Category: Functional

Title: A Long-Term Study of the Treatment of Nelson's Syndrome with Gamma Knife Radiosurgery

Authors: James P Caruso; Mohana R Patibandla; Zhiyuan Xu; Mary Lee Vance; Jason P Sheehan

Introduction: Nelson's syndrome can be a devastating complication for patients with Cushing's disease who undergo bilateral adrenalectomy. Previous studies have demonstrated that stereotactic radiosurgery (SRS) can be used to treat patients with Nelson's syndrome. We report the largest prospectively-collected cohort to date of patients with Nelson's syndrome treated with Gamma Knife radiosurgery to evaluate the effect of SRS on endocrine remission and tumor control.

Methods: Twenty-seven patients with Nelson's syndrome treated with Gamma Knife radiosurgery after bilateral adrenalectomy were included in this study. After radiosurgery, patients were followed with serial ACTH levels and MRI sequences to assess for endocrine remission and tumor control. Cox proportional hazards regression analysis was used to evaluate the relationship between the time to remission and potential prognostic factors.

Results: In 21 patients with elevated ACTH prior to SRS and endocrine follow-up data, 14 (67%) had decreased or stable ACTH levels, and seven achieved a normal ACTH level at a median of 115 months post-SRS (range 7 - 272) months. Tumor volume was stable or reduced after SRS in 92.5% of patients (25/27) with radiologic follow-up. Time to remission was not significantly associated with the ACTH prior to SRS ($p = 0.252$) or with the margin dose ($p = 0.3$). However, a shorter duration between the patient's immediate prior TSR and SRS was significantly associated with a shorter time to remission ($p = 0.045$).

Conclusions: This analysis suggests that SRS is an effective means of achieving endocrine remission and tumor control in patients with Nelson's syndrome.

Objectives: - Identify Nelson syndrome as a potential complication of bilateral adrenalectomy. - Evaluate the effect of radiosurgery on endocrine remission and tumor control in Nelson syndrome patients - Identify treatment variables associated with shorter time to endocrine remission and tumor control

Early and Late Complications in Surgical Correction of Proximal Junctional Kyphosis

Summary: Data on surgical correction of proximal junctional kyphosis (PJK) is currently lacking. Our study is the first to examine the complication rate of such procedures. We found that there is a uniquely high immediate complication rate with the majority being early complications.

Hypothesis: The immediate and delayed complication rates of PJF are different from reported complication rates of surgically treated adult spinal deformity (ASD).
Design: This study was a retrospective cohort analysis.

Introduction: PJK rates after ASD surgery have been reported as high as 34% and represent a significant source of patient morbidity and poor quality of life. Previous studies have focused on the timing of onset, predicting occurrence, and techniques for correction. The rate of patient complication after repair of PJK has not been currently reported, and may be distinctly higher than repair of ASD.

Methods: After obtaining appropriate institutional review board approval, the electronic medical record was queried for patients who underwent spinal fusion surgery that included at least one thoracic segment between 4/2001 and 12/2017 at the University of Utah. Patients were included if they underwent spinal fusion for correction of PJK (defined as a Cobb angle between the upper instrumented vertebrae and two supra-adjacent vertebrae of ≥15o). Demographic, surgical and complication variables were analyzed.

Results: Of the initial screen of 765 patients, 49 patients (mean age 59.3±16.0 years, 30.6% male) underwent 50 cases of PJK correction. Indications for the surgical procedure preceding PJK repair included degenerative spondylosis or scoliosis (78%), trauma (12%), osteomyelitis (4%), and unknown (6%). A total of 42 patients (85.7%) had at least one medical comorbidity with 35 having multiple comorbidities (71.4%). The mean follow up was 3.0±2.7yrs. A total of 32 complications occurred in 30 patients (61.2%). Early complications, occurring within 30 days of surgery, included pulmonary (n=8, 25.0%), neurological (n=4, 12.5%), gastrointestinal (n=4, 12.5%), urinary tract infection (n=4, 12.5%), cardiovascular (n=2, 6.3%), renal (n=1, 3.1%). A 30-day mortality rate of 4.1% (n=2) was seen. Delayed complications, occurring 30 days after surgery included hardware failure (n=2, 6.3%), recurrent PJK (n=3, 9.4%), and wound infection (n=2, 6.3%).

Conclusion: Surgical correction of PJK is a highly morbid undertaking. These procedures should be treated as a unique surgical fusion entity.

Spine Surgery in Octogenarians: Quality improvement and review of 256 patients

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Introduction

With the aging of the population in developed countries, spine surgeons have recently been more likely to encounter elderly patients in need of treatment. This review investigated whether surgery for elderly patients aged 80 years or older would likely be reasonable. We retrospectively reviewed 256 patients for a variety of factors and compered this to a separate population of 79 years of age and younger which served as a control group.

Materials and methods

We retrospectively reviewed all spinal surgical patients at our institution, dividing into a control group of those less than 79 years of age, and those 80 years of age and older. We examined those populations in regard to the following: Readmission within 30 days, ICU admission, the presence of osteoporosis, development of pulmonary embolus, uti, pneumonia, surgical site infection, anemia, myocardial infection, post-operative neurologic deficit, decubitus ulcers, csf leak, and death within 30 days.

Results

We examined retrospectively examined 256 patients who were 80 years of age or older at our institution in regards to the following: Readmission within 30 days, ICU admission, the presence of osteoporosis, development of pulmonary embolus, uti, pneumonia, surgical site infection, anemia, myocardial infection, post-operative neurologic deficit, decubitus ulcers, csf leak, and death within 30 days.

