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## Richard Menger, MD, MPA (LSUHSC-S)

### Service as a Military Neurosurgeon; A Socioeconomic Perspective

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#### Abstract

#### Background

Military conflict and neurosurgery date back to antiquity. Neurosurgery's development is intimately linked with Harvey Cushing's military experience. Previous papers highlighted unique opportunities and socioeconomic challenges facing military neurosurgeons. Here, we provide objective data from military neurosurgeons surrounding these issues.

#### Methods

Internet survey responses were solicited from current, separated, and retired military neurosurgeons regarding workforce issues and their perception of military neurosurgery. This was done through the Council of State Neurosurgical Societies in conjunction with the Joint Committee of Military Neurosurgeons.

#### Results

A total of 80.9% (98/121) of respondents enjoyed their military experience, 63.6% (77/121) were very pleased with their service; 97.4% (114/117) enjoyed treating military patients, and 78.2% (93/119) would recommend military service. Positives included feelings of patriotism (87.4%), development of camaraderie (71.4%), and deployment experience (93.8%). However, 76.5% of respondents noted concerns regarding military and civilian pay disparity. 37.5% were overwhelmed with administrative responsibilities, and over 50% desired higher case volume. Multivariate analysis showed those who failed to develop a sense of camaraderie were more likely to be dissatisfied ( $P = .02$ ). Those still currently serving trended towards dissatisfaction ( $P = .08$ ), and current military neurosurgeons were only 0.29 times as likely to recommend military service to another neurosurgeon as compared to those who were retired or separated ( $P < .024$ ).

#### Conclusion

Service as a military neurosurgeon is an overwhelmingly positive experience but opportunities exist for mechanisms to increase operative case load, reduce administrative responsibilities, and reduce military-civilian income disparity. Addressing these issues is important as current military neurosurgeons were more likely to be dissatisfied with their military experience and less likely to recommend military service to another neurosurgeon.

## **Derrick Umansky, MD (Tulane)**

### **Spontaneous Regression of a Syrinx following parturition in Chiari Malformation Type I: Case Report and Review of Literature**

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#### **Abstract**

#### **Introduction**

Symptomatic Chiari Type I malformation (CM I) is a hindbrain abnormality that can obstruct CSF flow out of the fourth ventricle, sequelae of which may include spinal syrinx and pathognomonic neurological symptoms. Such presentation is considered an indication for decompressive posterior fossa surgery to resolve outflow obstruction. Outcomes are generally favorable, although little data exists on the natural history of CM I with syringomyelia when untreated. Although rare, spontaneous regression of syrinx in CM I has been previously reported with little insight regarding the possible mechanism(s) by which resolution occurs. We present a case of spontaneous syrinx regression shortly following parturition.

#### **Methods**

A 30-year old gravid female with no significant past medical history presented with five-months of progressive left upper-extremity and truncal paresthesias and reduced sensation to pain, temperature, and light touch. MRI demonstrated cerebellar tonsil herniation through the foramen magnum and a holo-cord syrinx without enhancement. Surgery was planned but postponed until the patient's pregnancy was carried to term. Post-partum MRI showed significant reduction of the syrinx at twenty-one-days following labor. She experienced marked symptom relief, and is currently followed-up with expectant management.

#### **Discussion**

CM I is the most common Chiari malformation variant, with associated syrinx and symptomology serving as indications for treatment. While the pathophysiology of spontaneous syrinx regression and tonsillar ascension is unknown, it has been reported in the literature under various circumstances. In our patient, the rapid regression following delivery suggests an association between Valsalva-like maneuvers during labor resulting in resolution of CSF obstruction and syrinx reduction.

#### **Conclusion**

CM I with syrinx undergoing spontaneous regression is rarely seen due to prompt surgical interventions. We have detailed a single case and possible mechanism by which conservative management may be indicated as an option for symptomatic CM I with syrinx and non-debilitating symptoms in pregnancy.

