; Jose Lorenzoni, MD; David Wikler, BS; Philippe David, MD; Daniel Devriendt, MD; Serge Goldman, MD,PhD; Jacques Brotchi,

INTRODUCTION: Integration of PET in LGK radiosurgery is an ongoing project with Elekta R&D. The goal is [1] to improve targeting in recognized indications (metastasis, pituitary adenoma), [2] to optimize targeting for novel indications (i.e. infiltrative and primary tumors).

METHODS: Forty-six patients with recurrent tumors were treated using combined guidance of PET and MR for the dosimetry planning. This represents 10% of the patients treated with LGK during this period. There were 30 gliomas (5 pilocytic astrocytomas, 8 low-grade astrocytomas or oligodendrogliomas, 7 anaplastic astrocytomas or ependymomas, 10 glioblastomas), 2 neurocytomas, 1 ganglioglioma, 5 metastases (single or multiple), 8 pituitary adenomas. PET-FDG was used in 24 cases, mostly (21 cases) for the identification of specific areas of high metabolism within malignant primary tumors and metastases. PET-methionine was used in 22 cases, mostly (20 cases) to define tumor limits in benign primary tumors and pituitary adenomas. The final target selection also takes into account the nature of the tumor, the clinical condition, and the prognosis.

RESULTS: PET provided contributive data in 43 cases (93%) and the information were specifically used to adapt the target volume in 35 cases (76%). Preliminary analysis shows that this approach is accurately applicable in clinical routine and that it provides additional information significant benefit for the patients with primary or metastatic recurrent brain tumors. The use of PET-MET to guide LGK in recurrent pituitary adenomas helps to differentiate between the normal residual pituitary gland, the scar tissue and the residual or recurrent adenoma. PET is also useful for the pre-treatment and follow-up evaluation of these patients.

CONCLUSIONS: The integration of PET metabolic data influences the targeting of LGK radiosurgery, which may benefit to selected indications. Stereotactic PET also allows to accurately compare PET-based metabolic data with MR-based anatomical data which contributes to better understand the metabolic changes associated with radiosurgery.

OBJECTIVES: select/suggest indications for PET-guided radiosurgery; select the proposer radiotracer; define the place of PET-guided radiosurgery in the multimodality treatment of brain tumors

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Frameless CT stereotactic technique assist with microneurosurgery

AUTHORS: Zhao XianLin, MD; Wang YunJie, MD; Yao ChangYi, MD

INTRODUCTION: to summarize the experience of the CT frameless stereotactic technique cooperating with microneurosurgery.

METHODS: nine cases with focus in cerebrum were treated by the CT frameless stereotactic technique with microneurosurgery. 4 cases were cavernous hemangioma, two cases the tumors in the region of thalamus and basal ganglion, 1 granuloma, 1 cysticercosis and 1 cerebral sparganosis mansoni.

RESULTS: Results All patients were achieved the expect results without new nerve damage symptom and postoperative complications.

CONCLUSIONS: the technique of CT frameless stereotactic apparatus assist with microneurosurgery is a minimally invasive method with location exactly, minute trauma, convenience, shortcut and safety.

OBJECTIVES: (1) Introduce the Frameless CT stereotactic technique of China Medical University. (2) Communicate with fellows about the stereotactic technique. (3) Find out and study the last stereotactic technique.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Functional Magnetic Resonance Imaging in a Low Field Intraoperative Scanner

AUTHORS: Michael Schulder, MD; Hooman Azmi, MD; Elizabeth Van Iperen, BA; Bharat Biswal, PhD

INTRODUCTION: Functional magnetic resonance imaging (fMRI) has been incorporated into neurosurgical practice, including as a dataset for computer-assisted surgical navigation. However, most experience to date has been with elective preoperative images acquired with high field echoplanar MRI units. We explored the feasibility of acquiring fMRI of the motor cortex with a dedicated low field intraoperative MRI (iMRI).

METHODS: Five healthy volunteers were scanned with the PoleStar N-10 iMRI (Odin Medical Technologies, Israel). A finger-tapping motor paradigm was performed with sequential scans acquired alternately at rest and during activity. In addition scans were obtained during breath holding alternating with normal breathing. The same paradigms were repeated on four of the volunteers on a 3 Tesla MRI (Siemens Corp., Allendale NJ; one volunteer excluded himself from this portion of the study because of spinal instrumentation). Statistical analysis was performed offline using cross correlation and cluster techniques. The location, number of activated voxels, and degrees of statistical significance between the two scanners were compared.

RESULTS: Motor cortex activation was seen in all subjects to a significance of $p < 0.02$ or greater. No clustered pixels were seen outside the sensorimotor cortex. Similar data were acquired with the 3T MRI; there was no significant difference between functional maps generated with the low field and high field imagers. The breath holding paradigm confirmed that the expected diffuse activation was seen on 0.12 T and 3T scans. In the one volunteer with spinal instrumentation imaging with the PoleStar iMRI yielded activation without artifact from the metal implants.

CONCLUSIONS: Accurate functional MRI with a low field iMRI is feasible. The possibility of acquiring this data immediately before surgery and during surgery will increase the utility of iMRI and allow for updated functional imaging, free of the limitations of intraoperative brain shift.

OBJECTIVES: understand the potential for functional MRI at low field strength; compare it to fMRI with high field magnets; appreciate the utility of fMRI in the operating room.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Stereotactic Radiosurgery Compared to Surgery is Associated with the Reduced Risk of Leptomeningeal Spread in Patients with Posterior Fossa Metastases.

AUTHORS: Vitaly E Siomin, MD; Andrew A Kanner, MD; Shih-Yuan Lee, MHSA; John H Suh, MD; Michael A Vogelbaum, MD, PhD; Gene H Barnett, MD

INTRODUCTION: Our objective was to compare the incidence of leptomeningeal spread (LMS) in patients with posterior fossa metastases (PFM) following non-surgical therapies (stereotactic radiosurgery (SRS), whole brain radiation therapy (WBRT), or their combination and surgical resection.

METHODS: Medical records of 93 patients aged 57.88 \pm 10.76 years with PFM treated at Cleveland Clinic from 1995 to 2001 were retrospectively analyzed. The treatment protocols included surgery, SRS, WBRT and their combination. Impact of age, Karnofsky performance status (KPS), Radiation Therapy Oncology Group (RTOG) Recursive Partitioning Analysis (RPA) class, extracranial disease status, size, volume and pathology of PFM were studied with univariate and multivariate analysis.

RESULTS: There were 80 evaluable patients (10 lost to followup and 3 excluded for supratentorial surgery with LMS). LMS occurred after surgical removal of the PFM in 9 of 18 patients (50%). In 4 of 62 patients (6.5%) LMS followed non-surgical treatment (SRS and WBRT) ($p=0.0028$). Multivariate analysis showed that surgical patients were more prone to LMS than SRS patients ($p=0.0024$). Patients had a median 30-point KPS decline after LMS was diagnosed. The survival of patients with LMS was not significantly different from the rest of the patients (13.5 vs. 11.7 months, $p=0.7659$). Patients treated surgically had significantly larger lesions (3.43 \pm 0.74 vs. 1.96 \pm 0.95 cm maximum diameter, $p<0.0001$). Surgery was associated with higher complication rate (24 vs. 7%, $p=0.0263$) and more serious complications (hemorrhage, CSF leak) than non-surgical treatment. Duration of steroid use in SRS patients was not significantly longer than in surgical group (2.1 \pm 3.6 vs. 1.3 \pm 2.4 months). Myopathy and psychosis in one patient after SRS, were the only steroid-related complications. There was no association between the primary pathology and LMS.

CONCLUSIONS: Non-surgical treatment of PFM is associated with markedly lower incidence of LMS than surgery. LMS was associated with rapid considerable decline in the quality of life, but did not influence survival. SRS was associated with considerably lower complication rate and less serious complications than surgery. Surgical patients had poorer initial performance status and larger lesion sizes, which could introduce bias. A prospective study comparing surgery and SRS and the role of LMS in PFM is warranted.

OBJECTIVES: 1. compare the results of nonsurgical (SRS, WBRT) and surgical treatment of PFM 2. discuss the implications of these results on the treatment of PFM

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Is surgery tremor forever?

AUTHORS: Ronald Tasker, MD, PhD, FRCS(C)

INTRODUCTION: Exploiting a 40+ year experience with thalamotomy for tremor of differing types reveals marked differences of outcome.

METHODS: Review of files and of previous published accounts.

RESULTS: Parkinsonian tremor initially relieved totally seems not to recur. Essential tremor tends to recur slowly, while ataxic tremor usually recurs fairly rapidly. These findings suggest important differences in pathophysiology whose understanding might improve therapy. Supporting data will be presented and the data discussed and interpreted.

CONCLUSIONS: previous page

OBJECTIVES: better define surgical outcome.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: MRI Changes in the Rat Hippocampus Following Proton Radiosurgery

AUTHORS: Paul Chapman, MD; James Rabinov, MD; Jonathon Brisman, MD; Jay Loeffler, MD; Marc Bussiere, PhD; Patricia Lee, ; Gilberto Gonzalez, MD; Rees Cosgrove, MD,FRCS(C)

INTRODUCTION: Radiosurgery is being used for functional purposes but little is known about its radiobiology in normal tissues. We define the radiographic dose-response relationships for proton radiosurgery using a rat brain model.

METHODS: A group of 23 rats were treated with Bragg peak proton beam irradiation involving the right hippocampus. Single doses of 5 CGE, 12 CGE, 20 CGE, 30 CGE, 60 CGE, 90 CGE, and 130 CGE were delivered to groups of 3 animals. One extra animal was included at the 130 CGE and 30 CGE doses. Animals were imaged at 1.5 months, 3 months, 4.5 months, 6 months and 9 months using a standard 1.5 tesla GE Signa MRI. A 3" surface coil was employed to obtain T1 weighted sagittal images (TR 600 and TE 30) and dual echo T2 weighted coronal images (TR 3000, TE 30/90). T1 weighted coronal images were also obtained if an abnormality was detected on the T2 weighted images. Off-line volumetric analysis with custom software was done to evaluate areas of increased signal on T2 weighted images. Point to point analysis was used to identify areas of 25% signal increase compared to contralateral gray and white matter. Where signal abnormality involved both sides, comparison to images from the previous time point were also used. In addition the development of hydrocephalus was evaluated.

RESULTS: Signal change vs. time curves generated from volumetric MRI data demonstrate that peak tissue injury was more pronounced and occurred earlier with higher vs. lower doses of radiation. Maximal MRI changes were seen at the higher doses but changes were seen even at low dose (20 CGE) in at least one animal. Hydrocephalus also developed earlier with higher doses of radiation.

CONCLUSIONS: Following single dose proton radiosurgery of rat hippocampus, serial MRI's show T2 signal changes in animals ranging from 130 CGE down to 20 CGE as well as the development of hydrocephalus. Dose-effect relationships using proton radiosurgery in rats will be a helpful step in guiding further studies on radiation injury to brain tissue.

OBJECTIVES: To understand the dose response relationships of proton radiosurgery in the rat and its implications for functional radiosurgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Predictive Factors of Radiation Necrosis after Radiosurgery for Cerebral Metastases

AUTHORS: Charles A ValÈry, MD; Georges Noël, MD; Michel Duyme, PhD; Gilbert Boissarie, PhD; Jean-Jacques Mazon, MD, PhD; RÈmy van Effenterre, MD; Philippe Cornu, MD

INTRODUCTION: The risk of complication following radiosurgical treatment of tumors has been often correlated to their volume. The aim of the study was to determine whether this relationship might be related to the amount of normal tissue included in the prescription volume (V70%), more than to the tumor volume itself, or not.

METHODS: 377 patients presenting 760 lesions were treated between 1994 and 2001, using a 10MV LINAC, a Leksell G frame and the ISIS software for dosimetry. Mean age was 57 (30-86), mean Karnofsky index (KI) was 70, mean RPA was II. Main primary tumors had lung (56%), melanoma (9.5%), kidney (8.4%), digestive (7.1%), and breast (7%) locations. Seventy-five percent of the patients presented less than 3 lesions, located supra-tentorially in 79% of the cases. The overall mean diameter was 2.5 cm (0.7-5) and mean volume was 4.9 cm³ (0-71). Most of the lesions were treated with a single collimator; mean peripheral dose at the 70% isodose was 15.6 Gy, mean maximum dose was 21.6 Gy.

RESULTS: Six percent of the patients presented severe complications (grade >2 RTOG), including radionecrosis (n=9), oedema (n=6), seizures (n=6), haematoma (n=3). In 3 cases, a surgical procedure has been required for detersion, with a fair outcome. Median survival was 8.6 months, local control rate was 84% at 1 year and 79% at 2 years. Multivariate analysis showed influence of 3 parameters on survival: KI (p=0.04), disease control (p=0.05) and number of lesions (p=0.05). When comparing populations with vs without severe complications, the most significant parameter was conformity index (V70% /PTV): p=0.007.

CONCLUSIONS: Toxicity after radiosurgical irradiation seems to be more correlated to conformity of the treatment plan than to the dose, its homogeneity or to tumoral volume.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Predictive Factors of Radiation Necrosis after Radiosurgery for Cerebral Metastases

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CONCLUSIONS: Toxicity after radiosurgical irradiation seems to be more correlated to conformity of the treatment plan than to the dose, its homogeneity or to tumoral volume.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Electrode Placement in Deep Brain Stimulation by Functional Identification of the Targets: Macro- vs. Microrecording

AUTHORS: Jan Vesper, MD; Fabian Klostermann, MD; Mario Brock, MD

INTRODUCTION: The intraoperative determination of final electrode position in Deep Brain Stimulation (DBS) is commonly realized by indirect imaging techniques. The value of both microrecording and macrorecording techniques for target setting is still uncertain. Somatosensory evoked potentials might provide an easily obtainable information which is robust toward electrical noisy surroundings, status of analgesia and intraoperative compliance of the patient.

METHODS: Median nerve SEP were recorded from the final stimulation electrode (Medtronic 3389) and spontaneous discharges were recorded using semimicroelectrodes (Inomed, Germany) in 38 surgical procedures of 23 patients (targets: 12 STN, 11 VIM). Accuracy of target setting was determined by recalculation of the predefined target coordinates in comparison to the exact position of the final active contact using image fusion technique. SEP recordings were performed in the calculated target and 1 cm and 2 cm above along the trajectory. Microrecordings were performed in 1 mm steps starting 1 cm above the target.

RESULTS: Differences between the calculated and the final targets in VG and CT ranged from 0,75 to 2,08 mm (mean 1,8 mm). Thalamic SEP macrorecording revealed specific patterns along the trajectory for STN (positive peaking around 18 ms) and VIM (negative peaking) electrode placement. In the VIM a phase-reversal of the SEP was observed in all cases. Therefore three mislocalized electrodes were detected, after corrections typical SEP were obtained. Microrecordings were inconstant with large differences between the patients. If recordings were successful, the points of maximal discharge revealed a sufficient clinical result with 130 Hz stimulation, especially in the STN.

CONCLUSIONS: VIM and STN could be distinguished by SEP criterias. Microrecordings were inconstant and ? until now - with a limited importance for setting of final electrode. Intraoperative image fusion was helpful in order to improve the accuracy of target setting.

OBJECTIVES: Participants should be able to learn about the value of microrecording for target setting in Deep Brain stimulation. Furthermore macrorecording is introduced as an additional tool for target setting.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Cingulotomy for Intractable OCD: A Long Term Follow-up Study

AUTHORS: Rees Cosgrove, MD,FRCS(C); Darin Dougherty, MD; Lee Baer, PhD; Edwin Cassem, MD; Bruce Price, MD; Mike Jenike, MD; Scott Rauch, MD

INTRODUCTION: The purpose of this study was to prospectively assess long-term outcome associated with cingulotomy for treatment refractory obsessive-compulsive disorder.

METHODS: We conducted prospective follow-up assessments at multiple time points of 44 patients undergoing one or more cingulotomies for treatment-refractory obsessive-compulsive disorder. Patients were administered the Structured Clinical Interview for DSM-III-R pre-operatively. Patients were administered the Yale-Brown Obsessive-Compulsive Scale, Beck Depression Inventory, and Sickness Impact Profile pre-operatively and at all follow-up assessments. Patients completed the Clinical Global Improvement scales at all follow-up assessments. Patients were classified as Responders if they had a greater than 35% improvement on YBOCS and a CGI score less than or equal to 2; or as Partial responders if they had either a 35% improvement on YBOCS or a CGI score less than or equal to 2. Analyses of functional status (as measured by the SIPS) at most recent follow-up compared to baseline incorporated two-tailed, paired t-tests.

RESULTS: At mean follow-up of 32 months following one or more cingulotomies, 14 patients (32%) met criteria for treatment "responders", and 6 others (14%) were "partial responders". Thus, 20 patients (45%) were at least partial responders at long-term follow-up following one or more cingulotomies. Few adverse effects were reported.

CONCLUSIONS: Results indicate that 32% to 45% of patients previously unresponsive to medication and behavioral treatments are at least partially improved after cingulotomy. Cingulotomy remains a viable treatment option for patients with severe treatment-refractory obsessive-compulsive disorder.

OBJECTIVES: Understand the role of cingulotomy in the treatment of severe intractable OCD

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Selective Peripheral Denervation for the Treatment of Intractable Spasmodic Torticollis: The Mayo Clinic Experience with 168 Patients

AUTHORS: Aaron A Cohen-Gadol, MD; Dudley H Davis, MD; Eric Ahlskog, MD; Joseph Matsumoto, ; Mary Swansen, RN

INTRODUCTION: Selective peripheral denervation is currently the primary surgical treatment for intractable cervical dystonia. We assessed preoperative factors to determine which, if any, correlated with outcomes in patients with torticollis who underwent this procedure.

METHODS: The records of 168 consecutive patients who underwent selective peripheral denervation for cervical dystonia between 1988-1996 at the Mayo Clinic (Rochester, MN) were reviewed. There were 89 (53%) women and 79 (47%) men with the mean age of 53.4 years. Selection of muscles for denervation was based on the clinical presentation and electromyographic mapping studies. The most common torticollis vectors were rotational in 141 (84%) patients and laterocollis in 59 (35%). Seventy patients (42%) presented with combined vectors. The technique for both included denervation of the ipsilateral posterior cervical paraspinal and splenius capitus muscles. Denervation of the sternocleidomastoid muscle was performed on the contralateral side for rotational torticollis and on the ipsilateral side for laterocollis. A rigorous physical therapy program followed surgery.

RESULTS: At the three-month postoperative evaluation, 125 of 162 available patients (77%) had moderate to excellent improvement in head position; pain was moderately to markedly improved in 131 (81%). Follow-up averaged 3.4 years and was available for 130 patients. The original level of moderate to excellent improvement was retained in at least 71 (70%) patients for head position and pain. Outcome was not predicted by preoperative head position, severity, symptom duration, presence of tremor or phasic dystonic movements, or failure to respond to botulinum toxin treatment. Five patients recovered from postoperative complications including one myocardial infarction, one pulmonary embolism, and three respiratory failures. Three patients suffered from persistent C2 distribution dysesthesias and three from slight shoulder weakness; one had a wound infection, and one expired from respiratory arrest.

CONCLUSIONS: Selective peripheral denervation is an effective method of achieving lasting improvement of dystonia in most patients with intractable torticollis.

OBJECTIVES: 1. Understand the indications for surgical treatment of torticollis. 2. Be able to briefly describe the technique of peripheral denervation. 3. Be able to discuss the outcome from this technique.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Idiopathic Eagle Syndrome ? Underdiagnosed Syndrome of the Glossopharyngeal Nerve Entrapment

AUTHORS: Konstantin V. Slavin, MD; Konstantin V. Slavin, MD

INTRODUCTION: Eagle syndrome is a rare pain syndrome associated with elongation of the styloid process. Pain is usually localized in the earlobe, mandibular angle, upper neck, and tonsillar region. In his original description, Eagle recognized this syndrome in patients after tonsillectomy hypothesizing that scar tissue formation around the tip of styloid process is responsible for irritation of the glossopharyngeal nerve that passes in close proximity of the styloid tip. Subsequently, multiple reports appeared in oral surgery and otolaryngology literature, and in most cases previous traumatic event, mainly tonsillectomy, was implicated in Eagle syndrome development. In most cases, however, surgical removal of the elongated styloid process through transoral or transcervical approach completely eliminated the pain.

METHODS: We recently reported a patient with Eagle syndrome who had no previous surgeries or injuries to her oropharynx. This 38 year-old woman had unilateral pain in the oropharynx, earlobe and the mandibular angle. The workup revealed an elongated styloid process, and the local anesthetic block temporarily eliminated the pain, confirming the diagnosis. Once the elongated styloid process was resected, the pain resolved.