Some form of complications as identified below:	137/256, or 53.5 %
Readmission within 30 days	23/256, or 8.9%
ICU admission	67/256 or 26.1%
development of pulmonary embolus,	0
Urinary tract infections	11/256 or 4.29%
pneumonia,	1/256. Or 0.39%
surgical site infection	1/256 0.39%
anemia	33/256 or 12.8%
myocardial infection	1/256, or 0.39%
post-operative neurologic deficit	5/256 or 1.9%
decubitus ulcers	1/256 or 0.39%
Cerebrospinal fluid leak	2/256 or 0.78%
death within 30 days	3/256 or 1.1%

Conclusions

Elderly patients aged 80 years or older with comorbidities are at higher risk for complications than those 79 year of age and younger. The magnitude of the operating planned, and particularly a long operative time, can cause serious complications that may be life threatening. Therefore, careful decisions are required with regard to the surgical indication and procedure in elderly patients. Our review demonstrates that operations on that population may be worthwhile, however, those risks when carefully measured by the benefit may not be as high as previously thought.

Key Words: Octogenarians, Spine surgery

Objectives:

*Examine the rate of complication and adverse effects in our octogenarian population
*Add to sparse literature regarding outcomes of octogenarians undergoing spine surgery
*Provide data to clinicians regarding outcome to help weigh risk and benefits of surgery in this population

Category: Pediatrics

Title: Update on Transsphenoidal Approaches for Resection of Pituitary Adenomas in Pediatric Patients

Authors: Christopher G Wilkerson; Michael Karsy; Vijay M Ravindra; William Couldwell

Introduction: The microscopic and endoscopic transsphenoidal approach for resecting pituitary micro and macroadenomas is a well-established technique for treatment of these disease
processes. Advances in surgical technology, specifically the use of the endoscope has led to a trend towards it's use without clear data supporting the need for it.
Methods: After receiving institutional board review approval with a waiver of consent, we undertook a retrospective review of patients who underwent a transsphenoidal approach for resection of pituitary adenoma. Cases from February 14, 2002, to May 2, 2017, were identified who underwent resection. All age patients were included. Cases were narrowed to patients with ages <19 years. Nonpituitary lesions or patients with inadequate information were excluded from analysis. Complications were reviewed, including all unanticipated intraoperative and postoperative events. Determination of gross-total resection, defined as the removal of all visible tumor on T1-weighted contrast-enhanced imaging, was performed by the senior author.

Results: A total of 629 patients were retrospectively identified who underwent transsphenoidal approaches for pituitary adenoma resections. These patients were narrowed to 20 patients age <19 years. The mean age was 15.9 years. The youngest was 7 years old. 40% were male. The most common presentation was endocrinopathy at 80% of patients. Headache was the next most common presenting symptom at 35% of cases. Only 2 patients (10%) had any visual symptoms. Prolactinoma was the most common tumor type at 40% of cases. Of these, 4 (50%) had failure of medical management which preceded surgery. One presumed prolactinoma which had formerly been treated with medical management had a final pathology of non-functional adenoma. The next most common pathology was atypical adenoma at 35%. Cushing‚Äôs disease (ACTH secreting tumors) was present in 15% of cases. Just over half (55%) of tumors were macroadenomas. There was one giant adenoma, and the rest (40%) were microadenomas.

Conclusions: Transsphenoidal microscopic resection of pediatric pituitary adenomas is a safe approach for management of this disease. Endoscopic assistance is not necessary for gross total resection or to prevent complication.

Objectives: Understand the considerations for microscopic transsphenoidal resection of pituitary adenomas in the pediatric population. Have demonstrated that this is a safe approach. Understand that though there is utility in use of the endoscope for this approach, that it is not necessary.

From Dandy to Uganda: the punctuated history of endoscopic third ventriculostomy

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Contemporary literature has proposed the successful use of endoscopic third ventriculostomy (ETV) be defined as "freedom from a shunt", but paradoxically, the first report of a successful ETV predated shunting by at least 28 years. In 1917 Walter Dandy deliberately injected air into the ventricular system thereby developing ventriculography sparking interest in hydrocephalus, the ventricular pathway and cistern spaces, and cerebrospinal fluid (CSF) flow. Shortly thereafter, he fathered modern neuroendoscopy with the description of a funnel-shaped tube combined with head mirror to perform an endoscopic choroid plexectomy. However, William Mixter's 1923 report of a third ventriculostomy using a urethroscope in a 9-year-old girl with obstructive hydrocephalus marks history's first ETV. Refinements in instrumentation, endoscopic and open surgical approaches, and patient selection highlighted the 1920s until the early 1950s when ETV abruptly fell out of favor after a pioneering 1951 report by Nulsen and Spitz detailing external ventricular shunting for CSF diversion. Subsequent decades ushered technological advancements in optics and physics including improved lens types, refined image transmission with fiberoptic and charge-coupled devices (CCDs), and high-resolution anatomical localization with stereotaxy and navigation capabilities, priming a resurgence in ETV. More recently, the internally and externally validated ETV Success Score (ETVSS) has served as an algorithm to predict the probability of ETV success at 6 months in children based simply on a child's age, hydrocephalus etiology, and shunt history. Further, a 2017 randomized trial showed equipoise between ETV with choroid plexus cauterization versus ventriculoperitoneal shunting in Ugandan children with post-infectious hydrocephalus, providing additional evidence of the importance of this once forgotten treatment. As our collective understanding of the complexities of hydrocephalus and CSF fluid dynamics grows, ETV is likely to remain an invaluable tool within the neurosurgeon armamentarium.

Keywords: Endoscopic third ventriculostomy (ETV); neuroendoscopy; Walter Dandy

Objectives:

1)Appreciate the impact of Walter Dandy's early work in understanding the pathophysiology of communicating vs noncommunicating hydrocephalus and operative therapies for each.