## Kevin Holly, PhD (LSUHSC-S)

### **Structural Connectivity and DTI Metrics in Diffuse Relapsing-Remitting Multiple Sclerosis**

Phillip T. Holly<sup>1</sup>; Kevin S. Holly<sup>1</sup>, PhD Tina Phan<sup>1</sup>; Christina Ledbetter<sup>1</sup>, PhD; Eduardo Gonzalez-Toledo<sup>3</sup>, MD, PhD; and Hai Sun<sup>1\*</sup>, MD, PhD

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#### **Abstract**

Multiple Sclerosis (MS) is a chronic autoimmune disease that targets the myelin sheaths on axons within the brain and spinal cord. Potentially, the disease can cause axonal deterioration leaving the patient with permanent neurological damage. There is no known cure for MS, but it can be treated to manage symptoms and increase recovery time. Relapsing-remitting MS (RRMS) is the most common form of the disease. RRMS is defined by irregular relapses followed by months to years of remission. With each relapse and remission, pathological problems may resolve on their own or continue to produce problems after remission. In this study, we compared 47 subjects diagnosed with diffuse RRMS with 39 normal control subjects that had no medical history of neurological or psychiatric disorders. Diffusion tensor imaging (DTI) was utilized to measure DTI metrics, such as fractional anisotropy (FA), mean diffusivity (MD), radial diffusion (RD), and axonal diffusion (AD), and to derive deterministic tractography fibers to map out structural connectivity within the brain. We found MS subjects had lower structural connectivity within the cerebellum. MS subjects had lower FA and had an increased RD to AD ratio throughout the brain. MD was observed to have homogenous results with an overall increase compared to the controls. With this imaging study, we are striving to understand the pathological effects of MS on the white matter tracts of the brain.

## Tyler Scullen, MD (Tulane)

### Endovascular Management of Multiple Dysplastic Aneurysms in a Young Male With an Unknown Underlying Etiology: A Case Report and Review of the Literature

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#### Abstract

#### Background

Intracranial aneurysms (IA) are the leading cause of non-traumatic subarachnoid hemorrhage and are most commonly associated with the anterior cerebral artery (ACA) and anterior communicating artery complex. We describe the presentation and management of a 27-year-old male with concurrent bilateral A1-2 junction aneurysms and fusiform intraorbital ophthalmic artery (OA) aneurysms.

#### Case Description

A 27-year-old male with no past medical history presented with three months of headaches. Imaging revealed a large dysplastic left A1-2 junction aneurysm and a smaller saccular right A1-2 junction aneurysm, with potentially adherent domes. Two fusiform aneurysms of the intraorbital segment of the left OA were also identified. The patient underwent coil-assisted Pipeline embolization of the left A1-A2 aneurysm, with complete obliteration and reconstitution of the normal parent vessel. The right A1-2 aneurysm was found to have grown significantly at the three 3 week follow up, and was coiled. Three-month follow-up demonstrated spontaneous resolution of the OA aneurysms, persistent obliteration of the left aneurysm and significant recurrence of the right aneurysm, which was treated with stent-assisted coil embolization. A second recurrence three months later was successfully treated with repeat coiling. At the time of this treatment, the patient was also found to have two de novo distal MCA and ACA dysplastic aneurysms which were not treated. Follow up angiography 6 weeks later demonstrated stable complete obliteration of the right A1-2 aneurysm and interval complete resolution of the dysplastic MCA aneurysm. The distal ACA aneurysm was observed to have minimally increased in size, however, the parent vessel showed signs of interval partial thrombosis with contrast stasis within the aneurysm. This final aneurysm is currently being followed with serial imaging. The patient remains neurologically intact with complete resolution of his headaches.

#### Conclusion

We present a young male with no past medical history who presented with multiple dysplastic aneurysms. Successful staged endovascular intervention resulted in obliteration of aneurysms with spontaneous obliteration of the intraorbital OA aneurysms observed at three months. We highlight the use of several endovascular techniques in the management of multiple complex ACA aneurysms in a patient with an undiagnosed vasculopathy.