RESULTS: Subsequently, another patient presented with similar complaints; her workup also showed an impressive ipsilateral styloid process elongation. This 50 year-old woman had pain for 8 years; she had no history of trauma or surgical intervention involving the tonsillar area, neck or ear. In this case, there was also a complete pain resolution after surgical resection of the elongated styloid process.

CONCLUSIONS: Based on this limited experience, we suggest existence of idiopathic Eagle syndrome variant that is caused by an unexplained styloid process elongation and associated glossopharyngeal nerve entrapment. Neurosurgeons should be aware of this condition keeping it as a part of differential diagnosis of chronic pain in the ear, face and throat region.

OBJECTIVES: Upon reviewing this poster the attendees will be able to: 1. Describe clinical features of Eagle syndrome. 2. Describe diagnostic workup and surgical treatment of pain associated with elongated styloid process. 3. Discuss differential diagnosis of chronic pain in the ear and throat.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: The indication to Stereotactic Biopsy of deep-seated lesions with the Patil frame
. A classical indication even in the era of frameless Stereotaxy

AUTHORS: Mostafa Khashab, MD,PhD; Mostafa Khashab, MD,PhD

INTRODUCTION: The indications and results of stereotactic biopsy of deep-seated lesions of the brain in order to establish a tissue diagnosis is a classical indication. In the modern era, the development of frameless stereotaxy had taken over some of the indications for frame-based procedures. The place for frame-based stereotactic biopsy is still present when a biopsy is sought as it offers a straightforward and very reliable method for gaining the information needed, namely a histological tissue diagnosis.

METHODS: A comparison of the results of both methods for the biopsy of those lesions is summarized

RESULTS: We believe that the indication for performing those frame-based measures is a very useful method in experienced hands

CONCLUSIONS: The reliability of this method is very well-established and is very precise and accurate in experienced hands. A literature review about the comparison is given and analyzed.

OBJECTIVES: understand 1) the use of a frame for stereotactic biopsy 2) technique of the Patil frame 3) advantages of frame-based biopsies.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Operative technique and results of subtemporal amygdalohippocampectomy for medically intractable medial temporal lobe epilepsy

AUTHORS: Tomokatsu Hori, MD,DMSc; Fumitaka Yamane, MD,DMSc; Taku Ochiai, MD; Motohiro Hayashi, MD,DMSc; Takaomi Taira, MD,DMSc

INTRODUCTION: Since 1975, the technique of selective amygdalohippocampectomy for medial temporal lobe epilepsy has been established by Wieser & Yasargil. In 1993, the authors reported the subtemporal amygdalohippocampectomy as the alternative technique to transylvian approach. The operative and neuropsychological results will be presented in this communication.

METHODS: 23 cases of nonlesional 10 cases of lesional drug resistant medial temporal lobe epilepsy have been treated by subtemporal amygdalohippocampectomy. Postoperative results for seizure control using the criteria of Engel's seizure control classification will be reported. And pre- and postoperative (2m, 2y after the operation) neuropsychological data have been analyzed using paired t-test. And finally, postoperative complication will be reported in these 33 cases.

RESULTS: Seizure control(Engel's Class I & II) was 82.6% for nonlesional 23 cases, and 100% for lesional 10 cases. So far, no postoperative complication including visual field impairment, sensorimotor impairment, temporal lobe damage (hematoma, cotusion) has been encountered. VIQ improved after 2years, and PIQ and FIQ improved after 2 months and 2 years postoperatively. There was no significant decline of the postoperative verbal memory scores in those patients whose medial temporal structure of the language dominant side had been removed.

CONCLUSIONS: Subtemporal amygdalohippocampectomy is safe and effective operative technique for medically intractable medial temporal lobe epilepsy.

OBJECTIVES: learn (1) Surgical technique, (2) Surgical results, and (3) Neuropsychological results of subtemporal amygdalohippocampectomy.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Intraoperative Placement of Subthalamic Stimulator After Failed Thalamic Stimulation in Essential Tremor

AUTHORS: Nicholas M Wetjen, MD; Ryan J Uitti, MD; Margaret F Turk, MSN; Robert E Wharen, MD

INTRODUCTION: Deep brain stimulation of the thalamic ventralis intermedius (Vim) nucleus has become an established method for surgical treatment of medically resistant essential tremor. The positive effect of thalamic DBS has been documented to improve the level of impairment and quality of life in these patients. There is evidence however of patients who have tremor that is refractory to thalamic stimulation or who experience significant side effects at low stimulation parameters. We describe a patient who had essential tremor refractory to thalamic stimulation who experienced relief after moving the stimulating electrode to the subthalamic nucleus.

METHODS: We present a case of 65-year-old male with a fifteen-year history of progressive essential tremor predominantly involving his left hand. The patient was taken to surgery and a target in the right thalamic ventralis intermedius nucleus was chosen. A quadripolar deep brain stimulator electrode (Medtronic Activa) was advanced to the target. Stimulation through the electrode was unsuccessful in significantly relieving tremor along multiple pathways through the thalamus. Another target in the subthalamic nucleus was chosen to determine whether it was efficacious in relieving tremor.

RESULTS: Removing the stimulating electrode from the thalamus and redirecting it to the subthalamic nucleus resulted in elimination of contralateral upper extremity action tremor at low stimulation voltage with no side effects. Follow-up evaluation at three months has verified continued relief of the tremor with only minor adjustments in the stimulation parameters.

CONCLUSIONS: Subthalamic stimulation may prove to be an effective alternative to thalamic stimulation in patients with essential tremor. Stimulation of the subthalamic nucleus is currently a promising treatment for the relief of symptoms associated with Parkinson's disease. The potential role of the subthalamic nucleus in the pathophysiology of tremor and its role as a potential surgical target in the treatment of tremor are reviewed.

OBJECTIVES: 1. Efficacy of thalamic deep brain stimulation targets in the management of patients with essential tremor. 2. The subthalamic nucleus may prove to be a possible alternative when stimulation of the conventional thalamic target fails to control tremor or causes significant side effects. 3. The role of the subthalamic nucleus in the pathophysiology of various tremors is reviewed.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Comparative Evaluation of the Effects of Unilateral Lesion vs. Electrical Stimulation of Gpi in Advanced Parkinson's Disease.

AUTHORS: Fiacro JimÈnez, PhD; Francisco Velasco, MD; JosÈ D. Carrillo-Ruiz, MD; Luis GarcÌa,, MD; Joel Cevallos,, MD; Martha L PÈrez, BS; Irma M-rquez, PT

INTRODUCTION: We present a prospective analysis on the effects of unilateral lesion vs. electrical stimulation of Gpi in the treatment of patients with bilateral Parkinson disease (PD) symptoms.

METHODS: Eighteen Patients in stages III to V of Hoehn and Yahr scale (H-Y) with prominent rigidity, bradykinesia and gait disturbances were included. Patients were divided in 2 groups: patients treated with lesions (n=9) and with electrical stimulation (n=9) through totally implanted systems in the same Gpi target. Special attention was paid to have a homogeneous severity of symptoms of PD in both groups evaluated through New York Parkinsonís Disease (NYPDS), Unified Parkinsonís Disease Rating (UPDRS), Schwab and England (S-E) and H-Y scales and with another scale created with certain items of NYPDS estimating symptoms independently in each extremity. Both, lesions and electrodes were stereotactically placed in the ventro-posterior Gpi as confirmed by postoperative MRI. Scales were repeated at 3 and 6 months post-operation. Significance of changes was evaluated through Wilcoxon test and inter-group significance through Mann-Withney U Test.

RESULTS: Both procedures significantly decreased rigidity and bradykinesia in contralateral extremities. Only ES significantly decreased tremor in contralateral extremities and rigidity and bradykinesia in ipsilateral extremities. In none of the groups ipsilateral tremor was significantly decreased. Although improvement of symptoms seemed to occur before and to be more significant with ES, no significant differences were observed in the inter-group analysis. Overall improvement in the H-Y scale was from I to II points which allowed patients to be independent in daily activities. Dyskinesias significantly improved and L-DOPA dose decreased 223 mg/day average. Two complications were observed in the lesion group.

CONCLUSIONS: ES was safer than lesion and seemed more efficient in controlling PD symptoms, although not statistically significant. Unilateral lesions and ES had a bilateral effect and may improve the patients to a point of making them self-sufficient.

OBJECTIVES: 1. Participant should learn that electrical stimulation is more efficient than lesion. 2. They should also learn that Unilateral Electrical Stimulation may elicit bilateral improvement of symptoms. 3. Participants should learn that in order to locate the target of the lesion or electrode site, microelectrode recordings are not necessarily required.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Bilateral Electrical Stimulation of Prelemniscal Radiations in Advanced Parkinsonís Disease.

AUTHORS: JosÈ D. Carrillo-Ruiz, MSc; Francisco Velasco, MD; Fiacro JimÈnez, MD; JosÈ A. Hernandez-Silverio, Prof; Carlos Arg,elles, MD

INTRODUCTION: In a previous report electrical stimulation (ES) of prelemniscal radiations, (Raprl), a fiber system placed behind STN and lateral to red nucleus (Ru) has proved effective in controlling contralateral tremor and rigidity, without increasing bradykinesia. Present report analyses the effect of bilateral Raprl-ES in advanced Parkinsonís disease stages.

METHODS: Five patients in stage 5 of Hoehn and Yahr scale (H-Y) had bilateral electrodes for depth brain stimulation (DBS by Medtronic) placed stereotactically in Raprl. Ventriculography was used to estimate the location of Raprl and the target was evaluated by dividing the AC-PC length in 10 equal parts and using resultant units to determine stereotactic coordinates: X=5/10 lateral to midline, Y=8/10 posterior to AC and Z=2/10 below AC-PC. Simple insertion of electrodes for stimulation arrested or greatly decreased tremor and rigidity in contralateral extremities in all cases. Trans-operative macrostimulation and somatosensory evoked potentials determined the proximity of sensory or pyramidal fibers. Stereotactically oriented MRI demonstrated the position of electrodes always behind STN and lateral to Ru. Chronic bipolar electrical stimulation through internalized systems was continuous, 130 Hz, 0.09 to 0.330 μ sec, 1.0 -3.0 V. Patientís condition was evaluated pre-operatively, 3, 6, 9, and 12 months through H-Y, Schwab-England (S-E), UPDRS, NYPDS always performed after 24 hours OFF medication and ON stimulation. Significance of changes was estimated through Wilcoxon Test.

RESULTS: Significant improvement was detected in H-Y that decreased from 5 to 2.6 ($p<0.02$), NYPDS from 15 to 5 ($p<0.001$), UPDRS from 67.5 to 30 ($p<0.05$). Although with a tendency to improve in S-E scale, it was not significant. More important was the analysis of improvement by symptoms. Highly significant improvement was obtained for tremor and rigidity ($p<0.001$), and significant for bradykinesia and gait disturbances ($p<0.01$).

CONCLUSIONS: Raprl-ES is a useful procedure to improve advanced PD cases, simpler to target than STN and Gpi. We must wait for a comparative study to be tested against these other targets

OBJECTIVES: 1. New target for the treatment of Parkinson's Disease 2. Precision of ventriculography in targeting the posterior Subthalamic area when using standardization 3. Scale of evaluation of PD for each symptom and each of the extremities

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Frameless radiosurgery for Trigeminal Neuralgia

AUTHORS: Pantaleo Romanelli, MD; Gary Heit, MD, PhD; Steve Chang, MD; John Adler, MD; Dave Martin, MD

INTRODUCTION: Modern treatment of trigeminal neuralgia includes frame-based stereotactic radiosurgery, percutaneous radiofrequency ablation of gasserian ganglion and microvascular decompression. Stereotactic radiosurgery is the least invasive treatment but several weeks may elapse before pain relief is achieved. As a result this procedure is ill-suited for patients in acute pain.

METHODS: The Cyberknife is an image-guided radiosurgical instrument designed to avoid the use of a stereotactic frame. We have used the Cyberknife to deliver frameless radiosurgical treatment to the fifth nerve in selected patients with trigeminal neuralgia. Computerized tomography (CT) cisternography was used to identify the fifth nerve in its course from the pons to Meckel's cave. This method produces very accurate localization of the fifth nerve and, differently from MR based localization, is not subject to magnetic susceptibility distortion artifacts. Overall targeting accuracy is superior to frame-based localization methods.

RESULTS: Image-guided radiosurgery was employed in 5 patients with medically refractory trigeminal neuralgia. These patients were poor candidates for open surgery because of a combination of age and concomitant medical problems. An 80% isodose ranging from 66 to 70 Gray was delivered as a single fraction to the length of the nerve within the ambiens cistern in a conformal fashion. The average length of the trigeminal nerve treated was approximately 8 mm, sparing the proximal 3mm close to the root entry zone. Overnight pain relief was obtained in all with no relapses after 3 months follow-up.

CONCLUSIONS: Frameless radiosurgery is a new non-invasive treatment for trigeminal neuralgia. Due to the absence of a stereotactic ring, there are reduced constraints to treatment planning and patient's comfort is enhanced. Targeting accuracy is augmented by the more precise identification of the trigeminal nerve using CT cisternography. The use of conformal dosimetry may explain the overnight pain relief, as a longer segment of nerve is encompassed in the 80% dosimetry region as opposed to a spherical lesion. Additionally, positive contrast CT cisternography ensures accurate dose deposition on the nerve as opposed to MR targeting which is subject to spatial distortion artifacts on the order of the nerve diameter or greater.

OBJECTIVES: Discuss treatment options for trigeminal neuralgia. Discuss the difference between isocentric and non-isocentric conformal treatment planning. Discuss the advantages of frameless radiosurgery as opposed to traditional framebased radiosurgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: A 10 Year Experience with Magnetic Source Imaging in the Guidance of Epilepsy Surgery

AUTHORS: Joseph R Smith, MD; Don W King, MD; Yong D Park, MD

INTRODUCTION: Previous studies have shown that magnetic source imaging (MSI) may provide additional localizing information that assists in guiding resection of epileptic foci. The current study is an expansion of previously reported MSI data suggesting that MSI may enhance the outcome of epilepsy surgery in certain groups of patients

METHODS: Between 1991 and 2001, 100 patients with drug-resistant complex partial epilepsy underwent MSI. Data were available in 94 cases. All patients underwent volumetric MRI followed by magnetoencephalography (MEG). The MRI and MEG data were co-registered to create MSI data. MSI epileptiform data were blindly reviewed and spatial distributions were classified as focal, regional, multiple, scattered, or none. Post-resection photographs were blindly compared to MSI data to determine whether extensive ($\geq 2/3$ MSI focus), partial ($< 50\%$ MSI focus) or no resection of MSI focus was accomplished

RESULTS: 60 patients underwent surgery. There were 27 anterior temporal lobectomies (ATL) and 33 extra-temporal/neocortical (XMT) resections. Regarding ATL cases, neither extent of MSI resection, focality of MSI focus, or spatial agreement of MSI and electrographic data influenced outcome. Of the 24 XMT cases with MSI epileptiform foci and absence of structural lesions on MRI, 11/13 (85%) with extensive MSI resections were seizure free. Of the 11 XMT cases without extensive resections, 1 (9%) was seizure free.

CONCLUSIONS: The current study documents the usefulness of MSI in guiding epilepsy surgery for non-lesional XMT cases. More extensive studies are needed to further determine the utility of MSI in guiding epilepsy surgery.

OBJECTIVES: 1) know the relative utility of MSI and EEG in evaluation and guidance of epilepsy surgery, 2) types of cases in which MSI may assist in guiding epilepsy surgery, 3) what direction future MSI epilepsy studies may take

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Long-term Results of Thalamic Deep Brain Stimulation for Essential Tremor

AUTHORS: Nicholas M Wetjen, MD; John D. Putzke, PhD; Ryan J. Uitti, MD; Zbigniew K. Wszolek, MD; John J. A. Lucas, PhD; Margaret F. Turk, MSN; Robert E. Wharen, MD

INTRODUCTION: Essential tremor (ET) is a commonly diagnosed movement disorder typically involving high frequency postural and intention tremor. Individuals with essential tremor can experience disabling tremor that is resistant to pharmacological treatment in up to 50% of cases. Surgical intervention has generally targeted the ventral intermediate nucleus (Vim) of the thalamus for management of tremor. Multiple studies have demonstrated the beneficial short-term efficacy of Vim Stimulation among individuals with ET across a broad range of outcome domains. In comparison there are relatively few studies examining long-term outcomes of Vim stimulation.

METHODS: A clinical series of 52 consecutive individuals undergoing placement of a DBS system for treatment of essential tremor (ET). Longitudinal, unblinded assessment of tremor and activities of daily living at baseline (pre-surgical), and post-operative intervals of 1, 3, and 12 months and annually thereafter. A battery of subjective and objective measures of tremor was completed at planned post-operative intervals.

RESULTS: Analysis of the subjective measures indicated that stimulation was associated with significant improvement at nearly every post-operative interval as compared to pre-operative and stimulation off ratings of ADL functioning, midline tremor, contralateral upper extremity tremor, and contralateral lower extremity tremor. Objective measures also showed significant improvement with stimulation at nearly every post-operative interval as compared to pre-operative and stimulation off measurements of frequency (Hz), power (milligravities; mg), and total power (mg) for both resting and postural contralateral tremor. Some subjective and objective measures of ipsilateral tremor showed improvement with stimulation, but only over the first three months. Stimulation was not associated with significant change in reaction time, movement time, or finger dexterity. A consistent increase or decrease over time was not found for any of the outcome measures in either the on or off condition after the first month. Rate and amplitude increased only over the first three months. Pulse width remained unchanged.

CONCLUSIONS: DBS is generally a well tolerated and effective long-term treatment for essential tremor. Long-term tolerance to stimulation reported by others has not been observed.

OBJECTIVES: 1. Describe the long term subjective benefit (ADL) of thalamic stimulation for essential tremor. 2. Describe the long term results on objective measures of tremor control after DBS for essential tremor. 3. Describe the methodological analysis and drawbacks of determining outcome data in longitudinal series of patients who underwent DBS for essential tremor.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Implantation and Testing of Responsive NeuroStimulator (RNS) System for Epilepsy

AUTHORS: Michael Munz, MD; Robert D. Sweazey, PhD; Carla Barrett, MS; Audra Plenys-loftman, PhD; Harry Vinters, MD; Zaneta Popovska, BS; David A. Greene, BS

INTRODUCTION: An implantable Responsive NeuroStimulator System (RNSS) developed for intractable epilepsy will soon begin human trials. The RNSS is a system that is modifiable to the seizure dynamics of a specific patient and delivers therapy only in response to detected events. The RNSS consists of quadripolar depth and cortical strip leads, an advanced 8-contact Responsive NeuroStimulator (RNS), and programmer system (PS). The RNS includes the following capabilities: four-channel sensing, detection, stimulus delivery, stored ECOGís that can be downloaded into the PS, diagnostics and complex programmable therapies. The RNSS has been designed for use by clinicians. The objective of this study is to demonstrate the operational characteristics of the RNSS through chronic implantation and stimulation.

METHODS: Ten sheep were implanted with the lead system. Depth electrodes were placed stereotactically into the hippocampus and cortical strip electrodes were placed over the parietal and frontal lobes. Leads received 30 minutes of continuous stimulation per lead each week (50 Hz, 2.5 mA, 300 ms phase duration, biphasic) and weekly impedance measurements and signal recordings were performed. The animals were sacrificed at 4-9 months for histological analysis. Two additional animals were also implanted with RNS pulse generators, and a chronic replacement was demonstrated.

RESULTS: Stimulation of electrodes in the hippocampus produced afterdischarges suggesting that this model may be used for investigating kindling. The cortical electrodes showed slowing of activity after stimulation. Histopathological examination revealed no significant adverse tissue reaction to either implantation or stimulation.

CONCLUSIONS: The RNSS is a new approach for the treatment of epilepsy. Heretofore, stimulation therapy for epilepsy has used open-loop continuous or periodic stimulation paradigms. This study demonstrated the functionality of the RNSS in vivo and is an important part of the pre-clinical work required to begin the clinical trial of the system in patients.

OBJECTIVES: 1. Update participants on new developments for stimulation for epilepsy
2. Present in vivo methods for safety and functionality testing of new medical devices
3. A new animal model for kindling

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Spinal cord stimulator adjustment to maximize implanted battery longevity: A randomized, controlled trial using a computerized, patient-interactive programmer

AUTHORS: Richard North, MD; Sherri-Kae Calkins, ; David Brigham, BS; David Campbell, BS; Steven Piantadosi, MD, PhD; Michael Daly, MD; Bobby Day, MD; Giancarlo Barolat, MD

INTRODUCTION: Internally powered generators (IPG's) have been an important advance in spinal cord stimulation for the management of pain, but they require surgical replacement, when the implanted battery is depleted. Battery life is determined by the programmed settings of the implant, but until now the technical means have been lacking, to optimize these settings for maximal battery life.