2)Learn the progression of landmark neuroendoscopic procedures for hydrocephalus from the 1920s-1950s.

3)Understand the resurgence of ETV with and without choroid plexus coagulation (CPC) from the 1990s to today, including the ETVSS and 2017 NEJM study comparing ETV-CPC to shunting in Ugandan children with post-meningitis hydrocephalus.

Category: Tumor

Title: Lack of Progress in Treatment of Glioblastoma: Perspective from a Forty Year Oncology Career

Authors: Edward B Arenson, MD

Introduction: Despite advances in basic knowledge and treatment of cancer in general, prognosis for glioblastoma (GBM) remains poor. Although there is no simple explanation for this unfortunate fact, there are instructive clues to be gleaned from the remarkable progress in treatment of childhood cancer that began in the late 1960s.

Methods: A few seminal events occurred in the mid twentieth century that led to the curability of most childhood cancers. First, prototypical cooperative study groups were formed throughout North America. Second, these groups took the novel step of using combination chemotherapy instead of sequential single agent chemotherapy in a quest to cure cancer; palliation was never the goal. This new model required courage, creativity, and exceptional leadership from a small number of passionate individuals. These pioneers were not encumbered by corporate employers, academic institutions, nor "advisory boards" such as the NCCN. Even IRBs were new and less aggressive.

Results: Within a short span of time, nearly all pediatric and many adult cancers become curable. Even today, the model of curability of cancer through use of combination chemotherapy remains nearly inviolate despite the development of contemporary novel therapies. In this context, Between 2003 and 2010 I treated a group of 74 consecutively diagnosed patients with GBM with a three drug combination and submitted the results to SNO. The results demonstrated highly statistically significant improvement in overall survival compared to concurrent data from Stupp et al with temozolomide.alone. Nonetheless, this experience was chosen only for poster presentation which drew little attention and later rejected for publication.

Conclusions: Several factors, including the ceding of responsibility for care of GBM patients by medical oncologists to neurologists, abandonment of combination chemotherapy, nihilism, lack of courageous and innovative leadership, and the poor response of GBM to new therapeutic modalities, have led to a failure to improve the outlook for GBM patients. In my opinion, the professionals best equipped to change this tragically flat trajectory are neurosurgeons who are faced daily with the misfortune of completing elegant high grade surgical resections only to refer their patients to other professionals with very little to offer.

Objectives: 1. understand the importance of combination chemotherapy in the curability of most pediatric and many adult cancers 2. identify those pioneering physicians and the qualities necessary to make progress 3. understand some of the reasons for poor progress in treatment of GBM

Title: Ventriculoperitoneal Shunt Outcomes of Normal Pressure Hydrocephalus Patients: A Single-institution Experience of 116 Patients

Authors: Tarek Y. El Ahmadieh; Eva M. Wu; Benjamin Kafka; Salah G. Aoun; James Caruso; Aaron Plitt; Vin Shen Ban; Daiwai Olson; Hunt H. Batjer; Jonathan A. White

Introduction: Permanent cerebrospinal fluid (CSF) diversion with a ventriculoperitoneal shunt (VPS) is a treatment option for patients with normal pressure hydrocephalus (NPH). Herein, we examine predictors of VPS outcomes and the complication rates.

Methods: A retrospective review of 116 patients (68 male, 48 female) with NPH who underwent VPS placement (March 2008 to September 2017). Patients were admitted for overnight observation after VPS surgery and were discharged on the next day after a computed tomography scan was obtained. Chi-square table analysis was used to examine associations of clinical improvement after shunting. A subjective 3-level outcome measure (worse vs. same vs. better) was scored by the attending surgeon for NPH symptoms at each follow-up timepoint. Complications associated with the VPS procedure were recorded.

Results: The mean age was 77 years. The mean hospital length of stay was 1.8 days. At the first follow-up visit, 72 (62%) reported significant improvement in their gait, 20 (17%) reported improvement in their incontinence symptoms, and 23 (20%) reported improvement in their cognition. Clinical outcomes over time are summarized in figures 1, 2 & 3. A shorter duration of gait disturbance predicted improvement in gait after shunting ($p<0.01$). Being on a cognition-enhancing medicine predicted improvement in cognition and/or incontinence after shunting ($p<0.05$). Complications included misplaced proximal catheters (n=6) of which 2 required repositioning; asymptomatic catheter tract hemorrhages (n=3); bilateral hygromas (n=7) improved with valve pressure adjustment; subdural hematomas (n=5) of which one required evacuation; and CSF leak (n=1).

Conclusions: The placement of VPS in patients with NPH is well-tolerated and associated with improved outcomes at least in the short-term follow-up (<6 months). In this sample, gait improvement was more significant as compared to incontinence and cognition. A shorter duration of gait disturbance was associated with greater improvement in gait after VPS.

Objectives: -The placement of VPS in patients with NPH is well-tolerated - There is improved outcomes at least in the short-term follow-up (<6 months) - A shorter duration of gait disturbance was associated with greater improvement in gait after VPS.

SPECIAL GUEST LECTURE – Hunt Batjer, MD

Athletic Head Trauma: The interface Between Sport, Science, Pseudoscience, Politics and Money.

1)Attendees will be able to list the typical clinical symptoms of concussion.

2)Attendees will have an understanding of the problem of Chronic Traumatic Encephalopathy, its incidence and the science pointing to causation.

3)Attendees will have an appreciation for some of the ethical dilemmas posed by collision sports in youth athletes, collegiate athletes and professionals.