## **Jonathan Riffle, DO (Tulane)**

### **Dual Endovascular/Microsurgical Management of Complex Intracerebral Aneurysms**

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#### **Abstract**

##### **Introduction**

Subarachnoid hemorrhage secondary to aneurysmal rupture remains a significant source of morbidity and mortality even with advances in microsurgical and endovascular treatment. Fatality is approximately 50% and of survivors, 40% recover to an independent functional status with 10-20% remaining severely disabled. The mainstays of treatment are microsurgical clipping and endovascular embolization with clipping the gold standard. Debate has continued among the neurosurgical community as to the superior modality. While clipping is associated with a lower rate of recurrence many patients are not amenable to clipping due to vascular anatomy, location, or comorbidities. Moreover, endovascular treatment technology has undergone expansion with the advent of novel stents and flow diverters. Dual trained neurosurgeons are in a unique position to utilize all the microsurgical tools and endovascular techniques to synergistically treat complex intracranial aneurysms.

##### **Methods**

A 55 year-old African American female with history of HTN, smoking, and familial history of ruptured aneurysms presented with SAH. A cerebral angiogram revealed multiple anterior and posterior circulation aneurysms. All aneurysms were secured with a combined treatment approach.

##### **Results**

A cerebral angiogram with 3D reconstruction was performed to identify the source of SAH and for surgical planning. The angiogram revealed a ruptured basilar apex aneurysm whose dome was secured with coiling and multiple anterior circulation aneurysms with Murphy excrescences. After the vasospasm period the patient returned for coiling and clipping of the remaining aneurysms. She returned 7 months following discharge for definitive treatment of the basilar apex aneurysm which was obliterated with Y-stent assisted coiling. Favorable results were evidenced by the resolution of headaches and the obliteration of the prior treated aneurysms.

##### **Conclusion**

Complex, multiple intracranial aneurysms remain a challenging adversary for vascular neurosurgeons especially in the setting of SAH. However, this case illustrates how a combined approach can be employed to successfully obliterate intracranial aneurysms.

## Joseph Lockwood, MD (Tulane)

### **Ruptured Basilar Perforators Aneurysm in the Setting of AVM Treated Successfully with Endovascular Coil Embolization: A Case Report and Literature Review**

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#### **Abstract**

#### **Background**

Arteriovenous malformation (AVM) associated aneurysms are common, being reported in 15% of cases. In ruptured posterior fossa AVMs, associated aneurysms are present in 48%, and are the etiology for the bleed in 37%, and require treatment to prevent stepwise neurological decline. Definitive treatment of the AVM may be further evaluated after the patient stabilizes. In this case we report 75-year-old female who presented with subarachnoid hemorrhage (SAH) secondary to a ruptured flow related basilar perforator artery aneurysm of an anterior pontine AVM treated with endovascular coil embolization.

#### **Case Description**

A 75-year-old female presented with SAH with a focus in the posterior fossa cisterns. Following bedside ventriculostomy, the patient was taken to angiography, demonstrating a 2 x 3 mm fusiform aneurysm arising from a basilar perforator that was feeding a right-sided anterior pontine AVM measuring approximately 1 x 2 cm. Venous drainage from the AVM was predominantly to the superior petrosal vein continuing into the superior petrosal sinus. Under roadmap guidance, super selective catheterization of the basilar perforator aneurysm was performed. A total of three HydroSoft 3D coils (2.5x6/2x4/1.5x2) were deployed within the aneurysm dome with complete obliteration of the aneurysm. The patient was discharged on post-bleed day 15 to an inpatient rehabilitation facility. She was seen in clinic at two months' post-hemorrhage and is neurologically intact.

#### **Conclusion**

Aneurysms of the basilar trunk perforators are rare lesions, with aneurysms associated with brainstem AVMs being exceedingly rare. To the best of our knowledge, this is the second reported case of this unique clinical scenario. We hope the information presented serves to guide future surgical decision-making and management.