METHODS: We have developed a patient-interactive, computerized programmer, designed for easy operation and comprehensive data management, which have not been features of the standard programmers available until now. It automatically and rapidly presents to the patient a sequence of settings (contact combinations and pulse parameters) specified by the practitioner. Test results are analyzed and sorted to determine the optimal settings by multiple criteria, including battery life. We have compared the computerized, patient-interactive system with standard practitioner-operated, manual programming methods in a randomized, controlled trial in 44 patients at two study centers.

RESULTS: In 95% of patients (41/43), the computerized, patient-interactive system identified new settings with improved estimated battery life (and corresponding anticipated cost savings) which had not been recognized as such using manual methods. The estimated battery life for the setting chosen by each patient using manual methods averaged 25.4 ± 49.5 months; the longest battery life identified by computerized methods averaged 55.0 ± 71.7 , a 2.2-fold or 29.6 month improvement. In 65% of patients (28/43) these new settings had better technical results (overlap or coverage of pain by stimulation paresthesias), with equal or better battery life than any setting tested, let alone recognized, by manual methods. As reported previously, the new system also yields significantly ($p < 0.0001$) better technical results than traditional, manual methods in achieving coverage of pain by stimulation paresthesias; the very best technical results were achieved at some expense in estimated battery life (assuming the same frequency of use).

CONCLUSIONS: Significant potential savings in longevity of the implanted battery are possible in the majority of patients with implanted spinal cord stimulators, but have not been realized until now; these new programming methods facilitate this. Long-term clinical followup will be required to establish the full magnitude of the resulting savings.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Subtraction Ictal SPECT Co- registered to MRI (SISCOM) in the Long Term Outcome for Repeat Epilepsy Surgery

AUTHORS: Nicholas M Wetjen, MD; Gregory D. Cascino, MD; A. James Fessler, MD; Elson L. So, MD; Denise M Cambier, MD; Terence J O'Brien, MBBS; Brian P. Mullan, MD; W. Richard Marsh, MD

INTRODUCTION: Seizures persist or recur in 20-60% of patients who have undergone resection for intractable partial epilepsy. Recurrences typically occur within the first 2 years of the initial operation are likely to persist. Given the risks attendant to neurosurgical procedures and the costs involved in evaluating and treating potential surgical candidates techniques that predict likelihood of success in repeat surgery are needed. SISCOM has been shown to be a reliable indicator of the site of seizure onset in patients with intractable partial epilepsy. The diagnostic yield of SISCOM in patients being evaluated for re-operation is unknown. This study evaluates the role of SISCOM in patients who are undergoing evaluation for repeat epilepsy surgery. Long term follow-up data (at least 12 months) is presented.

METHODS: SISCOM images were analyzed in 59 consecutive patients who underwent vide-EEG monitoring between January 1996 and October 1999 for possible repeat epilepsy surgery. The mean age at the time of the imaging study was 29.7 years. Fifteen patients underwent subsequent chronic intracranial monitoring. Medical records, imaging studies, and surgical reports for these patients at initial evaluation and follow-up were reviewed.

RESULTS: The SISCOM study revealed a hyperperfusion focus in 46/59 patients (78.0%). Twenty-eight of these 46 (60.9%) foci were in the vicinity of the previous surgical site, whereas 13 (28.2%) were detached from the previous surgical site but in the same hemisphere. The hyperperfusion focus was in the contralateral hemisphere in the remaining 5 patients (10.9%). The site of the ictal EEG onset was concordant with the SISCOM focus in 37 of 46 (80.4%). Thirty patients underwent repeat epilepsy surgery and were followed for a minimum of 6 months (mean 25 months). Eight of the 19 patients (42.1%) with longer than 1 year follow-up experienced Engel Class I-II outcome.

CONCLUSIONS: SISCOM may help identify the seizure focus for repeat epilepsy surgery. This technique may prove useful in selecting candidates for repeat epilepsy surgery and in tailoring the extent of surgery.

OBJECTIVES: 1. Identify patients who may be potential candidates for repeat epilepsy surgery by using SISCOM. 2. Identify repeat surgical candidates for intracranial monitoring based on SISCOM imaging. 3. Describe long term follow-up data for patients who underwent repeat epilepsy surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Corpus Callosotomy in Children: A Review of 15 Cases

AUTHORS: Gustavo Luzardo-Small, MD; Lamar Davis, BS; V. V. Vedanarayanan, MD; Mecheri Sundaram, MD; Colette Parker, MD; Owen Evans, MD; John A. Lancon, MD

INTRODUCTION: Corpus callosotomy is a useful procedure for some children with generalized epilepsy. Although various reports suggest that up to 80 - 90% reduction in seizure frequency and intensity can be achieved in selected patients, few reports describe the long-term results as a function of age at the time of callosal division.

METHODS: This retrospective review describes fifteen children who underwent corpus callosotomy during a 2 year period. The children ranged in age from 18 months to 15 years. There were 5 girls and 10 boys. In thirteen cases, a complete callosotomy was performed as the initial procedure. A partial callosotomy was performed in two cases, one of which was subsequently converted to a complete division.

RESULTS: The demographics, seizure classification, indications for callosotomy and choice of procedure, perioperative morbidity and results at follow-up are presented. Although all patients did well initially, there was a decline in seizure control beginning at about 18 months following surgery in the youngest patients in this series.

CONCLUSIONS: The long-term efficacy of corpus callosotomy in young children may be age-dependent. This may reflect an unmasking of neuronal development and interconnectivity consequent to cessation of generalized seizure activity. Implications for achieving better long-term seizure control following complete corpus callosotomy in young children are discussed.

OBJECTIVES: 1. ...discuss the pre-surgical evaluation of generalized epilepsy in children. 2. ...discuss the indications for corpus callosotomy in children with generalized epilepsy. 3. ...discuss the outcome following corpus callosotomy in young children.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Effect of Stereotactic High-frequency Stimulation in the Anterior Lobe of Cerebellum in Cerebral Palsy

AUTHORS: Miroslav Galanda, MD, PhD; Stanislav Horvath, PhD

INTRODUCTION: The role of the anterior lobe of cerebellum in the modulation of stereotyped movements such as posture, locomotion, involuntary control of muscle tone is well established, but its therapeutic application in treatment of spasticity or central movement disorders is still controversial.

METHODS: 33 patients with cerebral palsy underwent chronic stereotactic stimulation of deep structures of anterior lobe of cerebellum. Previously the stimulation was performed by Tesla LSP system transtentorially, last three stereotactic implantation of Medtronic system (four contacts electrode) by new direct suboccipital approach. For final position of the electrode the high frequency stimulation test is mandatory. Immediate increase of muscle tone and pathological posture is exhibit by overstimulation. Just below this threshold level overall decrease of pathological muscle tone accompanied by feeling of pleasure was observed. These parameters were applied for chronic stimulation (frequency 185 Hz, amplitude individually 0.5 to 4V, for 15 to 30 min 3 to 8 times per day) by Soletra generator.

RESULTS: During stimulation immediate decrease of spasticity and gradual diminishing of dyskinesias (after weeks) created opportunity for physiotherapeutic program to gain new useful motor functions. Behavioral responses, change of mood, improvement in cooperation, anxiety and depression was also noticed. The stimulation amplitude needs to be increased after months of treatment, but the tolerance phenomenon is reversible after stimulation holidays.

CONCLUSIONS: For therapeutic stimulation in deep structures of the anterior lobe of cerebellum is crucial proper positioning of electrode, which must be verified by intraoperative high frequency stimulation. The pathological muscle hypertonus, dyskinesias and even behavior can be favorably influenced during chronic stimulation which demonstrates powerful modulating effects of circuits in which the cerebellum is involved.

OBJECTIVES: The role of the cerebellum in motor control, modulation of behavior and its possible applications in the therapeutic deep brain stimulation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Why to shift from Pallido- Thalamic to Microrecordings-based STN Stimulation in PKD?

AUTHORS: Pedro Roldan, MD,PhD,Prof; Fernando Talamantes, MD

INTRODUCTION: After the striking initial and mid-term results with differential pallidal-thalamic stimulation for PKD, long-term results show a progressive decrease in effectiveness, which prompted us to recently shift to microrecordings-based STN stimulation. This complex technique and the initial results are presented and discussed.

METHODS: In the period 1995-2000 a group of 70 patients with PKD was stimulated, the target depending on the predominant symptom: In 15 cases with tremor, Vop was stimulated, and in 55 cases with rigidity and akinesia GPi was unilaterally (13 cases) or bilaterally (42 cases) stimulated, using ventriculography and the stereoguide Barcia-Salorio. Since 2002 the target has shifted to STN no matter the predominant symptom. A group of 10 patients has been prospectively studied and operated with the Leksell frame and the Treon station, with CT-MR image fusion, Framelink software, and microrecordings (Leadpoint) to assess STN single-unit activity prior to electrode positioning. In all cases a bilateral Kinetra stimulation system has been implanted.

RESULTS: Our results with differential pallidal-thalamic stimulation show that thalamic stimulation is mostly effective for tremor and pallidal stimulation is better for rigidity and akinesia. But after a maximum follow-up of 7 yrs, long-term results show a clinical deterioration starting 3 yrs after stimulation and progressing with the natural history of the disease. These findings and current available technology made us shift to STN stimulation. The system does well and the microrecording facility is accurate and useful for STN activity determination, but is time-consuming and much dependent on patient's collaboration. Initial clinical results are as striking as with previous techniques, STN stimulation being effective on tremor and akinesia, but the time needed to get the most effective stimulation parameters is somewhat longer.

CONCLUSIONS: Transcortical magnetic stimulation evoked potentials support the differential and opposite effect of pallidal versus thalamic stimulation upon cortical excitability and PKD symptoms, but long-term results show a progressive decline in clinical benefit. Initial results with microrecordings-based STN stimulation are much promising, but the technique is troublesome and time-consuming, and a longer follow-up is necessary to assess the long-term clinical effectiveness of this technique and its assumed neuroprotective effect.

OBJECTIVES: Long-term results of pallido-thalamic stimulation in PKD tend to decline, maybe due to the natural history of disease. Microrecordings are a useful technique in experienced hands but are time-consuming and its need as a routine remains to be established. Initial clinical results with STN stimulation are promising but yet to be confirmed in the long-term.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Linac Radiosurgery of Skull Base Meningiomas. Initial versus Postoperative Remnants Treatment.

AUTHORS: Pedro Roldan, MD, PhD, Prof; Fernando Talamantes, MD; Antonio Conde, MD; Leo Arribas, MD

INTRODUCTION: Radical surgery is the treatment of choice of meningiomas, but recurrences appear in 5-10%, and in 60% after incomplete resections. Moreover in skull base meningiomas, as surgical approaches are troublesome and morbimortality increases mainly in elderly patients, radiosurgery may be considered as an alternative initial treatment or for tumor remnants after initial surgery.

METHODS: In the 4 yrs period between 1998-2001, a group of 22 patients with meningiomas of the cranial base was treated with LINAC-Radiosurgery, excluding in this study other locations, malignancies and recurrences due to poor surgical removal. Man to female ratio was 2:1 and the mean age 61 yrs (27/82). Tumor location related to cranial base triangles was in the medial (9 cases), lateral (2) and inferior (11 cases). From a topographic outlook, tumors were located in the cavernous sinus (6), tuberculum sellae (6), CPA (8), superior orbital fissure (2), retroclival (1) and olfactory groove (1). The mean follow-up was 30 months (11/38). Radiosurgery was performed with a LINAC model SATURN 42 and the stereoguide Barcia-Salorio. In the group of 22 patients, radiosurgery was the initial treatment in 14 cases, and in the other 8 cases radiosurgery was applied after initial surgery for treatment of tumor remnants. In 8 cases out the 22, and after radiosurgery, external radiotherapy was performed (50Gy). The average volume treated was 19600 cubic mm (210/49900). The mean marginal dose was 1230 cGy (800/1900) and the mean maximum dose 1560 cGy (1000/2700).

RESULTS: After a mean follow-up of 30 months (11/38), lesion control was achieved in 70% of cases, and the remaining 30% kept stabilized in subsequent controls, which means stabilization in 100% of cases. In 90% of cases a clinical improvement was recorded. Complications included an epileptic attack 2 days after irradiation, trigeminal neuralgia (2 cases), NPH (2 cases) and diplopia (1 case).

CONCLUSIONS: LINAC-based Radiosurgery appears as an effective treatment for skull base meningiomas, as the first choice when radical surgery is not possible, or for control of postoperative tumor remnants, with few complications, for the follow-up considered. Its efficacy upon recurrences after surgical treatment remains to be established.

OBJECTIVES: To know the possibility of Radiosurgery of skull base meningiomas as the initial treatment in special cases against surgery as the sole option. Accept Radiosurgery as an adjuvant therapy for tumor remnants after subtotal initial tumor removal. To know about Radiosurgery as a potential tool with little complications and side-effects.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Use of Tumor Geometry for Automatic Inverse Gamma Knife Radiosurgery Treatment Planning

AUTHORS: Robert J Maciunas, MD; David Dean, PhD; Pengpeng Zhang, PhD; Hu Eric, MSc

INTRODUCTION: We attempt to dissect Gamma Knife(TM) Radiosurgery (GKR) treatment-planning parameters for which a computer is better suited to determine than a human operator. Currently, the latter is best at locating lesions and critical structures and specifying tumoricidal dose. We hypothesize that the computer can free the treatment-planning team from determining the location, size, number, and weight of GKR shots.

METHODS: Once the patient's tumor volume is segmented from a 3D MR-scan, its medial axis 3D line skeleton is automatically located; the depth of all tumor voxels between the outer surface and the medial axis is also determined. This information is used to locate the largest GKR shots whose center points seat along the medial axis without extending outside the tumor boundary. Next the remaining space is filled with the largest shots fitting internal and tangent to the tumor envelope. Finally, the remaining interstitial spaces are filled. In multi-shot plans the resulting dose distribution is rarely acceptable. These data are then used to seed a Guided Evolutionary Simulated Annealing (GESA) algorithm optimization. GESA iteratively mutates only the position and weight of the seed plan, producing inter-generational competition, and rapidly coning the treatment-plan search space. Fifteen patient data sets that range dramatically in size and diagnosis. Our work is on a Silicon Graphics Inc. (Mountain View, CA) R5000 UNIX workstation.

RESULTS: Comparisons of dose conformality, heterogeneity, and sparing of normal and critical structure tissue with results obtained manually in the Leksell Gamma Plan(TM) demonstrate that our algorithm produces significant improvement. As we accumulate new patient data, we are increasing the range of diagnoses, tumor sizes, and image resolutions, by which we test this two part algorithm. Summary results would be presented.

CONCLUSIONS: Automated inverse GKR treatment-planning is a preferred.

OBJECTIVES: (1) understand challenges to LGK Tx planning (2) understand challenges to inverse Tx planning (3) understand limitations of LGK Tx implementation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Integration of a Neurosurgical Image Guidance System and an Intraoperative MR-Scanner: The University Hospitals of Cleveland Experience

AUTHORS: Robert J Maciunas, MD; Dean David, PhD; Lewin Jonathan, MD; Duerk Jeffrey, PhD; Selman Warren, MD; Ratcheson A. Robert,

INTRODUCTION: Worldwide, nearly two dozen hospitals have an MR-scanner integrated into an operating suite. The most widely accepted neurosurgical rationale for such a system is to verify the achievement of all surgical aims. However, we think it is equally compelling to note the use of serially updating an image guidance system (IGS) in order to compensate for "brain shift" (i.e., changes from pre-operative conditions) and to facilitate a minimally invasive procedure.

METHODS: The Siemens system was installed in August of 1998. A collaboration between our site, BrainLab AG (VectorVision[™]), and Siemens (0.2T OpenViva[™]) has resulted in, to our knowledge, the first integration of a commercial intraoperative MR-scanner and a neurosurgical image guidance system. To date this integration, initiated in March of 2001, has benefited nearly two dozen cases. One unique aspect of our system is a pivoting table that allows real time shift between surgery and scanning and the same when going back to surgery. The combination of this rapid transition and serial scan update minimizes both surgical duration and invasiveness.

RESULTS: The pivoting table limits downtime between surgery and scanning to 90 seconds. The University Hospitals of Cleveland Department of Neurological Surgery has treated 140 patients since installation of the system. The refreshing of pre-operative scans intra-operatively compensates for shift from the pre-operative scan during surgery due to changes in volume during debulking, gravity, reduction in CSF pressure, and osmotic or metabolic changes. This allows for rapid and less invasive localization of residual tumor.

CONCLUSIONS: This practical clinical tool and powerful IGS development platform for IGS is drawing together the interest and shared resources of physicians, industry, faculty, students, and engineers. Lessons learned from our clinical experience with this unit will be discussed.

OBJECTIVES: (1) understand effects of "brain shift" on use of pre-operative planning images for intraoperative guidance. (2) understand integration of commercial (BrainLab) guidance and intra-operative MR-scanner (Siemens) systems. (3) understand utility and possible concerns system brings to tumor resection cases.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Spasticity

TITLE: Neurological Deterioration Following Initiation of Continuous Intrathecal Baclofen Therapy Resultant to an Unrecognized Tethered Cord

AUTHORS: Jason E. Tullis, MD; Amanda E. Ellis, RN; V V. Vedanarayanan, MD; John A. Lancon, MD

INTRODUCTION: Continuous intrathecal Baclofen therapy (ITB) via an implanted programmable pump is an accepted treatment for spasticity/dystonia in children. The therapy is generally safe and well-tolerated but may be associated with a variety of potentially serious side effects. We describe the case of a young girl who experienced neurological deterioration following the initiation of continuous ITB therapy.

METHODS: An 11-year-old girl presented to the Multidisciplinary Spasticity Program at The University of Mississippi Medical Center. Following a comprehensive evaluation including a low-dose Baclofen trial, she underwent placement of a programmable Baclofen pump. Intrathecal Baclofen was initiated on the second postoperative day. She developed painful flaccidity of the right lower extremity several hours following initiation of the Baclofen infusion. The pain and weakness were accompanied by urinary incontinence and constipation. The Baclofen infusion was discontinued. A lateral spine radiograph showed straightening of the pre-operative lumbar hyperlordosis. An MRI of the lumbosacral spine showed a low-lying conus and thickened filum terminale. Over the next several weeks, the bowel and bladder symptoms improved although the extremity remained flaccid. The pain worsened and she developed cutaneous mottling. The extremity, particularly the foot, felt cooler to touch than the contralateral side. A vascular evaluation of the extremity was normal.

RESULTS: Exploration of the lumbar cistern with release of tethered cord was performed. The lumbar catheter was repositioned dorsal to the cauda equina. Six months following surgery the girl had regained the ability to move the right lower extremity and had normal bowel and bladder function. The pain, cutaneous, and temperature changes had completely resolved.

CONCLUSIONS: Lumbar hyperlordosis may be an indication for preoperative lumbosacral MRI in children with spasticity/dystonia in whom placement of a programmable baclofen pump is contemplated.

OBJECTIVES: 1. ...describe the potential complications associated with placement of a programmable Baclofen pump. 2. ...describe the differential diagnosis of delayed neurological deterioration following initiation of continuous ITB therapy. 3. ...describe a possible mechanism for neurologic deterioration following initiation of continuous ITB therapy in children with a tethered cord.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Resolution of Intractable Hypertension in a Young Boy Following Removal of a Retained Posterior Fossa Shunt Catheter

AUTHORS: Elbert A. White, MD; Amanda E Ellis, RN; Andrew D. Parent, MD; John A. Lancon, MD

INTRODUCTION: An association between compression of the lateral medulla and refractory hypertension has been described. This case report describes a young boy with intractable systemic hypertension secondary to a retained shunt catheter compressing the left lateral medulla.

METHODS: A 9-year-old boy presented with headaches, balance difficulty and tinnitus secondary to a large left cerebellopontine angle arachnoid cyst. A cytoperitoneal shunt was placed. He subsequently developed a shunt infection and underwent microsurgical fenestration of the cyst followed by removal of the shunt. A portion of the proximal catheter was not removed secondary to dense inflammatory adhesions to adjacent vessels and the medulla. During the following four years, the boy developed profound systemic hypertension, refractory to multiple antihypertensive medications. A metabolic and endocrine evaluation failed to identify a remediable cause. An endoscopic exploration and retrieval of the retained posterior fossa catheter with lysis of adhesions to the left lateral medulla was performed.

RESULTS: Within 12 hours following surgery, the boy's blood pressure had normalized and all antihypertensive medications had been discontinued. The boy has remained normotensive during one year of follow-up.