Category: Tumor

Title: Radiographic and Clinical Response to Hyperbaric Oxygen Therapy in Brain Tumor Survivors with Ischemic Radiation Injury

Authors: Edward B Arenson, MD

Introduction: Hyperbaric Oxygen Therapy (HBOT) is indicated and effective for treatment of radiation injury to bone and soft tissue, but there is limited information about the benefit of HBOT in radiation injury to brain (Niezgoda JA et al, ADV SKIN WOUND CARE 2016 Jan:29(1):12-19). Ischemic vasculopathy occurs frequently in irradiated brain tumor survivors and degrades functionality and quality of life.

Methods: We treated 27 symptomatic irradiated brain tumor survivors with HBOT. Most patients had pre-HBOT neuro-cognitive testing and MRI perfusion mapping which demonstrated reduced blood volume in all patients which conformed well to the radiation field. Our goals were to confirm the safety of HBOT in this clinical setting and assess benefit clinically and radiographically. We began with a conservative regimen of 30-40 treatments at 2.0 ATM, but once safety was confirmed, increased to 60 treatments at 2.4 ATM without air breaks.

Results: With mean follow-up of 24 months, range 16-47 months, 3 patients died of progressive tumor (all had glioblastoma). There were no unusual or severe side effects. Only 1 patient without progressive disease (30 treatments) declined neurologically but has responded after more treatments. Seventeen patients (68%)improved; 16 demonstrated both clinical and radiographic improvement thus far while one patient had only improved imaging. Examples of clinical improvement include ability to drive a car, return from full disability to full time work, improved seizure control, discharge from hospice care, and reversal of progressive visual decline. Responses have occurred as early as 3 weeks and as late as 18 months. Early results suggest superiority of 60 treatments at 2.4 ATM. Patients treated more that 10 years post RT are less likely to respond ($p<.002$).

Conclusions: HBOT is safe and effective in symptomatic patients with radiation vascular injury to brain and is a covered benefit under ICD 10 code L59.8, (radiation soft tissue injury). This treatment should be considered in all irradiated brain tumor survivors who demonstrate radiographic and/or clinical evidence of ischemic radiation injury and is most effective when given early.

Objectives: 1, understand the cause and methods of identification of neurologic decline after brain radiation 2. understand the rationale for HBOT in these patient 3. understand that HBOT is an effective and safe covered benefit for appropriate patients.

Jon A. White, MD

Interventional Stroke Update 2018

1). Review current guidelines and updates in stroke care and intervention.

2). Discuss advances in stroke intervention.

3). Review non-interventional medical therapy advances.

SPECIAL GUEST LECTURE – John Hurlbert, MD, PhD

Methylprednisolone in Acute Spinal Cord Injury: where did we go wrong?

Describe the historical use of steroids in spinal cord injury.

Discuss the current guidelines regarding the use of steroids in SCI

Describe the research and effect of trials and evidence on the use of steroids.

SPECIAL GUEST LECTURE – Hunt Batjer, MD

Perspective on Brain AVMs 1977-2018

1 Attendees will gain an appreciation of the natural history and hemodynamic impact of brain arteriovenous malformations.

2 Attendees will gain an appreciation of the problems associated with the ARUBA trial

3 Attendees will gain an understanding of the contemporary management of patients with brain AVMs including diagnostics, interventional strategies and outcomes.

Category: Cerebrovascular

Title: The Southwestern Aneurysm Severity Index (SASI) ‚Äì Prediction of Outcomes of Ruptured Aneurysms Treated with Microsurgery

Authors: Vin Shen Ban; Tarek Y. El Ahmadieh; Salah G. Aoun; Aaron Plitt; Om J Neeley; Benjamin Kafka; Babu Welch; Duke S Samson; Hunt H. Batjer; Jonathan A. White

Introduction: The Southwestern Aneurysm Severity Index (SASI) was developed to aid with aneurysm treatment outcome prediction to assist both the patients and the treatment staff. The purpose of this study is to develop and validate a scoring system that would predict functional outcome at 1 year

Methods: Patients presenting with ruptured aneurysms that were treated microsurgically between 2000 and 2014 were included. Outcome was defined as Glasgow Outcome Score at one year (GOS12m). The SASI is composed of multiple prospectively recorded patient demographic, clinical, radiographic and aneurysm-specific variables. Univariate and multivariate analyses were used to construct the best predictive models for patient outcome in a random 50% of the cohort and validated in the remaining 50%. A scoring system was created utilizing the beta-coefficients from the logistic regression.

Results: We identified 527 patients with ruptured aneurysms who were treated microsurgically. The median age was 53 years (IQR: 18) and 72% were female. The GOS12m was 1-3 in 152 patients (28.8%) and 4-5 in 375 patients (71.2%). In the univariate analysis, Hunt-Hess (p<.001), Non-neurological ASA (NNASA, p<.001), normal CT (p<.014), SAH (p<.001), ICH (p<.001), IVH (p<.001), hydrocephalus (p<.001), aneurysm location (p=.021), calcification/thrombosis (p=.004), age>64 (p<.001), and aneurysmal size,â•20mm (p<.001) were significant predictors of GOS12m. In the multivariate stepwise logistic regression, the best predictive model (without Hunt-Hess and/or NNASA) for unfavorable outcome included ICH (OR 2.53, 95%CI 1.55-4.13), aneurysmal size,â•20mm (OR 6.07, 95%CI 1.92-19.2), IVH (OR 2.56, 95%CI 1.15-5.67), age>64 (OR 3.53, 95%CI 1.70-7.35), location (OR 1.82, 95%CI 1.10-3.03), and hydrocephalus (OR 2.39, 95%CI 1.07-5.35). The scoring system predicts GOS12m with good discrimination (AUROC, derivation: 0.816, 95%CI 0.759-0.873; validation: 0.803, 95%CI 0.746-0.861) and accurate calibration (R2 0.939).