**Christina Ledbetter, PhD (LSUHSC-S)**

## **Resting State Connectivity as a Marker of Cortical Function: Initial Observations in a Cerebral Cavernous Malformation Patient Population**

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### **Abstract**

Cerebral cavernous malformations (CCM) are discrete vascular lesions surrounded by a pseudocapsule of gliosis generally containing hemosiderin deposits. These lesions are often quiescent, but when symptoms do manifest seizures is common. First line treatment is medical management. When seizure activity becomes intractable, CCM lesionectomy is considered, and seizure free surgical outcome has been linked to lesionectomy margins.

Seizure activity is known to disrupt normal brain connectivity. And while resting-state connectivity disturbances have been identified in generalized and focal epilepsy, no studies to date have specifically focused on intractable CCM related epilepsy.

The objective of this work was through a retrospective chart review to investigate resting-state brain connectivity as measured by functional magnetic resonance imaging (fMRI), in a group of patients (n=6) with cavernous malformations presenting with intractable seizures. First, anatomical and resting-state fMRI scans were located. MRI data was processed using the CONN SPM toolbox. First level single subject region of interest (ROI)-to-ROI, ROI-to-voxel, and voxel-to-voxel resting-state connectivity analyses were performed. Voxel-to-voxel analysis was expanded to generate color overlays indicative of cortical symmetry and whole brain connectivity for cortical areas adjacent to the CCM.

Across subjects the three analyses (ROI-to-ROI, ROI-to-voxel, and voxel-to-voxel) revealed aberrant brain network connectivity. Global network disruption of the default mode network (DMN) was detected (n=6), and for the two subjects whose post surgical connectivity scans were available, DMN network connectivity was improved after lesionectomy. While not evident at the ROI-to-ROI level, ROI-to-voxel and voxel-to-voxel connectivity was altered in CCM adjacent cortical areas. There was a loss of cross-hemispheric cortical symmetry and an increase in whole brain connectivity. Single subject connectivity overlays provided improved visualization of discrete CCM adjacent cortical areas where connectivity was non-uniform. Future work will expand single subject voxel-to-voxel connectivity mapping to determine if the method is advantageous in identifying appropriate lesionectomy margins.



## **Frank Farokhi, MD (LSUHSC-S)**

### **Pilocytic Astrocytoma in the Adult Population – Analysis From a Single Institution**

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#### **Abstract**

Pilocytic astrocytoma (PA) is an entity often discussed in the pediatric population. While only comprising 2.3% of all brain tumors, PA represents up to 25% of pediatric intracranial tumors. The adjusted worldwide incidence of PA is 4.8 per million per year. Curiously, PA appears to have a bimodal distribution, with most tumors occurring in the pediatric population. However, a small yet significant number of cases occur in the older adult population. At present, there are only a few published papers regarding PA in the adult population. There are even fewer studies that discuss intervention and outcomes in adult PA. What is compelling is that each study seems to highlight the aggressive progression and rapid recurrence of adult PA as compared to pediatric variants. Anaplastic pilocytic astrocytomas (APA) are encountered far more frequently in the adult population, suggesting that different biological pathways are involved. APA was previously designated WHO Grade III, but now exists without formal classification. This study seeks to review adult patients with the diagnosis of PA at a single institution. Over the past 10 years at this center, there have been 5 patients over the age of 18 who have a pathologically confirmed diagnosis of PA. This study seeks to analyze these patients, the course of their disease, and their outcomes in an effort to contribute to the understanding of this unusual disease.

## **Carotid Web Stenting in an African American Female: Case Report and Review of Literature**

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### **Abstract**

### **Introduction**

Carotid webs are shelf-like protrusions that form as a result of a developmental abnormality. Studies suggest a prevalence of up to 37% of cryptogenic stroke patients. Diagnosis is based on stroke symptomatology in the absence of traditional risk factors, and identification on CTA axial cut. Currently, the vast majority of cases undergo surgical resection. Our case report describes the diagnosis and stenting of a carotid web with favorable outcomes in an African American female.