CONCLUSIONS: Mechanical compression of the left lateral medulla may cause intractable hypertension in some children.

OBJECTIVES: 1. ...describe the diagnosis and evaluation of systemic hypertension in children. 2. ...describe the role of the medulla in the genesis of systemic hypertension. 3. ...describe the indications for surgical decompression of the medulla in children with systemic hypertension.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Correlation between Peroperative STN Neurophysiology

AUTHORS: Lazorthes Yves, MD; Cintas Pascal, MD; Simonetta-Moreau Marion, MD; Breffe-Courbon Christine, MD; Fabre Nelly, MD; Ory Fabienne, MD; Chaynes Patrick, MD; Sabatier Jean, MD; Rascol Olivier, MD; Berry Isabelle, MD

INTRODUCTION: Though peroperative neurophysiology is essential to precisely define the definitive target, few studies have assessed its predictive value in defining the most effective contact for chronic DBS.

METHODS: In a retrospective study we reviewed 20 consecutive patients implanted for STN stimulation. The theoretical target was defined using MRI targeting (on T1 weighted MRI, 12 mm lateral to AC-PC line, 5 mm inferior and 2 mm posterior to midcommissural point; eventually corrected by direct visualization of the STN on T2 weighted MRI). Peroperative neurophysiology was performed on the 5 simultaneously implanted electrodes on each side: - microrecording: detection of typical STN activity by 0.5 mm steps, - effects of macrostimulation on rigidity by 1 mm steps. At 3 months, we assessed most effective contact for rigidity, akinesia and tremor on each quadripolar electrode at 12 hours ' medication-off^a.

RESULTS: A total of 39 electrodes were implanted. There was no significant correlation between the electrophysiologically defined STN and most effective contact for chronic stimulation at 3 months which was on average 3,1 mm proximal. Similarly, there was no significant correlation between electrophysiology and most effective contact either on rigidity, akinesia or tremor at 3 months. Interestingly, at 3 months, the same electrode contact was maximally efficient for rigidity, akinesia and tremor only in 13 of the 39 cases. This lack of correlation does not impair the global improvement since most patients had a Schwab and England scale superior to 80%. Patients presenting a good correlation between neurophysiology and most effective contact at 3 months do not have a better outcome.

CONCLUSIONS: Peroperative neurophysiology does not predict the most effective contact for chronic DBS which was most often proximal on the trajectory. This lack of correlation does not impair a good outcome. The final contact chosen for chronic stimulation is rarely the most effective for all the Parkinsonian motor symptoms.

OBJECTIVES: predictive value of neurophysiology most effective contact for chronic stimulation non concordance of physiological effects

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Electrical Stimulation of the Inferior Thalamic Peduncle (ITP) in the Treatment of Unipolar Depression

AUTHORS: Francisco Velasco, MD; Fiacro JimÈnez, PhD; Rafael SalÌn-Pascual, PhD; JosÈ A. Hern-ndez, MSc; Ana L. Velasco, MD; Marcos Velasco, PhD

INTRODUCTION: Extensive literature supports the existence of a thalamo-orbito-frontal system (TOFS) engaged in inhibition of spontaneous and conditioned behavior. On the other hand, lesions in the subcaudate region improve severe depression. The present report links the improvement of depression by subcaudate lesion with disruption of inhibitory activity of TOFS.

METHODS: A 49 years old female with history of recurrent depression for 23 years and a 6 years episode of major depression full compliant with the DSM IV criteria (depressed mood, anhedonia, late night insomnia, increased appetite, hopeless attitude, suicidal ideas) was studied. Symptoms were resistant to medication and electroconvulsive therapy. The patient remained confined in a mental institution for over 8 months. Maximal scores were detected by the Hamilton, Beck, and Zung scales for depression. Further neuropsychological abnormalities in memory and praxias were assessed. She had bilateral multicontact electrodes for recording and stimulation, stereotactically implanted in ITP ($x=5.0$ mm, $y=2.5$ mm posterior to AC, z =from -1.25 to $+1.0$ mm AC-PC). Unilateral ES at 6-8 cps in ITP and reticular thalamic nuclei evoked bilateral recruiting responses, while simultaneous bilateral 3 cps evoked diffuse bilateral 3 cps spike-wave complexes, accompanied by arrest of ongoing activity only in ITP. Recording electrodes were replaced by DBS and connected to an internalized stimulation system, set-up for continuous stimulation at 130 Hz, 0.45 ms, 2.5 V. Monthly neuropsychological follow-up testing has been performed during 8 months.

RESULTS: Improvement of depression was evident after the initial placement of electrodes and partially returned after a 2 week period. Electrical stimulation further improved depression, normalizing the depression scales as well as the abnormalities in memory and praxias. Improvement has persisted even OFF medication and she is back to her normal daily activities.

CONCLUSIONS: Promising neuromodulation to treat unipolar depression results from ES of ITP, an anatomical link between orbitofrontal cortex and the thalamus.

OBJECTIVES: 1. New treatment for monopolar depression 2. Electrophysiological determination of Thalamic-orbito-frontal System 3. Neuromodulation in Psychosurgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Treatment of Atypical Facial Pain with Gamma Knife Trigeminal Rhizotomy

AUTHORS: Rebekah C Austin, MD; Thomas L Ellis, MD; Volker W Stieber, MD; Edward G Shaw, MD; Stephen B Tatter, MD, PhD

INTRODUCTION: Atypical facial pain is described as a dull, throbbing, continuous pain syndrome often accompanied by paresthesias, atypical distribution, and/or absence of triggers. Stereotactic radiosurgery has been increasingly used for treatment of typical trigeminal neuralgia with encouraging results however the subset of patients with atypical features have less than satisfactory responses. Patients with purely atypical facial pain often report worsening of pain after any deafferentation procedure. Since radiosurgical rhizotomy produces numbness in less than 10% and since there are few other attractive treatment options, we offered treatment to a selected population of patients with highly medically refractory atypical facial pain.

METHODS: The cases of 124 patients with facial pain treated with radiosurgical rhizotomy were reviewed. Atypical features were present in 24 (19.4%) and these patients underwent chart review and completed post-surgery telephone interviews. Evidence of neurovascular compression was seen on 84.6% of pre-procedural MRIs. Mean dosage used was 84.8Gy to 100% isodose line using a single 4mm collimator.

RESULTS: 17/24 patients (70.8%) reported at least partial relief of their facial pain with a median follow-up of 12 months. 8/17 patients developed recurrent symptoms with a mean time to recurrence of 19 weeks. Of patients who reported partial symptom relief, the dull, continuous pain component was more likely to be retained whereas lancinating pain was mostly resolved. Although 8/24 (33%) had no improvement with radiosurgery, no patient reported worsening of their atypical facial pain.

CONCLUSIONS: Stereotactic radiosurgery may provide modest, short-term relief to some patients with atypical facial pain. Equally important it appears not to result in worsening of facial pain by causing deafferentation in a large fraction of patients so treated. These patients must be counseled however that expected success rates are much lower than for typical trigeminal neuralgia and that the dull, continuous portion of their pain syndrome is more likely to persist.

OBJECTIVES: 1) Be familiar with atypical facial pain features 2) Understand the value of stereotactic radiosurgery as a treatment option for this subset of patients 3) Counsel patients with atypical facial pain on expected results with stereotactic radiosurgical rhizotomy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Failure of Single Unit Neuronal Activity to Differentiate Internal from External Globus Pallidus in Parkinsons Disease

AUTHORS: Steven J Schiff, MD,PhD; Robert M Worth, MD,PhD

INTRODUCTION: To examine the validity of single unit neuronal recordings as a method of differentiating internal from external segments of the globus pallidus in Parkinsonís Disease.

METHODS: 128 records of apparent single unit activity used to help guide final electrode placement in 8 cases of pallidotomy were analyzed with sophisticated spike sorting methods, and 185 neurons were characterized for mean firing frequency and percent of firing within bursts. In addition, total spectral power was calculated on the full measured waveform for each of 128 samples without spike sorting.

RESULTS: No correlation between these measures of neuronal activity and depth within the globus pallidus was identified.

CONCLUSIONS: These results call seriously into question the validity of relying on single unit activity and microelectrode recordings in the operating room to localize lesion or electrode placement within the internal segment of the globus pallidus during stereotactic pallidal surgery. Our findings suggest that the safety and efficacy of pallidotomy might derive more from MRI localization and micro- or macroelectrode stimulation, rather than from the added benefits from microelectrode recording.

OBJECTIVES: 1) What is spike sorting and why is it important in evaluating all microelectrode data purporting to show single cells. 2) Why the accepted physiological foundation of microelectrode localization in Parkinsons Disease may be flawed due to a lack of proper spike sorting in the original descriptions. 3) Why the safety and efficacy of microelectrode guided Palidotomy may derive from aspects of the technique unrelated to single cell recording.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Optical Imaging of Epileptiform Events in an Acute In Vivo Model

AUTHORS: Ashesh D Mehta, MD,PhD; Suh Minah, PhD; Bahar Sonya, PhD; Schwartz H Theodore, MD

INTRODUCTION: Optical imaging of intrinsic signals is a novel method for measuring the population of neurons participating in epileptiform events. Depending on the wavelength of light measured, the signals carry information about blood flow, metabolism and cell swelling. The optimal wavelength for imaging epileptiform events is not known.

METHODS: Adult urethane-anesthetized, intubated rats were placed in a stereotactic frame. The skull was thinned with a high-speed drill and covered with agar. The dura was opened focally and two glass electrodes, 10-20mm apart, were placed 400mm deep in somatosensory cortex. A 10-bit camera was focused 400mm below the cortical surface, which was illuminated with three separate wavelengths: 540nm, 630nm or 700nm. Iontophoresis of bicuculline was utilized to generate periodic interictal spikes (IIS), which were recorded with a local field potential with simultaneous recording of optical signals with a temporal resolution of 250ms. Images obtained after individual IIS were divided by images obtained prior to IIS and averaged over multiple IIS. Percent change in reflectance was computed over areas of interest at discrete time points for 15 IIS at different wavelengths.

RESULTS: There was a discrete change in reflectance of light that corresponded temporally with each IIS. Percent change in reflectance was 25 +/- 12 %, 39 +/- 2% and 9 +/- 2% for 540nm, 630nm and 700nm, respectively. The optical signal peaked 1.1 +/- 0.6msec, 1.0 +/- 0.6 msec and 1.4 +/- 0.5msec after the electrophysiological signal for each wavelength, respectively.

CONCLUSIONS: High-resolution maps of epileptiform events can be generated through a thinned skull in an acute rat model of epilepsy. The oxy/deoxyhemoglobin signal, recorded at 630nm is largest in amplitude, followed by signals due to blood flow (540nm) and cell swelling (700nm). All signals peaks occurred 1-1.5 seconds after the peak of the IIS, though there was a trend for the signal from cell swelling to occur later.

OBJECTIVES: Recognize the intrinsic signal generated by epileptiform events. Understand the relationship between intrinsic signal changes and electrophysiological changes. View the spatial spread of an interictal spike over the course of seconds.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Intraoperative MRI in Pediatric Neurosurgery

AUTHORS: Jeff E Catrambone, MD; Thomas J Sernas, PA-C; Michael Schulder, MD

INTRODUCTION: We describe a strategy for the use of intraoperative MRI (iMRI) in the management of patients with complex pediatric hydrocephalus.

METHODS: A patient with a variant of the Dandy-Walker syndrome required CSF diversion. We used the PoleStar N-10 iMRI (Odin Medical Technologies) to test whether the posterior fossa lesion was in communication with the ventricular system. The use of air versus liquid contrast agents will be discussed.

RESULTS: IMRI revealed lack of communication of the posterior fossa lesion with the ventricular system, confirming the need for independent shunting of the ventricles and the posterior fossa cyst.

CONCLUSIONS: The use of iMRI is a logical development in the management of patients with complex hydrocephalus. The interactive nature of this device and the dynamic information available in the operating room itself may make it the tool of choice for the surgery of such patients.

OBJECTIVES: 1) Understand the technical use of the PoleStar N-10 iMRI for pediatric neurosurgical patients. 2) Understand the use of ventricular contrast agents in the intraoperative study of complex ventricular anatomy. 3) Understand the importance of intraoperative MRI enabling intraoperative navigation and eliminating rigid fixation for pediatric neurosurgical patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Deep Brain Stimulation for Parkinson's Disease: Association Between Stimulation Parameters and Cognitive Performance

AUTHORS: Paul Francel, MD; Kersi J Bharucha, MD; Alan Stevens, BS; Katherine A Ryder, MS; Jeffrey Wetmore, BS; James G Scott, PhD

INTRODUCTION: Chronic subthalamic nucleus stimulation produces inconsistent patterns of cognitive change in Parkinson's disease patients. Individually tailored stimulation parameters may contribute to variable patterns of change. Variations in amplitude, pulse width, and rate of stimulation have been reported to produce unique changes in motor response. The current research evaluates the association between stimulation parameters and cognitive performance following unilateral DBS.

METHODS: Parkinson's disease patients (n=8) were assessed on medication before and after unilateral STN DBS surgery (1-4 months after stimulation activation). Cognitive measures included the MMSE, Repeatable Battery for the Assessment of Neuropsychological Status, Gambling Task and Frontal Systems Behavioral Scale. Neurological data included the UPDRS, Hoehn & Yahr score, DA Medication Equivalence, and Disease Duration. Cognitive and Neurological measures were correlated with subject variables and stimulation parameters.

RESULTS: Amplitude accounted for 42% of the variance in RBANS Immediate Memory Index scores, 40% of Gambling Task Total score variance, and 41% of variance in Digit Span performance. Pulse width accounted for 42% of score variance on Block 3 of the Gambling Task, and 48% of Delayed Figure Recall score variance as well as caregiver endorsements of Apathy symptoms in patients. Rate of stimulation accounted for 62% of RBANS Attention Index variance, 41% of Delayed List Recall score variance, and 77% of the variance in Digit Span performance. Rate was also significantly associated with patient endorsements of frontal lobe symptoms, accounting for 52% of the variance in Disinhibition scores, 50% of Apathy score variance, and 79% of the variance in Executive symptom scores.

CONCLUSIONS: The current findings suggest performance changes may be closely associated with stimulation parameters. The association between specific parameters and cognitive performance is consistent with similar findings for motor response to DBS, and suggest adverse cognitive/behavioral responses may be treated through parameter modifications while maintaining motor efficacy.

OBJECTIVES: 1. Understand the cognitive effects of Deep Brain Stimulator implantation in Parkinson's disease 2. Understand stimulator setting parameters effecting cognitive outcome and variability from deep brain stimulator implantation 3. Understand the relationship between cognitive and motor outcomes in deep brain stimulation for Parkinson's disease

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Stimulation-induced Mood Changes in Subthalamic Nucleus Deep Brain Stimulation; Location of the Cathodal Contact

AUTHORS: Paul S Larson, MD; Gabriel Zada, BA; Matthew Mori, BA; Geoff Rau, BS; Efstathios Papavassiliou, MD; Susan Heath, MS,RN; Chadwick Christine, MD; William J Marks, MD; Philip A Starr, MD,PhD

INTRODUCTION: Several investigators have observed stimulation-induced mood changes in patients undergoing deep brain stimulation (DBS) of the subthalamic nucleus (STN) for Parkinson's disease, ranging from depression to hypomania. It is unclear which neurons or fiber tracts in or around these two structures are responsible for these effects. We report three cases of intraoperative stimulation-induced depression in patients undergoing STN DBS placement, with documentation of the lead location by postoperative MR imaging.

METHODS: A retrospective review of 180 STN implants for Parkinson's disease was performed. Microelectrode recording was used in all cases. Intraoperative test stimulation was performed with pulse width 60, frequency 185 and bipolar mode. Lead locations were measured on postoperative volumetric gradient-echo MRIs that were computationally reformatted to be parallel to the intercommissural line.

RESULTS: Three patients with intraoperative stimulation-induced mood alteration were identified (1.7%). All three patients experienced reversible, reproducible acute mood depression during intraoperative test stimulation at a specific voltage threshold. The coordinates of the center of the cathodal contact producing the effect at the lowest threshold was located (with respect to the midcommissural point) at 9.29, -6.73, -8.45 for case 1, 9.73, -3.40, -6.96 for case 2, and 13.06, -3.68, -5.49 for case 3. With respect to intraoperative physiology, the center of the cathode was located 6.05, 4.50 and 4.55 mm inferior to the dorsal border of STN respectively.

CONCLUSIONS: The cathodal contacts in three patients that experienced stimulation-induced mood depression were located in the ventral STN or dorsal SNr, inferior to the contact that ultimately produced the best antiparkinsonian effect.

OBJECTIVES: 1) Understand the mood changes that can be seen with acute intraoperative test stimulation in STN DBS. 2) Understand which structures may be responsible for these effects. 3) Understand that the contact most likely responsible for these effects may be ventral to the contact producing the best antiparkinsonian effect.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Clinical study for alleviating opiate drug abstinence by method of lesioning nucleus accumbens with stereotactic surgery

AUTHORS: Gao Guodong, MD; Wang Xuelian, MD; He Shiming, MD; Wang Qinfeng, BA; Li Weixing, BA; Hou Fang, BSN; Liang Qinchuan, BA; Cheng Ling, ; Li Ailing, ; Zhang Hua, MD

INTRODUCTION: To making a lesion in nucleus accumbens which have close relationship with drug-induced psychological dependence by stereotactic surgery, blocking mesocorticolimbic dopamine circuit, alleviating craving for drugs, lowering relapse rate after detoxification and exploring a new way to treat drug addiction.

METHODS: On the basis of animal experiment, we did 28 cases of stereotactic surgery making a lesion in nucleus accumbens bilaterally to treat opiate drug dependence. Indications, criterion of therapeutical effect, treatment process, therapeutical and safe evaluation index of the surgery were formulated particularly. Mean follow-up period was 15 months.

RESULTS: Relapse not occurred in 11 cases up to now. Drug free time was more than half a year in 4 cases. Drug free time was less than half a year in 7 cases. Relapse occurred in 15 cases after surgery. Drug free time was more than half a year in 3 cases. Drug free time was within 1 months to half a year in 10 cases. Drug free time was less than 1 months in 2 cases. Therapeutical effect: good 65.4%. Relapse rate after surgery: within 1 month: 7.7%; between 1 month to half a year: 38.5%; more than half a year: 57.7%. There were no common complications of surgery. Character type of 2 cases were changed slightly and 4 cases suffered memory ability reduced slightly.

CONCLUSIONS: There were different effectiveness of treating drug addicts' psychological dependence with lesions in bilateral nucleus accumbens by stereotactic surgery. No peculiar complications occurred. The operation is safe and feasible. Mean follow-up time was 15 months. The effectiveness was satisfactory. Relapse rate of drug addicts after detoxification was reduced evidently.

OBJECTIVES: To making a lesion in nucleus accumbens which have close relationship with drug-induced psychological dependence by stereotactic surgery, blocking mesocorticolimbic dopamine circuit, alleviating craving for drugs, lowering relapse rate after detoxification and exploring a new way to treat drug addiction.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Chronic Electrical Stimulation (CES) of bilateral Hippocampal Foci in the Treatment of Temporal Lobe Seizures

AUTHORS: Ana L Velasco, MD; Marcos Velasco, PhD; Beatriz Rojas, BSc; JosÈ A. Hern-ndez, MSc; Martha L PÈrez, BSc; Francisco Velasco, MD

INTRODUCTION: Subacute electrical stimulation (SAES) of epileptic foci decreases the number of interictal spikes and prevents the occurrence of clinical seizures. Significant increase in benzodiazepine binding receptor level (BBRL) in the epileptic tissue after SAES suggests that this may be the mechanism of inhibiting epileptic activity. Therefore, Chronic Electrical Stimulation(CES)at the epileptic foci was used to control seizures in cases not candidates for ablative procedures.

METHODS: Two young male patients with bilateral temporal lobe epileptic foci associated to memory deficits were treated by CES of the hippocampal foci and followed over 3 years. They had a long history of partial complex seizures (12 and 24 years), not controlled by multiple anti-epileptic drugs (AED).Surface EEG, sphenoidal and deep brain recordings showed bilateral independent ictal and interictal activity. Neuropsychological tests demonstrated a severe memory deficit. One case had a normal MRI and the other hippocampal sclerosis on the left. Deep electrodes inserted through a bilateral occipital approach were replaced by DBS electrodes aimed to the site where maximal ictal and interictal activities were recorded and connected to an internalized stimulation system. Continuous stimulation at 130 Hz, 0.45 msec, 2.0-3.0 V was performed and number of seizures and interictal spikes counted every month for 3 years.