Conclusions: SASI score for ruptured aneurysms has been internally validated to provide an accurate prediction of GOS12m at presentation, thus optimizing patient or family expectations and possibly guiding therapeutic efforts.

Objectives: -Identify the items of the SASI score for ruptured aneurysms -Know that SASI can predict outcome of aneurymal subarachnoid hemorrhage treated microsurgically at one year -Know that SASI can help guide discussions with patients and families about outcomes upon presentation

Category: Spine

Title: Intraoperative sodium fluorescein for tissue biopsy and resection of spinal cord lesions

Authors: Timothy H Ung; Leslie C Robinson; Edin Nevzati ; Yasuaki Harasaki; Jens-Peter Witt; D. Ryan Ormond; Michael A Finn

Introduction: Recent evidence suggests that fluorescein-guided microsurgery facilitates resection of intrinsic and metastatic lesions in the brain. Similar to the brain, the spine is composed of analogous permeability principles and use of sodium fluorescein for angiography has previously been reported without non-specific diffusion into the adjacent spinal parenchyma. However, there has been limited research elucidating potential application for the resection of spinal lesions. Methods: Four patients with spinal cord lesions received fluorescein sodium 10% (Alcon Laboratories INC, Fort Worth, TX, USA) at 3 mg/kg prior to surgical resection. Intraoperative visualization of fluorescence was performed using a Zeiss Pentero (Carl Zeiss AG, Oberkochen, Germany) microscope equipped with a Yellow560 filter or a Leica OH6 (Leice Microsystems, Wetzlar, Germany) equipped with a FL560 filter.

Results: Administration of sodium fluorescein resulted in lesional fluorescent contrast extravasation and facilitated surgical resection. The addition of sodium fluorescein allowed for identification and complete resection of spinal lesions in two patients and facilitated biopsy in the other two patients. Pathology was consistent with a WHO grade I myxopapillary ependymoma and a WHO grade II cervical ependymoma in two patients who underwent surgical resection. In patients undergoing biopsy, tissue samples were positive for an intrameduallary abscess and EBV driven lymphoproliferative disease.

Conclusions: Fluorescein may be a helpful microsurgical tool in guiding resection and localization of intramedullary spinal lesions. Further research is necessary to explore fluorescein sodium applications in the resection of spinal cord lesions.

Objectives: 1. Understand the current evidence for NaFl guided microsurgery 2. Understand the safety of NaFL neurosurgery 3. Recognize potential applications of NaFL to surgical resection and biopsy of spinal lesions)

SPECIAL GUEST LECTURE – Hunt Batjer, MD

Advances in Surgical Management of Large and Giant Paraclinoidal Aneurysms.

1). Attendees will have a detailed appreciation of the microvascular anatomy of the paraclinoidal region.
2). Attendees will understand the historical progression of concepts leading to the successful management of most patients afflicted with this problem
3). Attendees will have an appreciation of the case selection process for endovascular versus open micro-vascular procedures.

SPECIAL GUEST LECTURE – John Hurlbert MD, PhD

Cervical Disc Arthroplasty: Lessons From 3 Generations

1). Understand history and evolution of artificial disk devices.
2). Learn about the benefits and limitations of generations of motion preserving devices.
3). Understand the technical advances in generations of disk arthroplasty devices.

SPECIAL GUEST LECTURE – John Hurlbert, MD, PhD **

Six Years of Border Jumping: Does the Fence Really Work?

ROUTE 91 HARVEST

By

Albert H. Capanna, M.D., J.D., Dawn M. Capanna, R.N., B.S., M.S.,
and Gianna Capanna, B.S.

There is no way of prediction when and where a mass trauma situation may arise. This was totally unexpected when it occurred in Las Vegas, Nevada, October 1, 2017. A shooter took aim from a high position in the Mandalay Bay Hotel as onlookers at a country music festival were watching the concluding performance.

The end result: 59 people dead (including the shooter) and hundreds of people wounded. This occurred at approximately 10:45 pm on a Sunday night. There was instant mobilization of the level I trauma center at University Medical Center of Southern Nevada, and multiple other hospitals to handle to less critical patients. Many patients arrived in private vehicles and all emergency vehicles were usually filled to capacity to transport victims as quickly as possible to care.

The mass casualty treatment will be reviewed from the perspective of the trauma team's best techniques. The ethical choices that are necessary will also be reviewed. Some of these choices can have lasting psychological consequences on the doctors involved.

Category: Spine

Title: Effect of Surface Topography on the Bacteriostatic and Osseointegration Behavior of Silicon Nitride

Authors: Karen L. de Mesy Bentley; Masahiro Ishikawa; Chao Xie; Bryan J McEntire; B. Sonny Bal; Edward M. Schwarz

Introduction: Silicon nitride (Si3N4) is a spinal biomaterial with remarkable bacteriostatic and osseo-integrative capability. However, the contribution of surface topography to these properties has yet to be determined. Using a murine model for implant-associated osteomyelitis, this study tested the hypothesis that the native surface nano-topography of ‚Äúas-fired‚Äù Si3N4 is responsible for its unique antimicrobial and osseo-integrative behaviors.

Methods: ‚ÄúAs-fired‚Äù and machined L-shaped Si3N4 implants (0.5mm x 0.25~0.5mm x 3.0mm, were prepared using conventional ceramic fabrication techniques. ‚ÄúAs-fired‚Äù components were not subjected to post-densification processing; whereas machined samples were finished using 120-grit diamond grinding. Using scanning electron microscopy (SEM) and colony forming unit (CFU) assays, the bacteriostatic behavior of the Si3N4 samples was assessed against stainless steel controls in an in vitro test using a bioluminescent strain of Staphylococcus aureus (USA300LAC:lux). A cross-sectional in vivo study was subsequently conducted using ‚Äúas-fired‚Äù and machined Si3N4 samples implanted into the left tibia of 6-week old female Balb/c mice. The implants were either sterile or contaminated with 105 CFU of S. aureus. They were harvested after 1, 3, 5, 7, 10 and 14 days in vivo and assessed by SEM.