### **Methods**

A 33-year-old African American female presented to the ED complaining of left hemiparesis and left facial droop. The patient did not have a significant past medical history including those predisposing for stroke. Initial physical examination showed left facial asymmetry, left upper extremity pronator drift, and left lower extremity weakness with a calculated NIHSS of 3. CTA showed an occlusion of M2 of the right MCA, and a carotid web at the carotid bulb visualized on axial and coronal cuts. Aspiration thrombectomy resulted in TICI 3 score, and double antiplatelet therapy was prescribed. Stenting of the carotid web was performed three weeks later. The patient returned for a two-week follow-up with complete resolution of her neurological symptoms.

### **Discussion**

This is the third reported case of carotid web stenting. Carotid webs are frequently underdiagnosed in patients presenting with stroke symptoms in the absence of the most common stroke risk factors. Diagnosis is made secondary to CTA imaging, particularly the axial cut. Surgical resection has been widely described in literature as the preferred method of treatment for carotid webs, but little has been reported on stenting techniques for this pathology.

### **Conclusion**

Carotid webs are increasingly suspected in cryptogenic strokes. We report the third existing case of carotid web successfully treated with stenting, and the first in an African American female patient.

## Sam Shamsnia, MD (Tulane)

### Ewing Sarcoma of the Spinal Cord in a 43-year-old male: Case Report and Literature Review

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#### Abstract

#### Introduction

Ewing Sarcoma (ES) and peripheral primitive neuroectodermal tumor (PNET) are rare tumors. They exist on a spectrum of neoplastic disease that includes extraosseous ES, PNET, thoracopulmonary malignancies, and atypical ES. ES can develop in most bones or soft tissues, but commonly localize to the femur. Only 8% of patients in the European Intergroup Cooperative Ewing Sarcoma Studies trial showed primary spinal ES. We describe the eleventh case of spinal ES in an older male treated with surgical resection.

#### Methods

A 43-year-old male presented with mid-sacral back pain for two months. Physical exam was negative for musculoskeletal provocative tests. Radiographs showed no acute pathologies or abnormalities. Three months later the patient reported numbness in the sacral area with progression of pain. MRI demonstrated a 6.8 cm intradural, extramedullary mass from L4-S1. Working diagnosis was myxopapillary ependymoma. Patient underwent wide tumor resection with posterior exposure from L3-S2. Pathology was positive for ES. Tumor staging was M1 Grade 3 Stage 3. At two-week follow-up, the patient reported stool incontinence, urinary retention, arthralgias, back pain, and gait problems.

#### Discussion

Ewing Sarcoma is a rare neuroectodermal tumor commonly found in patients between 10-20 years old with common primary sites in the long bones. Reports of spinal ES present in patients of similar demographics. Localization demonstrates intradural ES spinal tumors in the lumbar region that are intra- or extra medullary. Histology is required to distinguish from PNETs, and treatment is considered palliative with wide resection and chemotherapy for symptomatic relief. Timely diagnosis and management has offered a favorable prognosis, though recurrence and metastases are possible.

#### Conclusion

Current literature reports only ten cases of ES of the spine, and should be considered exceedingly rare. Diagnosis and treatment are critical to optimizing prognosis. We therefore urge consideration of spinal ES in the differential for intradural spinal tumors.

**Idiopathic Intracranial Hypertension presenting with Complete Ophthalmoplegia:  
Case Report and Review of Literature**

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**Abstract**

**Introduction**

Idiopathic Intracranial Hypertension (IIH) affects 1 in 100,000 persons annually, often in obese females. IIH presents with headache, decreased visual acuity, and transient visual deficits. Similarity to space occupying lesions warrants imaging to differentiate. Untreated ICH may compress cranial nerve VI and optic discs, resulting in permanent deficit. Oculomotor palsy with complete ophthalmoplegia is exceedingly rare. We present an otherwise healthy female with IIH and complete right-sided ophthalmoplegia.