RESULTS: Stimulation started in the most affected site. Partial improvement (42-87%) on seizures and interictal spikes accompanied the unilateral stimulation. Six months later, the contralateral stimulator was turned ON without significant improvement. Since both patients received carbamazepine that might interfere with BBRL, it was discontinued, which resulted in an immediate suppression of seizures in one case that has continued for 19 months and a further improvement in the other that has been seizure free for 8 months. Both cases normalized in memory.

CONCLUSIONS: CES of epileptic foci may be useful to control focal seizures in cases not candidates for ablative procedures

OBJECTIVES: 1. Treatment for bilateral independent temporal lobe epileptic foci. 2. Improvement of memory deficits by neuromodulation of the epileptic foci. 3. Neurochemical abnormalities in temporal lobe seizures.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: The Effects of Bilateral Subthalamic Nucleus Stimulation on Resting-state Cerebral Glucose Metabolism of Advanced Parkinson's Disease

AUTHORS: Bomin Sun, MD; Dianyou Li, MD; Jiankang Shen, MD; Yongbo Zhao, MD; Chuantao Zuo, MD; Yihui Guan, MD; Liqing Lang, MD; Wen Yu, MD; Shendi Chen, MD

INTRODUCTION: Measure of local glucose metabolism by 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET) in the brain of the patient with Parkinson's disease can quantitatively evaluate the degree of degeneration of striatum and substantia nigra as well as its relative focal brain metabolism. Therefore, FDG-PET can be used for diagnose PD and evaluate drug therapy and surgical treatment.

METHODS: Seven consecutive advanced Parkinson's disease patients (4 men, 3 women; mean age 64 \pm 4; mean H-Y disability scale 4.4 \pm 0.65) with bilateral STN DBS underwent 18F-FDG/PET examinations one month postoperatively with STN stimulation off and stimulation on respectively. The unified Parkinson's disease rating scale was used to evaluate the clinical state under each condition. Statistical parametric mapping (SPM) was used to investigate regional cerebral metabolic rate of glucose (rCMRGlu) during STN stimulation in comparison with rCMRGlu preoperatively.

RESULTS: STN stimulation improved the clinical symptoms obviously for each patient. The significant increase of rCMRGlu was found in bilateral lentiform nucleus, brainstem (midbrain and pon), bilateral premotor area (BA6), parietal-occipital cortex and anterior cingulate cortex, and the marked decrease of it was noted in the bottom of prefrontal cortex and hippocampus ($p < 0.05$).

CONCLUSIONS: Bilateral STN stimulation activated the projection axon from STN and improved the clinical symptoms of advanced PD patients, through improving both ascending and descending pathway from the basal ganglia and increasing the metabolism of higher-order motor control of frontal cortex.

OBJECTIVES: To study the effects of bilateral subthalamic nucleus (STN) stimulation on resting-state cerebral glucose metabolism in advanced Parkinson's disease, and investigate the mechanism of deep brain stimulation (DBS).

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Electrical Stimulation (ES) of Centromedian Thalamic Nucleus (CM) in Cases of Lennox-Gastaut Syndrome (LGS)

AUTHORS: Marcos Velasco, PhD; Ana L Velasco, MD; Fiacro JimÈnez, PhD; JosÈ a Hern-ndez, MSc; Francisco Velasco, MD

INTRODUCTION: Electrical Stimulation of the Centromedian Thalamic nucleus (ESCM) has been used to treat difficult to control seizures in patients not candidates for standard ablative procedures. Best results have been obtained in controlling generalized tonic clonic seizures (GTCS) and atypical absences (AA) that are particularly severe in LGS.

METHODS: Eleven patients (5 children, 2 adolescents, and 4 young adults) were studied. All of them had LGS, i.e. GTCS and AA associated to 2.0-2.5 / sec spike and wave (SK-W) complexes, 5 with demonstrable lesions in the MRI (symptomatic) and 6 without evidence of lesions (idiopathic). All of them were resistant to medical treatment and regardless of using supra-therapeutic AED presented from 18 to 2000 seizures/mo (1353 seizures/mo in average). Bilateral Deep Brain Stimulation (DBS) electrodes were stereotactically implanted through a frontal parasagittal approach guided by ventriculography. The target was the angle formed by the AC-PC and VPC lines, 10-12 mm lateral to the midline in each side. Recruiting responses elicited by 6-8 cps stimulation through different contacts of the electrodes confirmed correct position of electrodes. Intermittent ESCM in each side, 1 min ON, 9 min OFF, alternating right and left sides at 0.45 ms duration, 2.5-3.5 V amplitude, and 60-130 Hz frequency of stimulation was used for chronic ESCM.

RESULTS: Improvement of the total number of seizures ranged from 53.1% to 100% (mean 85.5%), 2 patients became seizure free and 8/11 had over 80 % improvement. GTCS disappeared in 7/11. SK-W complexes decreased 83.8 %, and in 4 patients EEG normalized. AED were maintained in all patients at therapeutic levels. Seven patients are back to school or work. Five patients (3 of them children) presented skin erosions over the internalized stimulation device that required additional surgery. There were no deaths.

CONCLUSIONS: ESCM is a safe and effective procedure to control seizures in the LGS.

OBJECTIVES: 1. Treatment for Lennox-Gastaut Syndrome. 2. Neurophysiological application of recruiting responses for targetting. 3. Neuromodulation in Epilepsy

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Target selection for primary dystonia deep brain stimulation: GPi or STN

AUTHORS: Bomin Sun, MD; Dianyou Li, MD; Chenyan Sun, MD; Daokuan Liu, MD; Yongbo Zhao, MD; Jiankang Shen, MD; Shendi Chen, MD

INTRODUCTION: Surgical treatment of dystonia such as thalamotomy and pallidotomy has long history. Recent year study has demonstrated deep brain stimulation (DBS) of GPi is a very effective and safe treatment. But so far there is no study to evaluate subthalamic nucleus (STN) DBS for generalized dystonia .

METHODS: 8 consecutive patients with primary generalized dytonia (4 males, 4 females; mean age 19.5 \pm 3.7) were randomly selected for bilateral DBS. Stimulating electrodes were implanted to GPi (n=4) and STN (n=4) respectively. The clinical symptoms of the patients were documented by video tape at pre-operation and post-operation respectively to evaluated the effects of the surgery. All of the patients have been followed up from 6-18 months (mean 13.6 months)

RESULTS: In STN DBS patients, more than 80% improvement were seen immediately or 1-3 days after the initial programming of the stimulators. The parameters of stimulation is similar to PD patient's, the parameters were as follows: mean voltage, 2.3V, range 1.8 \sim 2.8; mean duration, 90 μ s; frequency 180Hz. In GPi DBS patients, mild improvement were seen from 2-3 months after stimulation, only 2/4 patients has reduced 60% of symptoms after 9 months stimulation. The mean stimulation parameters for GPi were as follows: mean voltage, 3.5 V, range 3.2 \sim 3.8; mean duration, 210 μ s; mean frequency, 180 Hz.

CONCLUSIONS: Bilateral GPi and STN chronic high-frequency stimulation in different types of dystonia is a very effective treatment. STN stimulation demonstrated quicker improvement than GPi stimulation, and the parameters for STN stimulation is much lower compare with GPi. The symptoms improvement of STN stimulation are better than GPi, such as cervical dystonia and trunk dystonia.

OBJECTIVES: To study deep brain stimulation (DBS) of the globus pallidus internus (GPi) and subthalamic nucleus (STN) in 8 patients with generalized dystonia. The effects and advantage of GPi DBS with STN DBS in primary generalized dystonia were compared.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: The NASA Smart Probe Project for Automated Real-Time Multiple Microsensor Tissue Recognition

AUTHORS: Russell J. Andrews, MD; Robert W. Mah, PhD

INTRODUCTION: To perform remote surgery (e.g. surgery guided by a tertiary center neurosurgeon, or surgery in Space), one must automate all aspects of surgery ?the sensor, the effector, and the sensor-effector communication. Considerable work has been done to automate effectors for neurosurgery (e.g. NeuroMate by ISS, Davis, CA), but less has been accomplished regarding the sensors.

METHODS: To augment the sensor component, real-time tissue recognition using local tissue environment information is added to image-guidance techniques. The NASA Smart Probe uses neural networks to combine data from multiple microsensors to provide a unique tissue 'signature' in real-time. Sensor modalities utilized include optical spectroscopy (absorbance and fluorescence, laser and broadband near infra-red), pressure/resistance, microelectrode (spontaneous recording and impedance), pH/PCO₂/PO₂, laser-Doppler blood flow, and computerized analysis of neuroendoscopic images. Data have been collected in both animal and human trials in several probe configurations: (1) an 8 microsensor probe 2.5 mm diameter for rodent studies of normal and subcutaneously-implanted mammary tumors; (2) a less than 2 mm diameter 'needle' with multiple spectroscopic fibers and an impedance microelectrode for breast cancer diagnosis in humans.

RESULTS: Multisensor data have been collected in real-time using PC-type computers with update rates as fast as 100 times per second. The rodent data have demonstrated the ability to distinguish various normal tissues, as well as differentiate cancer from non-cancerous tissue. The human data (collected by the NASA licensee Bioluminate) have demonstrated - in more than a dozen women undergoing breast biopsy as of November, 2002 - the ability to differentiate normal breast tissue from both benign tumors and breast carcinoma. Tumor margins and necrosis are rapidly detected.

CONCLUSIONS: The potential applications of real-time microsensor tissue recognition for stereotactic and functional neurosurgery are considerable, e.g. real-time tumor diagnosis and margin detection, improved functional localization, differentiation of tissues in minimally-invasive stereotactic image-guided cranial and spinal surgery.

OBJECTIVES: (1) Identify issues involved in remote surgery; (2) Become familiar with microsensor technology for tissue recognition; (3) Recognize the potential of real-time tissue recognition for neurosurgery, especially in combination with image-guided and minimally invasive techniques.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Neurophysiology

TITLE: Effect of High Frequency Stimulation of Subthalamic nucleus on Subthalamic Neurons: an Intracellular Study.

AUTHORS: Kendall H Lee, MD,PhD; Uhnoh Kim, PhD; David W Roberts, MD

INTRODUCTION: The precise mechanism of action of deep brain stimulation in the subthalamic nucleus (STN) for the treatment of Parkinson's disease and epilepsy is unknown. In the present study, the intracellular effects on STN neurons of high frequency stimulation (HFS) of STN were examined to test the hypothesis that HFS results in either increase or decrease in neuronal action potential generation.

METHODS: Intracellular electrophysiological recordings were made in the rat STN neurons in in vitro slice preparation. A concentric bipolar stimulating electrode was placed in the STN and electrical stimulation (100-2000 msec duration; 10-500 microA amplitude; 10-200 Hz frequency) was delivered while simultaneously recording intracellularly from a STN neuron using a sharp electrode.

RESULTS: High frequency stimulation of STN resulted in the generation of excitatory post-synaptic potentials and increase in action potential firing during the stimulation period followed by a period of post-stimulation inhibition of firing in STN neurons. The degree of increase in action potentials from HFS was critically dependent on the frequency of electrical stimulation such that, at approximately 100-140 Hz, maximal increase was obtained, but at 200 Hz, the activity was blocked. Interestingly, the duration of post-stimulation inhibition of firing was dependent on the duration of stimulation such that the longer the HFS, the longer the inhibition.

CONCLUSIONS: These results suggest that the mechanism of action of deep brain stimulation involves initial excitation followed by later inhibition of STN neurons at a cellular level rather than primary inhibition, as previously hypothesized.

OBJECTIVES: 1. Understand that the high frequency stimulation of STN may involve both increase and decrease in action potential generation in STN neurons. 2. Understand that the response of subthalamic neurons to electrical stimulation is dependent on the frequency of stimulation. 3. Understand that the electrical stimulation to subthalamic nucleus results in excitatory post synaptic potentials in subthalamic neurons.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Stereotactic Brainstem Biopsy is Indicated for Diagnosis of a Diversity of Brainstem Pathology

AUTHORS: Uzma Samadani, MD,PhD; Kevin D. Judy, MD

INTRODUCTION: Adult brainstem tumors are rare, and diverse pathology can be found in this location. Thirteen studies since 1985 have documented a high diagnostic and a low complication rate from stereotactic biopsy of brainstem lesions. A meta-analysis of these studies combined with our recent series of nine patients with brainstem lesions comparing MRI findings to biopsy histopathology is performed to determine whether or not these lesions could have been diagnosed radiographically

METHODS: A literature analysis was performed. Additionally, nine patients with a mean age of 50 at our institution underwent stereotactic biopsy of clinically symptomatic brain stem lesions. Clinical histories and pre-operative radiographic studies were compared to pathologic diagnoses.

RESULTS: A total of 317 brainstem biopsies were performed in the thirteen published studies and at our institution. Only seven of these were non-diagnostic (98% diagnostic) and there was no mortality. 93 of the patients from six series were adults, pathology was listed for 81 of these patients and pre-operative MRI had been obtained in 61 patients. 40 of the lesions were gliomas (49%), 9 were metastases (11%), 5 were lymphomas (6%), 3 each (4%) were infarctions, demyelination, tuberculoma and cryptic AVMs. 2 each (3%) were radiation necrosis, hematomas, benign cysts, abscess, epidermoid tumor and vasculitis. The remainder (one each or 1%) were leukemia, leukoencephalopathy, and cryptococcus. There was no correlation between T1 or T2 intensity on MRI or characteristic gadolinium enhancement that could reliably predict pathology of adult brainstem lesions.

CONCLUSIONS: Empiric treatment of adult brainstem lesions on the basis of radiographic and clinical findings is not prudent because there is a wide spectrum of diverse pathology in this location. Stereotactic biopsy is a safe and effective method for determining histopathology.

OBJECTIVES: 1.) Understand that stereotactic biopsy of lesions in the brainstem is safe and highly diagnostic. 2.) Realize that there is a diversity of pathology that occurs in the adult brainstem. 3.) Appreciate the indications for stereotactic brain biopsy.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Post-Surgical Seizure Outcome and Neuropathological Findings in Patients with Refractory Temporal Lobe Epilepsy and A Normal MRI

AUTHORS: Kirk W Jobe, MD; Andres M Kanner, MD; Shilpa Tilwalli, BS; Susan M Palac, MD; Sue Leurgans, PhD; Leyla deToledo-Morrell, PhD; Richard W Byrne, MD; Michael C Smith, MD; Donna C Bergen, MD; Walter W Whisler, MD, PhD

INTRODUCTION: Approximately 60 to 80% of patients with mesial temporal sclerosis (MTS) become seizure-free after temporal lobectomy. This seizure outcome rate drops (to less than 50%) among patients with a normal brain MRI. The population of patients with normal MRIs has not been well studied.

METHODS: We reviewed the postsurgical seizure outcome, seizure risk factors (history of febrile seizures, meningitis, encephalitis, severe head trauma and family history of epilepsy) and neuropathological findings of 18 consecutive patients whose presurgical evaluation demonstrated a normal MRI (and normal volumetric measurements of mesial-temporal structures) and who underwent a tailored antero-temporal lobectomy for the treatment of refractory temporal lobe epilepsy (TLE) between 1992 and 2000 at RPSLMC. All patients were followed postoperatively for at least two years. Seizure outcome was divided into two categories: No seizures or only auras (Engel Class I) or persistent seizures (Engel classes II+ III+IV). Fisher's exact test was used for statistical analyses.

RESULTS: Of 18 patients, 12(67%) were seizure free and 6(33%) had persistent seizures. Ten of 12 patients (83%) with abnormal findings on neuropathological specimens were seizure free at follow-up compared to 2 of 6 (33%) patients without neuropathological findings. This difference failed to reach significance ($p = 0.1$), probably because of the small number of patients in each outcome group. The neuropathological findings included: ectopic neurons in 9 (50%), hippocampal sclerosis in 5(28%), dysplasia in 1 (6%) and a DNET in 1(6%). The presence seizure risk factors was not associated with a seizure free outcome ($p=0.6$).

CONCLUSIONS: Temporal lobe tailored resection for medically intractable seizures is effective in patients with a normal MRI and seizure free results approach those of patients with abnormal MRIs. The role of neuropathological abnormalities in the seizure outcome of these patients needs to be re-evaluated with a larger number of patients.

OBJECTIVES: At the completion of the session of demonstration, participants should be able to discuss the outcome of temporal lobectomy in patients with refractory temporal lobe epilepsy and normal MRIs.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Use of Propofol During Implantation of Deep Brain Stimulation (DBS) Electrodes

AUTHORS: Brian N Maddux, MD,PhD; Robert J Maciunas, MD,FACS

INTRODUCTION: Bilateral placement of DBS electrodes in subthalamic nucleus (STN) or globus pallidus (GPi) is frequently a lengthy procedure, usually with minimal or no sedation. General anesthesia is believed to interfere with successful physiologic monitoring and macrostimulation. Early in our institutional experience, we encountered two patients who required propofol in order to tolerate the procedure. Subsequently we began to use moderate to deep sedation with propofol more frequently as clinically warranted. We hypothesized that propofol would not impede successful outcome.

METHODS: Retrospective review of intraoperative monitoring and post-operative management.

RESULTS: A total of 36 DBS leads have been implanted in 18 individual patients in 22 operating room (OR) dates. Of these, 30 leads in 15 PD patients are in STN, and 6 are in GPi (in 3 patients with CD). In 22 OR procedures, propofol drip was employed in 13, and not at all in 9. Average age and duration of illness (PD) did not differ significantly in the propofol group versus the conventional group. The effect of propofol on activity recorded by the microelectrode was variable, so we routinely turned the propofol drip off 20 minutes prior to recording or macrostimulation. Comparing those patients with and without propofol use, there were no significant differences in total microelectrode recording time, number of recording tracks, and number of stimulation tests (for each side implanted). Propofol use did not prolong post-operative management, as measured by the number of stimulation adjustments and number of days to achieve a stable post-operative state. No apparent differences in complications or long-term outcome were observed.

CONCLUSIONS: We propose that the use of unconscious sedation with intravenous propofol may allow some individuals to undergo DBS implantation who would otherwise be unable to tolerate the procedure.

OBJECTIVES: describe the effects of propofol on deep brain stimulation procedures

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Sedation and Analgesia in Patients with Parkinson's Disease Treated by Pallidotomy and Thalamotomy

AUTHORS: Adam Szona, MD; Krzysztof Chmura, MD; Marek Harat, Prof; Wojciech Gaszyński, Prof

INTRODUCTION: The purpose of the study was to work up the anesthesiological support to reducing the intraoperative surgical risk in the parkinsonian patients treated by pallidotomy and thalamotomy. Since the intensive anxiety and pain can produce many danger cardiovascular disturbance, that can lead to myocardial ischemia and intracranial hemorrhage, the main problem to solve was to decrease the level of them. The second issue was to maintain satisfied verbal and logical contact between the patient and the physician during the intraoperative neurological investigation.

METHODS: 53 patients with Parkinson's disease were included in a prospective study protocol. It was applied intravenous remifentanyl hydrochloride and oral clorazepate for 26 of them. Twenty seven patients created the control group. The local analgesia was used in everyone surgical procedure. The following parameters were measured before, during, and after the operation: hemoglobin oxidation, pulse (HR), systolic pressure (SP), diastolic pressure (DP), mean arterial pressure (MAP), afterload, Visual Analog Anxiety Scale and Visual Analog Pain Scale.

RESULTS: The statistics, based on the 26-person control group, and the 27-person treated group shows decrease of the levels of the basic cardiovascular, pain, and anxiety indexes during the surgical procedures, when clorazepate and remifentanyl were administrated. Especially during the sorest parts of the operation, as the frame fixation, arriving to the operating theatre, and the skin incision.

CONCLUSIONS: Clorazepate and remifentanyl, that are administrated additionally to the local anesthesia decrease the cardiovascular risk factors (SP, DP, HR, MAP, afterload), and the intracranial hemorrhage risk factor (SP). Improvement of the intraoperative patients' comfort, reduction of the pain and the anxiety were obtained. The adequate level of the verbal and logical contact with patient during the intraoperative neurological investigation were maintained.

OBJECTIVES: 1. use analgetics in movements disorders the surgery 2. predict results of using the mentioned medications 3. decrease the risk of complications during the local analgesia operation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: The Results of The Stereotactic Pallidotomy and Thalamotomy in The Treatment of Idiopathic Dystonia

AUTHORS: Adam Szołna, MD; Marek Harat, Prof; Aleksander Litwinowicz, MD

INTRODUCTION: The purpose of the study was to review the experience and present the results of the stereotactic treatment by thalamotomy and pallidotomy in primary dystonia.

METHODS: From 13th December 1999 to 8th December 2002 we performed 13 thalamotomies and 13 pallidotomies in the treatment of primary dystonia. To assess the progress in treating and to characterise the clinical course of the presented cases we used following scales: Burke, Fahn, and Marsden Dystonia Rating Scale (BFMDRS) and Karnofsky Performance Scale. The results were evaluated before, and during follow-up (5 days, 1,3 and 6 months after surgery).