Results: In vitro, the Si3N4 implants displayed significant reductions in adherent bacteria versus stainless steel (i.e., 2.6 ¬± 0.5 x 105 vs. 4.5 ¬± 0.2 x105 CFU, respectively; $p < 0.05$). The bacteriostasis of the ‚Äúas-fired‚Äù implants resulted from macrophage clearance prior to biofilm formation on day 1, followed by osseo-integration via the recruitment of mesenchymal stem cells (MSC) on days 3-5 which differentiated into osteoblasts on days 7-10. In contrast, the antimicrobial behavior of the machined Si3N4 was due to repulsion of the bacteria ‚Äì a phenomenon that also limited osteogenesis.

Conclusions: These results suggest that the in vivo biological behavior of biomaterials can be driven by critical features of their surface nano-topography.

Objectives: 1.Spinal cage materials exhibit differing abilities to inhibit infection and promote osseous integration. 2. Silicon nitride is a spinal arthrodesis material that is resistant to biofilm formation while concurrently enhancing osteoconductivity. 3. The surface topography of silicon nitride has a profound implant on its ability to inhibit bacterial adhesion and promoting osseous integration.

Category: History

Title: Psychosurgery, Ethics, and Media: A History of Walter Freeman and the Lobotomy

Authors: James P Caruso; Jason P Sheehan

Introduction: At the peak of his career, Walter J. Freeman II was a celebrated physician and scientist. He served as the first chairman of the Department of Neurology at George Washington University and was a tireless advocate of surgical treatment for mental illness. His eccentric appearance, engaging personality during interviews, and theatrical demonstrations of his surgical techniques gained him substantial popularity with local and national media, and he performed more than 3000 prefrontal and transorbital lobotomies between 1930 and 1960 for a wide range of psychiatric conditions.

Methods: However, poor patient outcomes, unfavorable portrayals of the lobotomy in literature and film, and increased regulatory scrutiny contributed to the lobotomy's decline in popularity. The development of antipsychotic medications eventually relegated the lobotomy to rare circumstances, and Freeman's reputation deteriorated. Today, despite significant advancements in technique, oversight, and ethical scrutiny, neurosurgical treatment of mental illness still carries a degree of social stigma.

Results: Using excerpts from Freeman‚Äôs original manuscripts, personal correspondences, and his interviews with national media, we provide a historical account of Freeman‚Äôs life, career, and the lobotomy‚Äôs notoriety in the United States. Further, we examine select works of literature and film that shaped public perception of psychosurgery, and we offer an overview of the ethical principles and guidelines that underlie modern psychosurgery research.

Conclusions: Aided by an understanding of this pivotal period in medical history, and of Walter Freeman‚Äôs complex legacy, neurosurgeons are poised to confront the ethical and sociological questions facing psychosurgery as it continues to evolve.

Objectives: - Understand Walter Freeman‚Äôs influence on the field of psychosurgery - Understand the effect of negative media portrayals of lobotomy on public perception of psychosurgery - Identify the ethical principles and guidelines that inform research on neurosurgical treatments for mental illness

Category: Functional

Title: Using machine learning algorithms to estimate memory loss after temporal lobe surgery

Authors: Bradley Lega

Introduction: Predicting memory outcomes after temporal lobe surgery is a difficult problem at the level of the individual patient. Using data collected from intracranial recordings of subjects performing episodic memory task, we propose a new method for estimating memory outcomes based on the application of support vector machine learning algorithms.

Methods: 30 patients with intractable epilepsy underwent stereo EEG electric implantation and performed for the free recall episodic memory task as brain signals are recorded and analyzed. We develop patient specific machine learning models to predict memory encoding success using data obtained from across all brain areas sampled using intracranial electrodes. We then retrain the algorithms by selectively leaving out information from a single region and estimating the area under the receiver operating characteristic curve (AUC) obtainable with more limited data. This was done separately in the dominant and nondominant cerebral hemispheres.

Results: Leaving out the hippocampus from the machine learning model led to a 15% decrease in prediction accuracy, Although this varied across subjects considerably. Leaving out other regions led to a smaller amount of decrement and prediction accuracy as measured by the AUC for each subject specific model. Even though a verbal memory task was used, dominant and nondominant differences were not pronounced.

Conclusions: Machine learning algorithms can provide an estimate of memory decline after temporal lobe surgery using intracranial recordings. Prospective validation of the memory decline estimated buyer models is necessary.

Objectives: Be familiar with the issue of memory loss after temporal lobe epilepsy surgery understand how intracranial recordings provide patient specific memory data understand how machine learning models can be applied to this problem

Abstract Title: Early Experience with 3-D Stereo EEG electrodes for Seizure Focus Localization in Non-temporal, Non-lesional medically refractory Epilepsy.

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Several recently developed technologies are now available for use in patients with medically refractory epilepsy. Stereoelectroencephalography (SEEG) has made 3-dimensional seizure onset localization a less invasive and more precise option for the surgical work-up. Advances in software and computer power have allowed more precise co-registration of MEG data, which is important for patients with normal MRIs. All patients who were implanted with SEEG electrodes with the new software merged with MEG over the last 2 years are reported with early seizure outcome results. Learning points from implantation strategies and potential pitfalls and nuances of this recording strategy are discussed.