**Methods**

A 26-year-old obese female presented with headache, vision loss, and blurred vision. Examination revealed ptosis, restricted extraocular movements (EOM), pupillary mydriasis, total deficits in right visual fields and left sided monocular diplopia. Ophthalmologic examination revealed bilateral optic disc edema and retinal hemorrhages, with complete ophthalmoplegia of the right eye. Elevated ICP was confirmed by LP. Acetazolamide and furosemide were initiated. MRV and sinus dural venography showed sinus stenosis. Pressures of the superior sagittal sinus and transverse sinus were elevated. Right sigmoid sinus stenting decreased pressures to 30mmHg, and clinical improvement was noted with ophthalmoparesis of the right eye last to resolve; abduction and adduction returning first. Two-month postoperative examination showed resolution of ptosis and papilledema, full EOM, brisk pupillary reactivity bilaterally, and persistent left monocular diplopia. Visual field examination of the right eye remained poor, with only light perception noted.

**Discussion**

In addition to common abducens palsy in IIH, our patient exhibited oculomotor and trochlear involvement. It is accepted that ICP changes disrupt function of the abducens nerve, however, complete ophthalmoplegia involving the third and fourth nerves is rare. Thorough literature search yielded only three prior cases.

**Conclusion**

IIH patients treated with acetazolamide have shown significant clinical improvement. In addition, dural sinus stenting has been effective in patients exhibiting ophthalmoplegia as primary symptomatology. Sigmoid sinus stenting, in combination with medical therapy resulted in near resolution of symptomatic complete ophthalmoplegia.

## Zane Freeman, DO (Ochsner)

### **A Novel Approach in Pediatric Ventriculoatrial Shunt Implant via the Left Innominate Vein and Hepatic Vein: A Case Report**

Zane Freeman, MD; Edna Eldinice Gouveia MD; Randi Rasberry PA-C; Derrick Umansky MD; Joshua Allen Hanna MD; Olawale Sulaiman MD ; Cuong J Bui MD; Victor W Lucas MD

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#### **Abstract**

#### **Introduction**

Shunt malfunction is a major challenge in the treatment of persistent hydrocephalus in both pediatric and adult populations. In the event of access failure, different access points have been described for CSF diversion including ventriculoperitoneal, ventriculoatrial, ventriculopleural, and ventriculo-gallbladder. We present a case in which the patient had multiple shunt failures and infections that exhausted all traditional shunting methods, which was definitively resolved with a ventriculoatrial shunt via the innominate and hepatic veins.

#### **Methods**

A 10-year-old male with a 2q25 chromosomal deletion and multiple congenital pathologies including hydrocephalus presented with cranial asymmetry. Physical exam revealed grossly intact cranial nerves. The patient underwent a series of shunt revisions with various approaches including diversions to the peritoneum, right atrium, and gallbladder. VP shunt failure was detected when a pseudocyst was discovered following a presentation of lethargy. A VA shunt attempt failed due to abnormal neck vasculature. Subsequently, a ventriculopleural shunt resulted in pulmonary hypertension four months postoperatively. A second VA shunt was attempted after occluded iliac veins were visualized, with access to the right atrium being gained through the hepatic and innominate veins. Follow-up at seven months revealed a normally functioning VA shunt and a baseline neurological exam.

#### **Discussion**

Hepatic venous access is a novel methodology for right atrial access in a VA shunt placement. Early and late shunt failures are extremely common obstacles in the treatment of chronic hydrocephalus. Well-known CSF diversion methods describe shunting to the peritoneum, right atrium, lung, and gallbladder. However, literature is lacking in nontraditional approaches for these diversions.

#### **Conclusion**

VA shunting is usually achieved via the internal jugular vein. Our patient presented with abnormal neck vasculature, and a novel access to the right atrium was attempted. Successful resolution of hydrocephalus was achieved, suggesting this as a valid flow diversion technique in the treatment armamentarium.

**Stand-alone expandable cages without posterior instrumentation for thoracic and lumbar lateral interbody fusion: indications, techniques and outcomes**

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**Abstract**

**Objective**

Minimally invasive lateral interbody fusion (MIS-LIF) for the treatment of adult disc diseases has been increasingly implemented. The use of stand-alone expandable cages for this technique is gaining popularity in certain indications over static cages. Biomechanical studies have shown that expandable cages with and without pedicle screw fixation can provide immediate stability, increased lordosis, and indirect decompression of neural elements. There have been series on LIF using static stand-alone cages, but clinical and radiological outcomes in patients treated with expandable cages is lacking. The objective of this study is to evaluate clinical outcomes, describe techniques, and formulate possible indications for their use.