RESULTS: Median age of patients was 40 years (range 14-60) at the time of surgery. Median duration of illness 7 years (range 2-17). The mean preoperative and postoperative BMDRS score were estimated to be 70,3 and 49,9 points respectively. Range of improvement in BMDRS was very wide and was estimated to be 12 to 85%. Transient complication occurred in 5 patients (22,7%); permanent complications were presented in 2 cases (7,7%). There were no death and severe complications.

CONCLUSIONS: In the presented material, the stereotactic pallidotomy and thalamotomy is an effective treatment, resulting predominantly in contralateral improvement in motor function, but not in all cases. Very wide range of the results were observed in idiopathic dystonia. The efficacy of neurosurgical intervention for dystonia remains unpredictable but is an appropriate consideration in intractable cases because of low rate of complications.

OBJECTIVES: 1. know the means of stereotactic treatment of idiopathic dystonia 2. qualified the dystonia patients for stereotactic surgery 3. recognise the basic signs of dystonia

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: The Role of Pituitary Radiosurgery for the management of Intractable Pain and the Potential for Future Work

AUTHORS: Motohiro Hayashi, MD; Takaomi Taira, MD; Roman Liscak, MD; C-P Yu, MD; Tomokatsu Hori, MD

INTRODUCTION: Before two or three decades, cancer pain had been treated by surgical/chemical hypophysectomy. And there was a report that central pain was also tried to be controlled with chemical hypophysectomy. These treatments provided most of the patients to release from severe pain. Otherwise severe adverse effects had been accompanied in almost patients. These historical evidences prompt us to perform Gamma Knife Surgery (GKS) for this kind of severe pain with pituitary stalk/ gland targeting. Å@

METHODS: We've been doing prospective collaboration study for this treatment to evaluate the efficacy and the safety among Prague, Hong Kong, and our institute (Tokyo). An indication of this treatment for our proposal protocol: 1) No any other effective treatment prior to GKS, 2) General condition kept to be good (KPS>40%) , 3) Morphine is effective for pain control (for cancer pain), 4) No previous treatment with radiation (GKS/conventional radiotherapy) for brain metastasis. In our experience, we treated 10 patients (5: Prague, 2: Hong Kong, and 3:Tokyo,) who were suffered from severe cancer pain due to bone metastasis with GKS, and 10 patients (Tokyo only) who were suffered from central pain. The target was the pituitary stalk in 15 patients (Tokyo & Hong Kong: one 8mm collimator) and the pituitary gland in 5 patients (Prague: two 4 mm collimators). Maximum dose was 140-200Gy (median: 160Gy for cancer pain and 140Gy for central pain).

RESULTS: All of the cases with cancer pain experienced pain free, and 80% of the cases with central pain experienced significant pain reduction without any complication. Some of patients felt pain reduction in several hours later. Pain relief was appeared within several days. We could follow-up 1-24 months, no recurrence excluding 1 central pain patient and no hormonal insufficiency were observed.

CONCLUSIONS: Our study is not mandatory and still insufficient. However, the efficacy and safety have been shown instead of small numbers of patients. We believe this treatment has a potential to cure the patients suffered from severe pain, and GKS will play a much important role in the field of intractable pain.

OBJECTIVES: to learn this treatment concept and how to treat cancer pain and central pain with Pituitary radiosurgery

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: New Modified Treatment Method in MTLE radiosurgery- Based on the evaluation of 23 MTLE cases in Marseille Timone Hospital -

AUTHORS: Motohiro Hayashi, MD; Jean Regis, MD; Taku Ochiai, MD; Fumitaka Yamane, MD; Tomokatsu Hori, MD

INTRODUCTION: Precise definition of optimum target boundaries and optimum dose/energy in the Gamma knife surgery (GKS) for Mesial Temporal Lobe Epilepsy (MTLE) are unknown. Our goal is to identify the technical parameters correlating with a higher probability of seizure cessation.

METHODS: A clinical and radiological follow-up of over 2 years is available for 23 patients. We systematically evaluated clinical outcomes (Engel's class: I-IV) and MRI changes. Using Gamma Plan software (ELEKTA instruments AB), we have retrospectively analyzed pre/post operative anatomical data and dosimetry in each anatomical structure of the mesial temporal lobe has been precisely delineated in 3D into 16 parts (4 parts of the archeocortex, the parahippocampal cortex and white matter, and the collateral fissure cortex on the coronal images and 4 zones of the amygdala, the hippocampal head, body, and tail on the axial images). In each of them we have calculated maximum, minimum, and average dose, volume, delivered energy, unit energy (mJ/cm³), and coverage percentage of 20 Gy volume.

RESULTS: In the group of 20 patients treated by the latest protocol, seizure cessation occurred in 85.0% (17/20: Engel's class IA=14, IB=3, IIB=1, IV=2). A multivariate analysis demonstrated that the collateral fissure cortex at the zone of hippocampal body level (%20GyV) was the most significant predictive parameter. Consequently, the parahippocampal cortex and the parahippocampal white matter at the zone of hippocampal head, and the parahippocampal cortex at the zone of hippocampal body (%20GyV) were near to significant.

CONCLUSIONS: Our results are obviously valuable for optimization of our technical protocol in MTLE radiosurgery. Target definition turn out to be crucial one should pay attention to include extensively the parahippocampal cortex and the medial wall of the collateral fissure. In Dose Planning, priority covering these important anatomical structures with multi-isocenters and safer dose (20Gy at 50% isodose line). This study protocol is supposed to provide more excellent clinical result for MTLE radiosurgery.

OBJECTIVES: to learn new treatment concept for Mesial Temporal Lobe Epilepsy by Gamma Knife

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: The Role of the Basal Ganglia in Voluntary Movement Selection

AUTHORS: Joseph S Neimat, MD; Emad N. Eskandar, MD; John A. Assad, PhD

INTRODUCTION: Current models suggest that the basal ganglia play a role in selecting desired movements among a number of possible movement choices. This may account for the paucity of movement in Parkinsonism and the inability to suppress movement in cases of ballism or chorea.

METHODS: Single-unit electrode recordings were made in macaque monkeys trained to execute movements using a joystick to guide a spot to a target presented on a video monitor. Trials with a single object for movement were interleaved with trials presenting 2 objects and thus requiring a movement selection.

RESULTS: One hundred thirty-eight cells (72 in the putamen, 59 in the pallidum, and 7 in the sub-thalamic nucleus) were recorded during the selection task. Two-way ANOVA ($p < 0.05$) was used to analyze the effect of movement direction and presence or absence of choice on neuronal firing rates. Firing rates were analyzed both before movement initiation and during movement. Of the putaminal cells 31(43%) and 37(51%) were significantly modulated by the direction of movement before and during movement respectively. In the same epochs, 36(27%) and 21(29%) cells were modulated by the situational context in which the movement was made; i.e. by the presence or absence of a competing choice for movement direction. In the pallidum 24(41%) and 23(39%) were modulated by direction before and during movement, while 8(14%) and 13(22%) were modulated by movement context. Preliminary data on 7 STN cells demonstrated significant context variability in firing of 4(57%) and 5(71%) cells before and during movement respectively.

CONCLUSIONS: These data support the proposition that the basal ganglia may play a role in selecting among potential voluntary movement choices.

OBJECTIVES: 1. Understand current theories of basal ganglia structure and function. 2. Discuss new models for basal ganglia function. 3. Consider evidence for a role of the basal ganglia in voluntary movement selection.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Image guided interstitial laser thermotherapy: A canine model evaluated by magnetic resonance imaging and quantitative autoradiography

AUTHORS: Alexander Muacevic, MD; Michael Peller, MD; Dieter Berg, MD; Lutz Ruprecht, MD; Freidrich W. Kreth, MD; Hanns-Juergen Reulen, MD, PhD; Joerg-Christian Tonn, MD, PhD

INTRODUCTION: To determine the applicability and safety of a new canine model suitable for correlative magnetic resonance imaging (MRI) studies and morphological/pathophysiological examination over time after interstitial laser thermotherapy (ILTT) in brain tissue.

METHODS: A laser fiber (Diode Laser 830 nm) with an integrated temperature feedback system was inserted into the right frontal white matter in 18 dogs using frameless navigation technique. MRI thermometry (phase mapping i.e. chemical shift of the proton resonance frequency) during interstitial heating was compared to simultaneously recorded interstitial fiberoptic temperature readings. To study brain capillary function in response to ILTT over time quantitative autoradiography was performed investigating the unidirectional blood-to-tissue transport of carbon-14-labeled alpha aminoisobutyric acid (transfer constant K of AIB) 12, 36 hours, 7, 14 days, 4 weeks and 3 months after ILTT.

RESULTS: All laser procedures were well tolerated, laser and temperature fibers could be adequately placed in the right frontal lobe in all animals. In 5 animals MRI-based temperature quantification correlated strongly with invasive temperature measurements ($r=0.97$). In the remaining animals the temperature fiber was located in the area of susceptibility artifacts, therefore, no temperature correlation was possible. The laser lesions consisted of a central area of calcified necrosis which was surrounded by an area of reactive brain tissue with increased permeability. Quantitative autoradiography indicated a thin and spherical blood brain barrier lesion. The mean value of K of AIB was 19.26 times (2.06 times) that of normal white matter (cortex), respectively. The magnitude of K of AIB increased from 12 hours to 14 days after ILTT and decreased thereafter. MRI follow-up investigation showed a continuous reduction of both lesion size and enhancement within a mean of 3 months.

CONCLUSIONS: ILTT causes transient, highly localized areas of increased capillary permeability surrounding the laser lesion. Phase contrast imaging for MRI thermomonitoring can currently not be used for reliable temperature readings in vivo. The suggested model proved to be safe, accurate, easy to use, and applicable for minimal invasive neurosurgical procedures. Future research utilizing this model could investigate additional effects of ILTT and offer a basis for further neuroimaging, morphological and physiological research.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Deep Brain Stimulation in Movement Disorders - the Kiel Experience in Parkinson's Disease

AUTHORS: Maximilian Mehdorn, MD,PhD; Bettina Schrader, MD; Joachim Herzog, MD; Johannes Volkmann, MD; Wolfgang Hamel, MD; Günther Deuschl, MD,PhD

INTRODUCTION: In order to elucidate the role of Deep Brain Stimulation (DBS), patients enrolled in the movement disorder program since 1999 at the University of Kiel/Germany were evaluated for DBS and, if operated, followed in a prospective way for up to nearly 4 years, in the Depts. of Neurology and Neurosurgery.

METHODS: Between January 1999 and December 2002, 103 patients (age range 23 ñ 76 ys.) have undergone DBS, mostly bilaterally, for various movement disorders: 79 for Parkinson's Disease (PD), 7 for Essential tremor (ET), 6 for dystonia, to name the most frequent ones. Target selection was STN for PD except in pats. with tremor dominant PD and was based on direct MRI visualization, or ET in whom VIM was chosen. Final electrode position was chosen on the basis of 5 parallel tracts of microelectrode recording and stimulation which was performed in the awake patients with PD and ET. During surgery the neurologists controlled the patient's reaction to stimulation, the neurostimulator was implanted immediately following final electrode positioning and position control, then stimulation was fine-tuned by the neurologists over the ensuing weeks while tapering off the medication. Patients were evaluated regularly in both depts. with formal neurological testing including L-DOPA-test.

RESULTS: Results for the patients with PD and DBS into the STN: in the first 48 patients operated upon for PD and evaluated at 6 months using the UPDRS, DBS reduced the UPDRS motor score by 50,5% compared to the base line. This improvement remained constant at 12 months with 57,5% (N=32) and at 24 months (N=20) with 57.3%. Relevant side effects following STN- DBS included 1 subdural hematoma without neurological sequelae, minor intracerebral bleeding with slight transient hemiparesis (n=1), dislocation of impulse generator (n=2), and various transient psychiatric disturbances requiring additional care. One patient died because of heart failure during the first postoperative year.

CONCLUSIONS: The current series is demonstrating efficacy and safety of STN-DBS beyond the first year after surgical procedure. Besides surgical problems early in the series, complications of STN- DBS comprise a wide range of psychiatric adverse events which, however, were temporary.

OBJECTIVES: Participants should understand the techniques applied to obtain best surgical results in DBS for PD and know the long term results up to 2 years following surgery as well as complications in this selected group of patients.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Repeated gamma knife surgery for multiple brain metastases from renal cell carcinoma

AUTHORS: Alexander Muacevic, MD; Freidrich-W. Kreth, MD; Joerg-Christian Tonn, MD, PhD; Berndt Wowra, MD

INTRODUCTION: Aim of this study was to evaluate the therapeutic profile of repeated gamma knife surgery (GKS) for renal cell carcinoma that has metastasized to the brain on multiple occasions.

METHODS: In this one-institutional study 93 patients (64% with multiple metastases) harboring 414 cerebral metastasis were consecutively followed over a 8-year period. All patients were treated by outpatient radiosurgery. A rigid standard protocol for indication, dose planning, and clinical and imaging follow up was established. In the case of local or distant recurrences repeated gamma knife radiosurgery was performed. Survival time was analyzed with the Kaplan Meier method. Prognostic factors were obtained from the cox model.

RESULTS: The actuarial local tumor control rate was 96.6%. Median survival was 9.8% after radiosurgery. Repeated radiosurgery was performed in 28 patients (30%) because of new distant metastases to the brain except for one case. Unfavorable predictor of survival was a pretreatment Karnofsky performance score (KPS) <70 and a progressing extracranial tumor status. Age, side of the renal cell carcinoma, pretreatment of the cerebrum by surgery or radiotherapy, number of brain metastases, synchronization with the primary renal cell carcinoma and the frequency of radiosurgical procedures did not gain prognostic relevance. Symptomatic late radiation toxicity was encountered in 12% of all patients.

CONCLUSIONS: Outpatient repeated radiosurgery is an effective treatment option for multiple brain metastases from renal cell cancer particularly in patients with limited extracranial disease. Characteristic aspects of late radiation toxicity must be taken into account.

OBJECTIVES: #NAME?

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Deep Brain Stimulation Extension Wire Implantation: Complication Avoidance

AUTHORS: Jules M Nazzaro, MD

INTRODUCTION: Implantation of the Activa (Medtronic, Inc.) deep brain stimulation (DBS) system (brain lead, extension wire, and neurostimulator), in the setting of intraoperative test stimulation, is often performed in staged operations, with the extension wire and neurostimulator being implanted several days to possibly weeks after stereotactic lead placement.

METHODS: Observations of potential difficulties encountered upon delayed DBS extension wire surgery are now reported.

RESULTS: Since difficult scar/granulation-type tissue may be encountered, subgalea attachment with setscrews and implantation of only the proximal-most portion of the provided temporary wire for external post-operative test stimulation to the distal lead end at time lead placement/implantation, makes subsequent distal lead subgalea retrieval easier and safer; the cover is exposed and removed at time of extension wire implantation surgery. The distal lead end should be of sufficient straight length so that retrieval does not involve dissection in the area of the more proximal portion of the lead, which often is intentionally looped/curled in the subgaleal space; retrieval of the distal lead end requires sufficient exposure of the lead to allow the boot connection cover length to be slid proximally over the lead while securing the lead within the permanent extension via setscrews. The provided flat-bottom clear boot connection cover is preferred to the provided opaque boot covers (round or flat bottom); upon sliding the boot cover proximal to distal following securing the lead within the extension wire, there may easily be severe kinking of the distal end of the lead within the cover given the tight fit of the proximal end of the cover orifice in relation to the lead within. The kinking, which may damage the lead, may not be readily recognized if the opaque boot cover is used; flat bottom/low-profile cover design may decrease the incidence of overlying soft tissue erosion.

CONCLUSIONS: Delayed implantation of the DBS extension wire warrants particular attention to the lead-extension wire junction area.

OBJECTIVES: Consider and understand surgical technical factors concerning delayed DBS extension wire implantation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Anatomopathological basis of microsurgical DREZ lesions. Report of two cases

AUTHORS: guilherme lepski, MD; SÈrgio Rosemberg, PhD; F·bio Godinho, MD; Manoel Teixeira, PhD

INTRODUCTION: Dorsal root entry zone lesion is a commonly used method for the treatment of chronic pain. However, no attempt was made to precisely describe the anatomical lesion and the physiological alterations it causes.

METHODS: The anatomic delineation of radiofrequency dorsal root entry zone lesion is showed in two patients who died 8 and 13 days after the surgical procedure.

RESULTS: Both patients were pain free after surgery. The first patient showed a trauma related left sharply bordered tissue defect reaching from the dorsal root entry into the gray matter of the posterior horn. The sharply delineated radiofrequency lesions involved a major portion of the posterior cord including Rexed's laminae I to VI, Lissauer's tract, substantia gelatinosa and part of posterior columns (Cuneate fascicle) in both patients

CONCLUSIONS: According to these results, pain relieving mechanisms in DREZ lesions possible involve wide areas besides the substantia gelatinosa and Lissauer's tract, contributing to understand the mechanisms of spinal generators of chronic deafferentation pain.

OBJECTIVES: pain study, pathological description, physiological considerations

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Deep Brain Stimulation of the Subthalamic Nucleus in Parkinson's Disease: Correlation of Active Electrode Contacts with Intraoperative Microrecordings

AUTHORS: Wolfgang Hamel, MD; Urban Fietzek, MD; Andre Morsnowski, MSc; Dieter Weinert, MD; Bettina Schrader, MD; Jens Volkmann, MD; Gunter Deuschl, MD,Prof; Dieter Müller, MD,Prof; H. Maximilian Mehdorn, MD,Prof

INTRODUCTION: Although deep brain stimulation (DBS) of the subthalamic nucleus (STN) has been performed successfully in hundreds of patients suffering from advanced Parkinson's disease the actual site of permanent stimulation remains a matter of debate, in particular it is unresolved whether stimulation within the STN proper or if anatomical structures adjacent to the nucleus may be relevant for the therapeutic effects. To this end the actual (stereotactic) position of active electrode contacts was correlated with the dorsal margin of the STN as determined by intraoperative microrecordings and MRI.

METHODS: DBS electrode (n=49) implantation into the STN of twenty-five patients suffering from severe, levodopa-sensitive parkinsonian symptoms was guided by microrecording and microstimulation along five parallel tracks. The stereotactic position relative to the midcommissural point of the most effective electrode contacts selected for permanent stimulation (n=49) was determined by postoperative x-ray and/or correlation of pre- and postoperative MRI. In cases in which the dorsal margin of the STN could be mapped in at least three microrecording tracks (n=37) this was correlated with the stereotactic position of the active electrode contact using a novel algorithm developed for direct 3D-comparisons.

RESULTS: In all patients STN stimulation resulted in marked improvements of levodopa-sensitive parkinsonian symptoms and levodopa-induced dyskinesias as reflected by significant improvements in UPDRS III scores. Projection of electrode artifacts onto the STN as visualized by T2WI-MRI suggested passing of the electrode through the STN in several patients. Correlation of the actual position of active electrode contacts (n=35) with the dorsal margin of the STN as defined neurophysiologically revealed that most contacts were located either in proximity (± 1.0 mm) to the dorsal border of the STN (32.4%) or farther dorsal within the subthalamic region (37.8%). The other active contacts (29.7%) were found within the dorsal (sensorimotor) STN. The average position (mean \pm standard deviation) of all active contacts (n=49) was 12.8 mm (± 1.0) lateral, 1.9 mm (± 1.4) posterior, and 1.6 mm (± 2.1) ventral to the midcommissural point.

CONCLUSIONS: STN stimulation appears to be optimal in the border area between the dorsal (sensorimotor) STN and the subthalamic area containing the zona incerta, fields of Forel, and STN projections.

OBJECTIVES: ... agree that the actual site of stimulation should be determined in all patients operated ... keep in mind that STN stimulation may involve other structures than

(or in addition to) STN and ... reflect these structures with respect to a possible role in the therapeutic effects of STN DBS

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Radiosurgery

TITLE: Trigeminal neuralgia treated by means of Gama Knife Radiosurgery

AUTHORS: Simm F Renata, MD; Paulo H Aguiar, MD,PhD; Jacobsen Teixeira Manoel, Prof; Canteras Miguel, MD; Lepski Guilherme, MD; Delgado Villora Rita, MD; Bunge Herman, MD

INTRODUCTION: The trigeminal neuralgia is a disease, which has many options of surgical treatment including microvascular decompression, percutaneous thermalcoagulation and baloon compression of meckel cave. The refractory trigeminal neuralgia mainly due to multiple sclerosis could be treated by Gama Knife Radiosurgery and the target point could be easily calculated besed on MR images.