Learning Objectives:

1. Participants will be made aware of recent advances in technology which allow for minimally invasive approaches for epilepsy surgery to be applicable to more patients than in the past.
2. Participants will be informed by case presentations and outcome studies to understand the minimal-access surgical philosophy, demonstrating the potential to improve patient outcomes and decrease morbidity.
3. Participants will be introduced to the relatively new concept of SEEG based mapping and temporal-spatial epileptic zone origination modeling, correlated to MEG data, to more precisely localize an epileptic focus.

Key Words: Epilepsy, MEG, SEEG

Category: Spine

Title: Potential Advantages of Lumbar Endoscopy for Disc Herniations at L1/2. A Review of Initial Experience and Comparison With Traditional Techniques.

Authors: Bryan Wohlfeld, MD

Introduction: L1/2 disc herniations are rare and present unique surgical challenges compared to herniations in lower lumbar levels. Challenges included tight spinal canals that are less wide, more roots, proximity of the conus and orientation of the L1/2 joint allowing less removal to gain access without potentially destabilizing the spine and difficulty retracting the thecal sac to expose disk herniations. The foramen at L1/2 is wider than lower levels and the take-off of the L1 exiting root is at closer to a right angle allowing easier transforaminal access. Caution must be taken in pre-operative planning regarding the relative position of the lateral thecal sac and transiting L2 nerve root when considering transforaminal endoscopic spine surgery at this level but the bone and muscle sparing nature of the approach and ability to access even central disc herniations and extrusions make this a compelling technique for addressing these disc herniations.

Methods: Initial consecutive cases of L1/2 endoscopic microdiscectomies were reviewed. Type of sedation (general or MAC +local, location of disc hernia, improvement in VAS and incidence of reherniation and other complications.

Results: Transforaminal Endoscopic Spine Surgery offers direct access to wide ranging pathology including central, paracentral, caudal and rostral extrusions and far lateral disc herniations that can be accessed with variations in targeting including trans-pedicular approach. This can be done with removal of minimal bone, little to no retraction of the thecal sac and nerve roots and with patients conscious throughout the operation providing benefit to the patient and the operative surgeon and should be considered as an excellent option for this pathology.

Conclusions: Caution must be taken in pre-operative planning regarding the relative position of the lateral thecal sac and transiting L2 nerve root when considering transforaminal endoscopic spine surgery at this level but the bone and muscle sparing nature of the approach and ability to access even central disc herniations and extrusions make this a compelling technique for addressing these disc herniations. Initial experience with this technique is encouraging and suggests potential for shorter hospital stay and recovery and lower likelihood of developing instability.

Objectives: 1). Participants should become familiar with the option of transforaminal endoscopic spine surgery for disc herniations at L1/2. 2). Participants should understand the limitations and potential complications of traditional trans-laminar approaches to disc herniations at L1/2. 3). Participants should become familiar with unique anatomic considerations at L1/2 that provide potential advantages to transforaminal endoscopic disc surgery at this level.

Category: Spine

Title: Comparison of Allograft Spacers versus Silicon Nitride Cages in Cervical Fusion

Authors: Micah W. Smith; Daniel R Romano; Bryan J McEntire; B. Sonny Bal

Introduction: Allograft bone spacers are one option for anterior cervical discectomy and fusion (ACDF). While allograft bone is osteoconductive, it has limited supply and potential disease transmission concerns. In contrast, silicon nitride (Si3N4) is a ceramic material with structural integrity as well as osteopromotive and antimicrobial behavior. In this study, the clinical outcomes of ACDF with allograft spacers versus Si3N4 intervertebral cages were compared in terms of osseous integration, fusion percentage, time to fusion, and subsidence.

Methods: Fifty-eight ACDF patients (108 segments) implanted with Si3N4 cages were retrospectively compared to thirty-four similar ACDF patients (61 segments) implanted with fibular allograft spacers. Lateral radiographs (normal, flexion, and extension) were compared at 3, 6, 12, and 24 months to examine osseous integration, the presence of bridging bone, the absence of peri-implant radiolucencies, subsidence, and fusion using both interspinous distance (ISD) and Cobb angle methods.

Results: At a minimum of 12-months follow-up, fusion for the allograft spacers and Si3N4 cages was 87% and 97%, respectively (ISD method, p=0.10), and 68% and 84%, respectively (Cobb method p=0.07), while osseointegration was 76% and 94%, respectively (p=0.02). Si3N4 cages achieved earlier fusion, 4.1 vs. 8.6 months (ISD method, p=0.01), and 6.8 vs. 11.7 months (Cobb method, p=0.04). Time to full osseointegration was 7.8 and 19.2 months for Si3N4 and allograft, respectively (p=0.00). Mean subsidence was 0.5mm and 2.7mm for the Si3N4 and allograft cohorts, respectively (p=0.00). The time-series comparison of fusion indicated that the Si3N4 cages provided earlier and more effective arthrodesis outcomes than the allograft spacers.

Conclusions: While both allograft spacers and Si3N4 cages achieved cervical fusion at ,â• 12 months follow-up, earlier time periods favored the Si3N4 group. Si3N4 cages showed faster fusion by both the ISD and Cobb angle methods, greater osseous integration and less subsidence. These results suggest that Si3N4 cages are at least as effective as traditional allograft in ACDF.

Objectives: 1. Silicon nitride cages provide early and more effective cervical fusions than allograft spacers. 2. Silicon nitride cages show better osseous integration than allograft spacers. 3. Silicon nitride cages exhibit lower subsidence than allograft spacers.