**Methods**

A retrospective chart review was conducted to identify patients who underwent lateral interbody fusion with placement of an expandable Globus LLIF cage filled with allograft and autograft between 2015 and 2017. Spinal pathologies included were chronic instability (retrolisthesis, lateral listhesis), disc herniation, degenerative disc disease with or without spinal stenosis, degenerative adjacent level disease with stenosis and/or kyphosis. Intra-operative surgical times and estimated blood losses were recorded. Routine follow up was scheduled at 1 to 2 weeks, 1 to 2 months, 3 to 4 months and after 5 to 12 months. Outcome measures included Macnab criteria, motor strength, subsidence rate, fusion rate, and lordotic angle. The Macnab criteria is a measure of clinical outcome based on level of pain and functional capacity. Patients are rated on a scale of poor, fair, good, or excellent. Plain radiographs and computed tomography (CT) scans were used for assessment of fusion status, segmental lordotic angle and cage subsidence.

**Results**

Low back pain scale was performed on 10 patients (9 male, 1 Female). Average age was 61 (range 31-89). The average estimated blood loss was 261.67 (SD 302.3) mL. The average estimated surgical time was 276.78 (SD 120.1) minutes. The mean length of hospital stay after surgery was 5 days (SD 4.11). The analysis showed Macnab criteria pre-operative 7 poor, 2 fair, and 1 was not evaluated. Outcomes for back pain and functional capacity at 1-4 weeks were 0 poor, 3 fair, 7 good, and 0 excellent. Outcomes at 1-2 months were 0 poor, 3 fair, 7 good, and 0 excellent. Outcomes at 3-4 months were 0 poor, 1 fair, 7 good, and 0 excellent. Outcomes at ≥5 months were 1 poor, 1 fair, 4 good, and 1 excellent. The only patient that had poor outcome for back pain also had excellent outcome for leg pain. All patients experienced motor strength improvement after surgery. 40% of patients required opioid medication at ≥5 months. Overall 7/10 patients underwent one level fusion and 3/10 patients underwent 2 level fusion. 7/10 patients were evaluated for fusion rate with CT scan at 5-6 months. 6/7 patients evaluated by CT had successful fusion. The single patient with pseudoarthrosis on CT scan had undergone a 2 levels fusion, and had successful fusion at the other level. Subsidence occurred in 2 patients (cut-off <2 mm), with one requiring subsequent laminectomy for recurrence of radiculopathy. Both of these patients had undergone a 2 levels fusion.

**Conclusion**

The use of stand-alone expandable cages without posterior instrumentation for thoracic and lumbar lateral interbody fusion is a practical minimally invasive option with successful fusion rate in a wide variety of degenerative spinal conditions involving a single or multiple segments. It was effective for improvement in motor strength and Macnab criteria, and reduces use of opioid medications post-operatively.

## **Peter G. Campbell, MD (Spine Institute of Louisiana)**

### **Symptomatic degenerative spondylolisthesis at L4/L5 treated with LLIF without decompression**

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#### **Abstract**

#### **Introduction**

There is still debate about the best surgical approach and the need for direct decompression at L4/5 for degenerative spondylolisthesis. Clinical, neurological and radiographic outcomes are reported for patients receiving transposas lateral lumbar interbody fusion (LLIF) with indirect decompression to treat neurogenic claudication secondary to grade 1 and 2 spondylolisthesis at L4/5.

#### **Methods**

A prospectively maintained database was retrospectively reviewed for consecutive patients with grade 1 or 2 spondylolisthesis. Patients underwent TLIF with posterior percutaneous instrumentation without decompression. At follow-up, radiographs and neurological exams were performed, and patients completed the Oswestry Disability Index (ODI), and the 12-Item Short Form Health Scores (SF-12).