METHODS: A 55 year old patient with refractory left side trigeminal neuralgia was submitted a radiosurgery of Meckel Cavum. He was undergone before a 2 percutaneous Fogart baloon compression procedures, and he used 1400 MG per day Carbamazepine without results. The MRI showedwith many periventricular points of hypersignal. He refused to be submitted a microvascular decompression or stereotatic nucleotomy.

RESULTS: 6 months after radiosurgery, the patient diminished the Carbamazepine to 400MG per day. The pain had amelliorated and decreased its intensity. The facial sensibility was worse than previously the surgery, except for corneal sensibility which was kept.

CONCLUSIONS: In dramatic cases of trigeminal neuralgia due to multiple sclerosis the Gama Knife radiation could be employed as a not aggressive therapeutic method.

OBJECTIVES: Option for trigeminal neuralgia treatment Not aggressive method Should be used in a selected group not able for conventional procedures

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Stereotactic-guided Gamma Probe-assisted Brain Tumor Microsurgical Resection

AUTHORS: Osvaldo Vilela Filho, MD; Omar Carneiro Filho, MD

INTRODUCTION: Gamma-probe assisted surgery (GPAS), developed under the premise that the sensitivity and specificity of radiodetection increase by minimizing the distance between the radiotracer and the detector, was introduced into clinical practice in 1985, enabling the surgeon to identify radioactive tissues targeted by a preadministered gamma-emitting tumor-associated radiolabeled substance. This technique, successfully applied in a variety of tumors, was pioneered employed by the present authors in one patient with brain tumor in 2002, aiming not only an improvement of tumor detection, but mainly assurance of its complete removal. In the present study we report our experience with our first four patients, harboring different types of tumors.

METHODS: Patients' informed consent and demonstration of the tumor by the preoperative ^{99m}Tc-MIBI (a radiotracer with affinity for brain tumors) SPECT were the inclusion criteria adopted for GPAS, which was performed in four patients (GBM, 1; recurrent grade II astrocytoma, 1; meningioma, 1; and metastasis, 1). ^{99m}Tc-MIBI was injected in a peripheral vein 1-5 hours before the stereotactic-guided operation. A tumor to-normal tissue count ratio equal to or greater than 2/1 was considered indicative of tumor.

RESULTS: The gamma probe rapidly detected the four tumors; demonstrated the complete resection of the meningioma and low-grade astrocytoma; and indicated a small piece of residual tumor (metastasis) after what was thought to be a complete removal, allowing its resection. Complete resection was confirmed by postoperative CT in these cases. Regarding the GBM, a significant amount had to remain untouched, in spite of its demonstration by the gamma probe, since it was invading eloquent areas.

CONCLUSIONS: GPAS seems to be a reliable technique to improve brain tumor detection and to confirm the presence or absence of residual tumor. MRI does not precisely show some tumors margins; for this very reason, we believe that GPAS is more accurate than neuronavigation and intraoperative MRI.

OBJECTIVES: 1- Understand the principles and indications of gamma probe-assisted surgery; 2- Use the gamma probe; 3- Infer the perspectives of the gamma probe-assisted surgery for brain tumors.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Multicenter prospective trial of Deep Brain Stimulation (DBS) for the treatment of intractable Obsessive Compulsive Disorder (OCD)

AUTHORS: Ali R Rezai, MD; Gerhard Friehs, MD; Nuttin Bart, MD; Rauch Scott, MD; Malone Donald, MD; Cosyns Paul, MD; Rasmussen Steven, MD; Greenberg Benjamin, MD

INTRODUCTION: Obsessive compulsive disorder (OCD) affects 2-3% of the US population. Despite advances in medication and behavior therapy, at least 10% of patients have refractory and disabling OCD. The neurosurgical management of intractable OCD has involved radiofrequency lesioning of the cingulate cortex and internal capsule as well as gamma knife capsulotomy. Deep brain stimulation (DBS) technology is being increasingly used for the treatment of movement disorder. Our group will now report on the use of chronic DBS of the anterior limb of the internal capsule for medically intractable OCD.

METHODS: Fifteen severely disabled OCD patients refractory to prolonged medical and behavioral therapy were enrolled in the prospective multicenter study from 1998-2003. Patients underwent stereotactic implantation of bilateral DBS leads in the anterior limb of the internal capsule using CT and MRI based anatomical targeting and physiological verification with macrostimulation. Patients were operated on at University of Leuven, Belgium, Brown University/Rhode Island Hospital, and The Cleveland Clinic Foundation. All patients were evaluated pre and post-operatively at monthly intervals using standardized measures including the Yale-Brown Obsessive Compulsive Scale (YBOCS), Clinical Global Impression (CGI), as well as other psychological and neuropsychological tests. In addition pre and post-operative Positron Emission Tomography (PET) scans were performed.

RESULTS: Preliminary analysis suggest that symptomatic improvements in mood and YBOCS scores can occur with DBS of the anterior limb of the internal capsule. The programming of the DBS can be complicated and significantly time consuming. No patient has experienced a major complication to date. Results with long-term follow-up (mean >1 year) including safety, efficacy and imaging will be presented.

CONCLUSIONS: Preliminary results indicate that bilateral DBS of the anterior limb of the internal capsule appears to hold promise for the treatment of refractory OCD. Longer term follow-up results are necessary

OBJECTIVES: Understand the anatomy and physiology of OCD Gain insights the use of DBS in refractory OCD

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Craniotomy for Metastatic brain tumour resection guided by stereotactic devices

AUTHORS: Paulo H Aguiar, MD,PhD; Manoel Jacobsen Teixeira, Prof; Edison Nakagawa, MD; Hector Navarro-Cabrera, MD; Eric Fonoff, MD; Guilherme Lepski, MD; Joel Ribeiro-Teixeira, MD; Valter Sperling-Cescato, MD; Fabrício Porros, MD; Fernanda Andrade, MD

INTRODUCTION: Craniotomy for small deep or subcortical seated brain metastasis could be easily guided by means of stereotactic devices followed by microsurgical resection. This method is well known and allow a precise approach to these lesions avoiding difficulties to find them.

METHODS: 47 patients harboring of brain metastasis were surgically treated at Hospital das Clínicas, São Paulo University from October 1999 to May 2002 by the Group of Neuroncology, Division of Neurosurgery. Twenty patients (20/47) of this group, aged from 43 to 78 years (average=64 years), 12 women and 8 men, were submitted to a craniotomy guided by stereotactic procedures under general neurosurgical anesthesia. The primary tumours were lung in 5 patients, breast (8 cases), melanoma (1 case), kidney (1 case), indeterminate (5 cases). The indications were small deep seated lesions (13/20) and small subcortical lesions (7/20). The patients had taken dexametason 16 mg per day one week previously to the surgery. All of them were submitted a post operative radiotherapeutic device. The stereotactic frame was a TMH, Micromar, Diadema Brazil.

RESULTS: The tumours were reached in all operations by means of the craniotomies guided by stereotactic localization without technical difficulties. The complications were: post operative bleeding (1 case), partial resection (1 case), incision infection (1 case). They were not related to the stereotactic method of localization, but directly related to surgical procedure and intraoperative brain anaesthetic conditions. The operative mortality was 1 case in 20, and due to huge post-operative brain oedema in a patient with partial resection. Transitory deficits were observed in 2 patients.

CONCLUSIONS: The craniotomy guided by stereotactic localization is a safe method to reach deep and subcortical small secondary brain lesions. The complications are not related to the stereotactic method.

OBJECTIVES: Safe method - Low rate of complications - Useful for small deep and subcortical secondary brain lesions -

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Chronic pain after spinal cord injury: clinical aspects and results of pharmacological, physiatric and functional neurosurgical treatments.

AUTHORS: guilherme lepski, MD; Luis Rogano, MD; Lin Yeng, PhD; Manoel Teixeira, PhD

INTRODUCTION: Pain due to spinal cord lesions is very common. Many clinical and surgical procedures were proposed for its control. However, clear evidence of their efficacy is still lacking.

METHODS: Eighty one patients presenting chronic pain due to myelopathies were treated. Fifty-seven (70.4%) were male and the mean age was 46.4 y. Cervical myelopathy was diagnosed in 28.4% of the cases, thoracic myelopathy in 44.4% and, conus medullaris lesion in 27.2%. Myelopathy was caused by gunshot wound in 43.2% of the cases, close traumatism in 32.1%, tumors in 6.2%, multiple sclerosis in 5.0%, infectious or parasitary lesions in 3.6%, cervical stenosis in 2.5%, iatrogeny in 5.0%, syringomyelia in 1.2%, and spinal cord ischemia in 1.2%. Complete section of the spinal cord was diagnosed in 35.8% of the cases, spasticity in 34.6%, regional myofascial pain syndromes in 42.0%, segmentar pain in 30.9% and distal pain in 69.1%. The mean duration of the myelopathies was 66.1 months. The mean intensity of pain accordingly to the visual analogue scale was 9.4. All patients underwent physiatric treatment and were treated with combination of antidepressants, neuroleptics, and or anticonvulsivants and or antiinflammatory analgesics.

RESULTS: In 50 (61.7%) patients the pharmacological and physiatric treatments were not effective and functional neurosurgical procedures were performed: 18 (36.0%) underwent implantation of catheter and pump for spinal infusion of morphine, 12 (24.0%), spinal cord epidural electrode, 11 (22.0%), dorsal root entry zone lesions (DREZ), and in nine patients the association of surgical procedures were done. The mean follow-up period lasted 19.1 months. The original pain at the end of the follow-up period reduced from 9.4 to 3.4 ($p < 0.001$). Both the intensity of pain as measured by visual analogical scale and the quality of life of majority of the patients improved at the end of the follow-up. Differential results according to the kind of treatment are presented.

CONCLUSIONS: Interdisciplinary assistance based mainly in the use of psychotropics, anticonvulsivants and physical medicine is mandatory in the treatment of myelopathic pain; DREZ, spinal cord electric stimulation and or intrathecal infusion of morphine are also effective options when pain persists.

OBJECTIVES: medical treatment of central pain, surgical treatment of central pain, casuistic presentation

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: Interstitial irradiation for CNS lesions

AUTHORS: guilherme lepski, MD; Cl-udio Correia, PhD; Paulo Henrique Aguiar, PhD; Manoel Teixeira, PhD

INTRODUCTION: Several authors have succeed in the defense of interstitial irradiation for SNC lesions, as supported by various experimental and clinical works on this matter. The advantages of this method are as follows: low dose rate, high dose in tumor cells, low dose in surrounding normal cells, regeneration of sub-lethal fraction, and synchronization of cell proliferative cycle.

METHODS: 138 patients with low grade gliomas (45), anaplastic astroцитomas (19), glioblastomas (50), metastasis (23) and meningioma (1) were selected for study of the effectiveness of brachytherapy on the treatment of brain tumors. Patients were stratified by risk factors and p parameters were determined. Kaplan-Meier curves of survival for different risk factors were drawn.

RESULTS: After a mean follow-up period of 9 months (1 to 60 months), improvement was noted in 97 patients (70.3%), n oprogression of the disease in 84 (60.1%), progression in 12 (8.7%), deaths in 3 (2.1%).

CONCLUSIONS: The authors conclude that interstitial brachytherapy represents a selective, low cost, and safe form of adjuvant therapy in malignant lesions of CNS.

OBJECTIVES: goal treatment of brain malignant tumors, study of brachytherapy effectiveness, survival study on brain tumors as general

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Pain

TITLE: Bulbar trigeminal stereotactic nucleotomy for treatment of facial pain.

AUTHORS: guilherme lepski, MD; guilherme lepski, MD; Paulo Henrique Aguiar, PhD; Valter Cescato, MD; Luis Rogano, MD; Manoel Teixeira, PhD

INTRODUCTION: Many surgical procedures were developed for the treatment of facial pain. However the control of deafferentation facial pain is still a very difficult subject: the ablation of the peripheral and central nervous system structures do not alleviate pain in many patients and are associated with many complications. For option, the CNS stimulation is very expensive and the long term results unsatisfactory.

METHODS: 61 patients with Wallenberg syndrome (7), post-herpetic trigeminal neuralgia (28), atypical facial pain (7), trigeminal neuralgia (2), and oncological facial pain (14) were studied. Tricyclic antidepressants, anticonvulsants and neuroleptics were previously prescribed for all patients. All presented insomnia, reduction of domestic and professional performance, anorexia and depression. Surgical procedure: A Teixeira-Micromar Stereotactic Frame (TM - Diadema-S.,o Paulo-Brazil) was fixed under local anesthesia to the head of the patients and the target points calculated based in a computer stereotomographic reconstruction of brain images (MSPS-Micromar, Diadema,S.,o Paulo-Brazil). A special TC electrode (Radionics, Burlington - USA) was stereotactically inserted in the pars caudalis of the trigeminal nucleus and electric stimulation (1ms, 5-100Hz, 0.4-1V) was used for confirmation of target position (reproduction of pain symptoms or paresthesias over the painful areas). Radiofrequency lesions were made in 3 different contiguous points of the caudalis trigeminal nucleus.

RESULTS: The results were evaluated based in VAS, and in the modification of daily professional or domestic activities sleep patterns and appetite. Complications were also quantified. All Wallenberg's patients had immediate alleviation of facial pain and at least of one the daily activities after surgery. One had full recurrence of pain after 4 weeks and one partial recurrence after 6 months. One of them had a repeated procedure. 71,4% of atypical facial pain patients presented alleviation of pain. No trigeminal neuralgia patients improved. 87,7% of the oncologic pains improved. The overall final improvement was 80%. Temporary upper limb ataxia occurred in 60% of patients. The mean follow up period was 14 months.

CONCLUSIONS: Stereotomographic caudalis trigeminal nucleotomy is a safe and effective method for treatment of certain facial pains.

OBJECTIVES: description of a surgical technique, treatment of refractory facial pain, casuistic report

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Contralateral GPi-DBS in Patients with Prior Unilateral Pallidotomy

AUTHORS: Ira M Garonzik, MD; Nirit Weiss, MD; Shinji Ohara, MD,PhD; Sherwin E Hua, MD,PhD; Lance H Rowland, BS; Stephen Grill, MD,PhD; Frederick A Lenz, MD,PhD

INTRODUCTION: Patients with Parkinson's disease who have undergone prior unilateral pallidotomy may develop symptom progression. This may be due to progression related to symptoms which are axial or contralateral to the side of the initial surgery. It is unclear which surgical procedure best ameliorates these symptoms and may target contralateral pallidum or contralateral or bilateral subthalamic nuclei. Contralateral GPi-DBS is sometimes advocated because it does not lead to decreases in the dose of L-Dopa which may be indicated after STN-DBS and which will increase parkinsonian symptoms contralateral to the pallidotomy. We describe the outcomes of 12 patients with prior unilateral pallidotomy, who subsequently underwent contralateral pallidal stimulation (GPi-DBS).

METHODS: Twelve patients with implantation of contralateral GPi-DBS after pallidotomy were evaluated by UPDRS scores. A Mann-Whitney U test was applied to pre and post operative UPDRS scores.

RESULTS: Twelve patients out of 114 who had a prior unilateral pallidotomy underwent contralateral GPi-DBS; 8 were male and 4 were female with a median age of 59.7 years (range 47-74). The median time to the second surgery was 43.6 months (range 19-69). UPDRS total and motor scores were measured pre and post GPi-DBS with mean follow-up of 14.8 months (range 3-25). As judged by total UPDRS 8 improved, 2 worsened, and 2 remained the same. By motor UPDRS 7 improved, 3 worsened, and 2 remained the same. The total UPDRS pre GPi-DBS (mean 47.9, range 32-63) was not significantly different from the post GPi-DBS group (mean 39.7, range 19-68, $p=0.10$, Mann-Whitney U-test). The motor UPDRS for the pre GPi-DBS group (mean 18.2, range 5-30) was not significantly different from the post GPi-DBS group (mean 16.2, range 7-35, $p=0.53$).

CONCLUSIONS: Although there is a trend toward improvement in our series of 12 patients with prior unilateral pallidotomy, who subsequently underwent GPi-DBS, the improvement in UPDRS scores was not significant.

OBJECTIVES: 1. Describe microelectrode recordings during GPi procedures. 2. Discuss technique for radio-frequency lesioning and DBS placement in GPi. 2. Discuss the surgical options for patients with prior pallidotomy and disease progression.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Gene Therapy

TITLE: PTEN Anti-Oncogene Induces Reversion of Undifferentiated Pheochromocytoma Cells Away from a Neuronal Phenotype

AUTHORS: Michael G Kaplitt, MD,PhD; Jill Roberts, BS; Donald Pfaff, PhD; Sergei Moussatov, PhD

INTRODUCTION: The PTEN anti-oncogene, which is among the most frequently mutated genes in malignant gliomas, influences several pathways important for normal neuronal function. Some of the effects of PTEN on these pathways could increase sensitivity to neurodegeneration. This study was undertaken to examine the influence of PTEN on neuronal physiology.

METHODS: Stable cell lines overexpressing PTEN and matched controls were made from rat PC12 (pheochromocytoma) cells, which normally differentiate into neurons in response to nerve growth factor (NGF). Microarray was used to screen for changes in gene expression between cell lines. Levels of mRNA for individual genes were measured by quantitative PCR (qPCR), while protein levels were measured by Western blot.

RESULTS: Cells overexpressing PTEN unexpectedly were found to be completely resistant to all effects of NGF, including differentiation. This was due to inhibition of expression of both the trkA and p75 NGF receptors at the mRNA and protein levels. Microarray screening of over 8000 rat genes indicated that most genes were unaffected by PTEN, but many neuronal genes appeared to be inhibited. qPCR and/or Western blot confirmed that tyrosine hydroxylase and GTPCH1, both essential for dopamine biosynthesis, were also substantially inhibited, as were genes for subtypes of several neurotransmitter receptor. Most interestingly, the neuronal gene SNAP-25 (synaptosome associated protein) was inhibited, while its non-neuronal homolog SNAP-23 was induced. Several other genes were confirmed to be either unaffected or induced as controls. Drugs which mimic the effect of PTEN on certain pathways did not fully reproduce these results, suggesting that PTEN may function via previously unidentified pathways.

CONCLUSIONS: The PTEN anti-oncogene influences expression of numerous proteins associated with the neuronal phenotype, including genes for growth factor receptors and dopamine biosynthetic enzymes. This provides a novel link between a gene which prevents malignancy and neuronal physiology, and may have important implications for precursor cell differentiation into neurons.

OBJECTIVES: Understand the known biology of the PTEN anti-oncogene Understand the effects of PTEN on gene expression in neuronal precursor cells Increase familiarity with molecular methods used to analyze differences in gene expression, including microarray and quantitative PCR

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Analysis of Potential Factors Affecting MRI-related Heating of Deep Brain Stimulation System

AUTHORS: Jules M Nazzaro, MD; Slawomir Daniluk, MD

INTRODUCTION: Available data addressing potential variables that may play an important role in the heating of magnetic resonance imaging (MRI)-exposed deep brain stimulation (DBS) system is very limited. As DBS leads are now commonly placed within the basal ganglia in the treatment of movement disorders, elucidation of such variables is paramount.

METHODS: The possible variables that have been proposed in the literature to affect MRI-related heating of DBS implants have been reviewed and critically analyzed.

RESULTS: We propose that the most probable factors affecting MRI-related heating of DBS components include: a.) the radiofrequency (RF) field strength expressed as the specific absorption rate (SAR) averaged over the volume contained within the RF coil (partial body SAR); b.) the distance of the bulk of the DBS lead/extension (especially of the coiling) from the isocenter of the RF coil; c.) the fraction of the DBS system (particularly the brain lead and extension wire) contained within the RF coil; d.) the total time and number of scan sequences of MRI session; and e.) the status of the connection between the DBS lead/extension and the neurostimulator (connected or disconnected) including any breakages or poor contacts along the DBS system. Our analysis also suggests that less probable factors affecting MRI-related heating of DBS system include: a.) the number, diameter, and location of loops along the span of the DBS lead/extension; b.) the orientations of the wire loops in relation to the RF coil axis; and c.) the direction of the wire-loop coiling (clockwise versus counter-clockwise).

CONCLUSIONS: Further research is required to determine and define the factors that may play an important role in MRI-related heating of DBS system components.

OBJECTIVES: Identify potentially important factors which may contribute to DBS implant heating in the setting of MRI scanning.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Accuracy of Targeting the Subthalamic Nucleus for Deep Brain Stimulator Placement using MRI and the Leksell Stereotactic System: Report of 6 Cases

AUTHORS: Scott L Simon, MD; Jurg L Jaggi, PhD; Atsushi Umemura, MD; Gordon H Baltuch, MD, PhD

INTRODUCTION: Deep Brain Stimulator (DBS) targeting within the subthalamic nucleus (STN) can be achieved using the Leksell G frame and magnetic resonance imaging (MRI). Magnetic resonance imaging is preferred because of its excellent anatomic resolution even though it may provide inaccurate spatial information due to object-related magnetic susceptibility, chemical shift artifacts, and imperfection in the scanner magnetic fields. However, there are no in vivo reports that have confirmed the exact accuracy between MRI targeting and Leksell stereotactic space.