Category: Epilepsy

Title: Integrating new innovations in the treatment of intractable epilepsy

Authors: Bradley Lega; Sarah Seger

Introduction: The advent of laser ablation to treat mesial temple sclerosis has been a significant advance in the treatment of epilepsy within the past five years. This development comes in the setting of other technological innovations namely NeuroPace responsive stimulation and the popularization of stereo EEG for invasive evaluation. Epilepsy surgeons have new tools to treat otherwise difficult cases, to better diagnose the seizure onset location, and to provide less invasive alternatives to standard resection techniques.

Methods: In this lecture, I propose to review three cases that highlight the role of these new innovations in the treatment of epilepsy and how surgeons can cobble together effective treatment strategies in challenging cases by employing them in a case-by-case basis. The first case discusses how to counsel patients with likely temporal lobe epilepsy with and without frank mesial temporal sclerosis. The second discusses peri-ventricular nodular heterotopia, and how this condition can be treated with a combination of laser therapy, responsive stimulation, and possible surgical intervention. The final case discusses the use of stereo EEG in previous failed surgical interventions and how information gained from this technique can lead to a custom tailored treatment plan to optimize seizure outcome in patients.

Results: LITT To treat temporal lobe epilepsy offers better verbal memory outcomes in the aggregate at the expense of lower seizure freedom rates, although this can be difficult to predict on a case-by-case basis and outcomes will be worse if surgeons employ LITT outside of its wheelhouse for MTS. Periventricular nodular heterotopia is a frequent cause of intractable epilepsy and the management can be challenging. Results can be optimized by combining these three new techniques. Stereo EEG has revolutionized surgical treatment for patients that have previously failed surgical intervention, unlocking therapies for a frustrating population for epilepsy surgeons.

Conclusions: The cases presented highlight nuances in the management of intractable epilepsy by neurosurgeons. The goals of the lecture will be to inform surgeons of these new innovations, moving beyond data that has been published focusing on the treatment of mesial temporal lobe epilepsy. It will help surgeons employ these new tools in an effective strategy for complex cases.

Objectives: Counsel patients regarding the use of LITT for temporal lobe epilepsy understand how NeuroPace can be used in combination with other treatments Understand the role of stereo EEG in failed cases.

Mark Mahan, MD

Learning Curve for Endoscopic Interlaminar Decompression.

1). Describe advantages of intralaminal decompression versus traditional open and minimally invasive techniques.
2). Discuss unique technical considerations of this procedure.
3). Participants should become familiar with expected learning curve for this procedure.

Category: Spine

Title: Revision Strategies in MIS SI Joint Fusion

Authors: Brad Duhon

Introduction: With the increased use of Minimally-Invasive (MIS) sacroiliac joint (SIJ) fusion, pseudoarthrosis must be recognized. Due to the morbidity of traditional open SIJ fusion, minimally-invasive revision strategies are necessary. This details revision strategies for minimally-invasive SIJ fusion.

Methods: Retrospective chart review and techniques discussed for MIS SIJ fusion pseudoarthrosis.

Results: Images and clinical findings discussed suggest success with a modified open version of SIJ fusion. The early findings would suggest efficacy of this approach for pseudoarthrosis.

Conclusions: Images and clinical findings discussed suggest success with a modified open version of SIJ fusion.

Objectives: 1. Recognizing SIJ fusion pseudoarthrosis. 2. Surgical approach for SIJ revision fusion. 3. Assessing radiographic "fusion" with MIS SIJ fusion.

Hypertonic saline versus Mannitol: A characterization of physical properties

Authors: Jonathan Scoville, MD[1]; Christopher Carr, BS[2]; Jim Ruble JD, PharmD[3]; Chad Kent Condie, PharmD[4]; Gregory Hawryluk, MD, PhD[1]

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Presenter: Jonathan Scoville, MD

Learning Objectives: 1. What is the history of hypertonic solutions in neurosurgical patients? 2. What are the current guidelines for hypertonic administration? 3. What are the physical properties of hypertonic saline, and how should they guide their use?

Introduction: Hyperosmolar solutions are the first line therapy for management of increased intracranial pressure. As research interests have focused on the superiority of one solution over the other, detailed characterization of their physical properties may lead to improved understanding of differential responses to the agents and how and in what circumstances they are best administered. We sought to examine hyperosmolar solutions by measuring the pH, salinity, osmolality and filtered particulate matter of 3%, 5%, 14.6%, 23.4% normal saline and comparing these values to 20% mannitol.

Methods: We sampled 3%, 5%, 14.6%, 23.4% normal saline solutions and 20% mannitol from various manufacturers and separate lots and measured pH, salinity, and osmolality for each. pH was determined using both pH paper and digital pH measurement. Salinity/specific gravity were determined using a portable refractometer. Osmolality was determined using both vapor pressure and freezing point osmometryWe constructed 95% confidence intervals based on our data and compared these with the specified manufacturer range of +/-10% of the target value. We then compared the results of the Hypertonic saline solutions to mannitol.

Results: We found that pH values were acidic in all samples, for hypertonic saline solutions: 3%, 5.52; 5%, 5.38; 14.6%, 5.74; 23.4%, 5.64. 20% Mannitol had a slightly less acidic pH than found in the hypertonic saline solutions of 6.09. Salinity was measured for all samples and all the hypertonic saline solutions corresponded with the manufacturers published range, except for 20% mannitol which was outside the published range in all lots tested. When comparing osmolarity 20% mannitol and 3% Normal saline had the lowest osmolarity as expected with averages of 958 Osm and 1373 Osm respectively, and 23.4% normal saline had an average Osm of 8022. Again only 20% Mannitol fell outside of the manufacturers published range, while all hypertonic saline solutions were within published range.

Conclusions: We found that hypertonic saline has a greater osmolarity than mannitol even at concentrations of 5%. Overall hypertonic saline solutions tended to be more uniform from lot to lot, and manufacturer to manufacturer and displayed more cohesion to their accepted parameters.