METHODS: Six patients who previously underwent stereotactic placement of a DBS into STN using the Leksell G frame based on MRI imaging, underwent placement of a second DBS electrode into the contralateral STN as part of a staged procedure. The coordinates for the original DBS tip position for each patient were entered into the Leksell stereotactic system. Targeting was performed using the Stealth Station. And magnetic resonance imaging accuracy was confirmed using fluoroscopy.

RESULTS: In each case, fluoroscopy demonstrated that the DBS electrode tips were at the center of the arc-based Leksell G frame.

CONCLUSIONS: This report suggests that MRI localization for DBS provides an accurate translation in stereotactic space. It also supports evidence that MRI does not appear to have any deleterious effects to patients with stimulators in place.

OBJECTIVES: Understand the potential problems with stereotactic localization using MRI information. Understand the accuracy of the Leksell G frame when using MRI data. Understand that MRI does not have any deleterious effects to patients with stimulators in place.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: A Non-contacting 3-D Digitizer For Use in Image-Guided Neurosurgery

AUTHORS: Hai Sun, MSc; Hany Farid, PhD; David W. Roberts, MD; Kyle Rick, BA; Alex Hartov, PhD; Keith Paulsen, PhD

INTRODUCTION: We have designed and implemented a non-contacting 3-D digitizer that attaches to the binocular optics of an operating microscope. This system can be used to register the surgical scene to the preoperative image volume through cortical feature analysis and then efficiently and automatically track the 3-D surface topology within the operating field in order to account for motion-induced changes that occur during surgery.

METHODS: We have attached two CCD cameras to the binocular optics of an operating microscope. Prior to surgery, this stereo imaging system is calibrated to obtain the extrinsic and intrinsic camera parameters. During surgery the 3-D coordinates of salient image features are automatically determined from a stereo pair of images and registered to the preoperative image volume to provide navigational guidance. This estimation requires the robust matching of features between the images, which, when combined with the camera calibration, yields the desired 3-D coordinates. A parameterized 3-D surface can then be fit to the estimated 3-D coordinates and, when registered to the preoperative image volume, provides navigational information in the face of tissue motion during surgery.

RESULTS: We are able to estimate the 3-D structure of a surgical scene with an average accuracy of 1.3mm. Executing on a 1.1 GHz Pentium machine, the 3-D estimation from a stereo pair of 1024x768 images requires approximately 8 minutes of computation.

CONCLUSIONS: We have demonstrated that an operating microscope is capable of, without inducing brain deformation, digitizing 3-D surfaces with efficient acquisition and image analysis of stereo pairs, which can also be coregistered to the preoperative image volume through related feature analysis.

OBJECTIVES: 1) discuss the concept of using the operating microscope as a 3-D digitizer, 2) compare a stereoptic digizer with currently used digitizing technologies, and 3) evaluate the potential advantages that may accrue from an automated, non-contact image-guidance system.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Subthalamic Nucleus Deep Brain Stimulation in Advanced Parkinson's Disease (PD): Analysis of Anatomical Location versus Intended Target and Clinical Outcome

AUTHORS: Robert R Goodman, MD,PhD; Shearwood McClelland III, BA; Blair Ford, MD,FRCP; Patrick B Senatus, MD,PhD; Linda M Winfield, RN; Seth L Pullman, MD,FRCP; Qiping Yu, PhD; Guy M McKhann II, MD

INTRODUCTION: Little is known regarding the correlation between deep brain stimulation (DBS) electrode location and clinical outcome in Parkinson's disease. To address this issue, we analyzed the relationship between subthalamic nucleus (STN) electrode tip placement and tremor control.

METHODS: 26 consecutive patients underwent bilateral STN implantation, aided by stereotactic MRI, microelectrode recording (MER), and intraoperative macro-stimulation. Electrode tip stereotactic coordinates were independently obtained by three observers by fusing post-operative and immediate pre-operative MRIs. Coordinates were compared to the intended target coordinates (i.e. the center of the STN nucleus, based on the planning MRI and MER results). DBS settings were optimized for each patient. Patients underwent videotaped neurological examinations at baseline and one year post-operatively. The videotapes were rated by an observer blinded as to stimulator status. In this analysis, we evaluate the relationship between stimulator tip placement and the effect of STN DBS on tremor. Statistical analysis was performed using Chi square.

RESULTS: The mean distance of the electrode tip for 26 patients (52 electrodes) from the idealized target was <2 mm in any single dimension (X, Y, Z). There was excellent interobserver agreement for estimated electrode tip location. 16 of 52 electrodes were intended to suppress disabling hand tremor. According to blinded clinical ratings, 12 of 16 (75%) electrodes were effective, and 4 were not. There was not a significant correlation between electrode placement and blinded measurements of contralateral tremor. However, in the X dimension, the mean tip position was 10.2 mm lateral to midline. 10 of 12 'effective' electrodes were within 1 mm, while all 4 'ineffective' electrodes were more than 1 mm from the overall mean ($p=0.008$). One 'ineffective' electrode, the most laterally placed in the series, was reimplanted, with excellent tremor control.

CONCLUSIONS: DBS electrode location within the STN can be reliably determined by MRI, and correlated with clinical outcome. In this analysis, variability of electrode tip placement in the sagittal plane (x-axis) was the most important factor for tremor suppression. In further studies, we are addressing the relationships between electrode location and other measures of clinical outcome.

OBJECTIVES: Understand the objective of subthalamic stimulation for Parkinson's Disease
Understand the significance of accuracy in the placement of DBS electrodes
Describe techniques used for DBS implantation in PD

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Epilepsy Surgery for Cortical Dysplasia (CD) : Outcome and Efficacy of Moderate to Severe CD

AUTHORS: Werner K Doyle, MD

INTRODUCTION: A retrospective review of all Epilepsy Surgery performed by the author selecting all pathological diagnosis of Cortical Dysplasia (CD) for which complete data was available was undertaken. The objective was to derive characteristics describing this epilepsy surgery population, and determine outcome of surgery.

METHODS: The digital database review yielded 211 unique cases meeting criteria. 139 of these (66%) were used, the remainder had insufficient follow up data. Of those remaining 30 patients (22%) had a pathological characterization of moderate or severe CD. Outcome data was collected from independent chart review by a knowledgeable worker blinded to pre-op details. All patients underwent extensive preoperative multidisciplinary evaluation. 2-stage procedures were used in all cases, using subdural grids, strips and sometimes augmented with depth electrodes. Three stage surgery was performed in 5 cases.

RESULTS: The study population's average age is 32.1 years (s.d. = 11.3, range = 64 to 0.25 years) and the average age at the time of the first seizure was 13.7 years (s.d. = 9.9 y). The sample was further divided, extracting the pathology of either moderate or severe CD. The remainder of the sample was diagnosis with mild CD. The average age of this group was 29.6 years (s.d. = 10.8 y, max = 51, min = 0.15). Only six patients from this group had a febrile seizure history. Using the Engel outcome score to quantitate pre and post op seizure state yielded the following respective % values of the total: Preop score of 4/3/2/1 = 93/3/3/0% and postop score 4/3/2/1 = 0/13/10/76%. Follow up was greater than 1 year in all patients. Six of the 30 had a history of febrile seizures. The surgical targets were 21 temporal, 3 frontal, 2 parietal, 1 occipital, 1 Rolandic, 1 temporal frontal, and 1 temporal occipital resection.

CONCLUSIONS: Invasive intracranial electrode monitoring for seizure localization and brain functional mapping followed by resection yields good to excellent efficacy for controlling the refractory epilepsy. Specific evaluation details and operative techniques will be discussed along with other perspectives describing cortical dysplasia in the context of contemporary Epilepsy Surgery.

OBJECTIVES: understand epilepsy surgery indications and approaches to refractory seizures from cortical dysplasia, relate the use of multi-stage surgery to this problem, know the relative efficacy of surgery in this setting.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Brain Machine Interfaces: Functional and MRI-guided Placement of High-Density Microelectrode Arrays in the Study of Movement in Non-Human Primates

AUTHORS: Parag G Patil, MD,PhD; Dennis A Turner, MD,MA; Miguel A.L. Nicolelis, MD

INTRODUCTION: The simultaneous examination of electrical activity in large numbers of neurons in well-localized regions of primate brain is a critical step not only in the study of the neural circuits underlying movement but also in the development of functional neuro-prosthetic devices. Traditionally, study of motor cortex in primates has involved the sequential observation of neuronal activity in single electrodes placed according to standardized stereotactic atlases. We have developed methods allowing simultaneous observation of up to hundreds of neurons utilizing high-density, multi-electrode arrays placed into the motor cortex of adult rhesus monkeys according to MRI localization and direct cortical stimulation.

METHODS: Adult rhesus monkeys (*macaca mulatta*) were anesthetized with medetomidine and ketamine and placed into a modified CRW stereotactic frame. Fine-cut contiguous MRI images were then obtained. Standard stereotactic techniques were used to localize and mark the skull overlying the central sulci and regions of interest. In a separate operative session, subjects were intubated and placed under isoflurane anesthesia. Craniotomy was performed in marked regions and the underlying cortex was stimulated, allowing direct observation of motor responses. With the localization as a guide, multi-electrode arrays were then placed.

RESULTS: Primate subjects tolerated both sessions well. MRI of individual subjects revealed considerable variation from standardized atlases. The accuracy of MRI-guided stereotactic localization was similar (2-3 mm) to that expected with human subjects. Robust motor activity was observed following direct cortical stimulation using biphasic current pulses of 0.5-1.0 mA. Surgically placed multi-electrode arrays allowed simultaneous observation of large numbers of neurons in awake, behaving primates.

CONCLUSIONS: The combination of stereotactic localization and direct cortical stimulation allows for accurate and efficient placement of multielectrode arrays for the study of the neural circuitry underlying movement and the development of brain-machine interfaces.

OBJECTIVES: State the advantages of multielectrode recordings in the study of movement, State the advantages of MRI-guided localization versus the use of standardized atlases, Be more familiar with techniques utilized to study motor cortex

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: STN Lesioning-induced Dyskinesia in Patients with Parkinson's Disease: What is Behind It?

AUTHORS: Osvaldo Vilela Filho, MD; DÈelson J. Silva, MD; Joaquim T. Sousa, MD,PhD; Fernando A.P. Ferraz, MD,PhD; JosÈ Edison S. Cavalcante, MD,PhD

INTRODUCTION: Operation-induced dyskinesia (OID) is the most feared complication of STN lesioning for the treatment of Parkinsonís disease. In the present paper, the authors try to establish the factors involved in its genesis, which happened in 8 of our 40 patients.

METHODS: The patients with and without OID were compared considering the following parameters: hemispheric dominance; extension of the lesion to the zona incerta (ZI); presence of stimulation-induced dyskinesia (SID); and territories of STN damaged by the radiofrequency lesion.

RESULTS: Seven patients were male and the dominant hemisphere was involved in 6 cases. Initial series (23 patients): the lesion was restricted to STN in 9 patients (none of them developed OID) and extended to the ZI in 10, including one patient with OID; in the other patient with OID, the lesion could not be detected. Only 1 patient presented SID, but none of the two with OID. Complete STN damage was seen in 3 patients, including one with OID; the lesion was not possible to detect in the other patient with OID and was partial in the rest of the group. Last series (17 patients): 6 patients developed OID: the lesion extended to STN in 4 of them. Five of 6 patients with OID presented SID, while only 1 of 11 patients without OID presented a very mild SID. The following were the STN regions destructed by lesion in its 3 diameters: a- vertical: upper, 5 patients; lower, none; both (complete), in 1; b- lateromedial: lateral, 2 patients; medial, none; both, complete in 3 and incomplete in 1; c- anteroposterior: anterior, 1 patient; posterior, in 1; both, complete in 1 and incomplete in 3.

CONCLUSIONS: Damage of the entire STN, mainly of its upper and, secondarily, lateral region, the presence of SID and operation on the dominant hemisphere seem to be significant factors in the genesis of OID. Involvement or not of the ZI by the lesion, though, is apparently irrelevant in this regard.

OBJECTIVES: 1- Determine the relationship between STN and lesion; 2- Know the possible risk factors for STN lesioning-induced dyskinesia; 3- Try to avoid dyskinesias during STN lesioning for Parkinson's disease and how to treat them.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Epilepsy

TITLE: Automatic Recognition of Cortical Sulci Using a Congregation of Neural Networks For Epilepsy Surgery

AUTHORS: Jean Regis, MD; Denis Riviere, PhD; Taku Ochiai, MD; Didier Scavarda, MD; Stephane Grimaud, BA; Dmitri Papadopoulos, BA; Jean-François Mangin, MD

INTRODUCTION: Cerebral cortex high level of variability in its superficial aspect is wellknown in human. The study of the functional value of pieces of cortex requires precise recognition of the gyri and sulci of the cerebral cortex in spite of this interindividual and intraindividual variability.

METHODS: In order to elaborate a model of the human cerebral cortex variability, we state that, integration of the phylogenic and ontogenic aspect of gyrogenesis dynamic was required. This study led us to search for a theoretical generical model of cerebral cortex relying on spatial organization of "sulcal roots" and annectant gyrus (plis de passage) cortical subunits. These subunits are organized according to a basic schem we call the meridian-parallel model. We have elaborate such a model and evaluated its generical value in a population of 10 normal voluntary. Each voluntary was explored with 3D T1 MR sequences rebuilt on workstation. Analysis of each cerebral cortex area and of 3D visualization of sulci extracted with an original software.

RESULTS: A wide variety of sulcal pattern in surfacic aspect have been encountered. All these patterns were perfectly described by our model. Each sulcal complex was composed of the same number of sulcal unit (sulcal roots). Analyzed through this model these brain were demonstrated to be identical in number of sulcal and gyral units. The variability of aspect in surface was perfectly explained in this population by interindividual difference in operculization of gyri (difference in size of cortical neighboring areas) and difference in depthness of annectant gyrus. This systematic approach of the gyration gave us a global understanding of the functional and anatomical organisation of the brain (the "Meridian-Parallel" model).

CONCLUSIONS: To deal with precise recognition of human cerebral cortex anatomy, allowing anatomical and functional homology between individuals, new strategy of cerebral cortex description are required. Our meridian parallel generic model relying on preliminary recognition of sulcal roots and annectant gyrus is a very original approach reducing dramatically the supposed structural variability of the cerebral cortex. This allows in a second step to investigate qualitative variability of cortex as reduced to the only changes in maps surfaces areas. This is a comprehensive description of cerebral cortex gyration excluding structural variability and reducing the cerebral cortex variability to variation in surfacic size of a defined and constant number of cortical maps.

OBJECTIVES: Understand the concept of neural networks; appreciate their applicability to brain mapping; understand the relevance of this technique for epilepsy surgery.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Technology

TITLE: Intracranial Navigation with the Instatrack System. A view into the indication to the use of Navigation and report of the early experience.

AUTHORS: Mostafa Khashab, MD,PhD; Mostafa Khashab, MD,PhD

INTRODUCTION: The indications to the use of Navigation had been expanded in the recent years tremendously. At its conception, it was viewed with a lot of scepticism whether it would fulfill the anticipated benefits or be a new sophisticated tool which is only possessed by just a few departments and not for the regular use of the busy clinical units. In the middle east, Navigation was not really propagated until the last year and there are only a very few systems in the whole region.

METHODS: We studied the early experiences of the pioneers and were convinced of the usefulness of Navigation technology to be available both for operative indications and also for medico-legal issues.

RESULTS: The preliminary report focuses on the indications of using this technology, the extra-time being used during the learning curve and the benefits of this technology. We report about our preliminary experience with the Instatrack system and its precision and accuracy as well as its user-friendliness.

CONCLUSIONS: It is clear to us that there is a learning curve for the use of Navigation and that the indication to the use of navigation can not be overemphasized.

OBJECTIVES: understand the 1) indications for surgical navigation 2) the use of the InstaTrak system 3) the limitations of surgical navigation.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Movement Disorders

TITLE: Intraoperative Fusion of Preoperative 3D Volumetric MR Images with Stereotactic Fluoroscopic Images for Electrode Localization during Deep Brain Stimulation Procedures

AUTHORS: Paul C Francel, MD,PhD; David Coffman, MD

INTRODUCTION: While deep brain stimulation (DBS) can provide relief of the symptoms of Parkinson's disease and essential tremor, further improvement can be had with advances in target localization. Using stereotactic technology and multiple special imaging sequences, we have improved the accuracy with which we create stereotactic lesions and position DBS electrodes.

METHODS: Using the stereotactic x-ray localizer indicator box from the Leksell system, 125 patients have undergone intraoperative fluoroscopic imaging. Preoperative stereotactic 3D volumetric matrix-acquisition MRI images are fused with the intraoperative fluoroscopic images, allowing localization of separate deep brain stimulator contacts as well as the alignment of the electrode itself.

RESULTS: By allowing selection of electrode entry point and trajectory, this imaging technique has reduced the risk of intracerebral hemorrhage and inadvertent entry into the ventricular system. This methodology also reduces total operating room time and improved the accuracy of placement of the DBS electrode.

CONCLUSIONS: Using these imaging techniques we can select entry point and trajectory for the DBS electrode, reducing risk and shortening total time spent in the operating room. The fluoroscopic and pre-operative MRI stereotactic images can be fused in the operating room, allowing real time confirmation of lead placement and appropriate targeting. We believe these techniques reduce patient risk and allow for a more effective electrode placement, resulting in an overall improved outcome.

OBJECTIVES: 1. Understand the utility of image fusion techniques in electrode placement 2. Understand the advantage of these techniques over conventional MRI methodologies 3. Appreciate the improvement in patient safety and potential overall improved outcome resulting from these techniques.

American Society for Stereotactic and Functional Neurosurgery

CATEGORY: Stereotaxy and Brain Tumors

TITLE: The effect of treatment of the brain malignant gliomas with iridium-192 brachytherapy

AUTHORS: Jacek Furtak, PhD; Jacek Furtak, MD; M Harat, MD; T Szyberg, MD; A Lebioda, ; R Makarewicz, ; P Sokal,

INTRODUCTION: The management of malignant brain gliomas remains not satisfactory. Despite a variety of therapeutic modalities, the prognosis remains poor. The primary advantage of brachytherapy is the ability of an implanted radioactive source to deliver a high focal radiation dose that relatively spares normal tissues surrounding the lesion. The most often used sources of radiation are iodine-125 and iridium-192. Interstitial brachytherapy can be used in the treatment of primary malignant brain gliomas. The management of malignant brain gliomas remains not satisfactory. The primary advantage of brachytherapy is to deliver a high focal radiation dose that relatively spares normal tissues surrounding the lesion.

METHODS: Among 176 patients with brain gliomas who were treated with iridium-192 brachytherapy, 135 (76.7 %) were analyzed. In the analyzed group were 22 patients with primary anaplastic astrocytomas, 42 patients with primary glioblastoma multiforme, 25 patients with recurrent anaplastic astrocytomas and 46 patients with recurrent glioblastoma multiforme. The patients with primary malignant gliomas delivered brachytherapy (15 Gy) before external beam radiotherapy (50 to 60 Gy). The patients with recurrent gliomas delivered brachytherapy (15 Gy) after conventional treatment: operation + external beam radiotherapy (50 to 60 Gy). In the statistical analysis Kaplan-Meier survival curves were generated and Multivariate Cox Regression Model was used to evaluate prognostic factors associated with survival outcomes.

RESULTS: The median follow up was 40 weeks, median age was 49.9 years (min. - 20, max. - 82), median tumor volume was 38.2 ml. The median survival time was 37 weeks for primary anaplastic astrocytomas (n=22) and 26 weeks for primary glioblastoma multiforme (n=42); 1-year survival rate was 50 % for primary anaplastic astrocytomas and 14.7 % for primary glioblastoma multiforme. There was no significant prognostic factor. In the group of recurrent gliomas the median survival time was 31 weeks for anaplastic astrocytomas (n=22) and 25 weeks for recurrent glioblastoma multiforme (n=46); 1-year survival rate was 32 % for recurrent anaplastic astrocytomas and 32 % for recurrent glioblastoma multiforme. The significant prognostic factor was age (p=0.01) and volume of the tumor (p=0.03).

CONCLUSIONS: Iridium-192 brachytherapy allows to prolong the survival time patients with primary and recurrent brain malignant gliomas.

OBJECTIVES: understand the role of brachytherapy for gliomas; learn the technique of seed implantation; know the radiobiology of iridium 192.