#### **Results**

TLIF was performed on 15 patients with grade 1 spondylolisthesis and three with grade 2 for total of twenty operated levels. Mean operative time was 165 minutes and estimated blood loss was 113 milliliters for combined anterior and posterior phases. The most common cage width was 22 mm, A-P (78%). Mean follow-up was 6.2 months (range:3-13). Sensory evaluation identified anterior thigh dysesthesia in 6/18 patients (33%); all resolved within 6 months post-operative. No patient had lasting sensory loss or motor deficit. Mean ODI improved 26 points by 6-months, and SF-12 mean physical and mental health composite scores, improved by 5.4 and 4.7 points respectively. No patient required additional decompression surgery post-operatively.

#### **Conclusion**

Grade 1 and 2 degenerative spondylolisthesis at L4/5 is successfully treated with minimally invasive TLIF. TLIF provides excellent arthrodesis rates, and favorable clinical outcomes and low rates of post-operative complications. TLIF technique, such as minimal table break, an initial look and see approach to the psoas, clear identification of the plexus, minimal cranial caudal expansion of the retractor, mobilization of any traversing sensory nerves and total psoas dilation times less than 20 minutes remain critical to ensure the lowest possible complication profile for visceral and neural injuries.

**Multi-Modality Investigation Into the Safety and Efficacy of Spinal Surgery Techniques in the Aging Population**

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**Abstract**

**Introduction**

There is considerable discussion in spine surgery regarding the eligibility of elderly patients for surgery, due to the perception of poorer peri-operative outcomes in this patient population. There are few papers detailing outcome data for elderly patients in spine surgery and even fewer that analyze outcomes based on operative approach. Spine surgery may best be divided into three broad categories as 1) direct decompression with laminectomy alone, 2) direct decompression and fusion such as the Transforaminal Lumbar Interbody Fusion (TLIF), and 3) indirect decompression and fusion as in the Direct Lateral Interbody Fusion (DLIF). Our study will focus on patient outcomes by comparing these types of spine surgery using common patient outcome measurements.

**Methods**

A retrospective chart analysis was prospectively accumulated and analyzed in patients sixty-five years and older who underwent spinal surgery from 2013-2016. One-hundred-seventy-one qualifying patients underwent spinal surgery with the senior author, and were divided into 3 groups for statistical analysis with ANOVA testing by 1) direct decompression without fusion, 2) direct decompression and fusion (TLIF), and 3) indirect decompression and fusion (XLIF).

**Discussion**

Concerning patient demographic analyses, TLIF patients were significantly younger and possessed significantly less comorbidities than XLIF or decompression alone, while the decompression group experienced significantly less blood loss and fewer days in the hospital. No significant differences were seen between groups for VAS score and ODI reductions, while each group possessed significant reduction within groups.

**Conclusion**

The historic hesitancy to treat surgical low back pain in the elderly may be overstated. Our study's results demonstrate both safety and efficacy with spine fusion in the aging population. Furthermore, between techniques, the approach, type of decompression and presence of instrumentation was not found to impact post-operative outcomes between groups.



## **Efficacy and Fusion Outcomes Comparing Allograft Versus Autograft in Lumbar Interbody Fusion Operations: Literature Review and Study Series**

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### **Abstract**

#### **Introduction**

The use of bone graft material in spinal fusion operations is standard practice. The two most common types of graft materials are autograft from the surgical site, or the use of cadaveric allogenic bone graft. Historically, allogenic graft was preferred due to the highly morbid harvesting of iliac bone graft material, with significantly increased operative time, EBL, hospital stay, and post-operative pain scores. This line of research has been re-examined in multiple publications, however significant heterogeneity exists based on number of levels fused, location within the spine, and types of interbody implants.

#### **Methods**

Our single-center study retrospectively assessed a prospective registry of 89 spinal fusion patients who underwent Transforaminal Lumbar Interbody Fusion (TLIF) procedure in the lumbar spine in an attempt to further focus our study sub-demographic. Patients were allocated to four groups based on the use of allograft or autograft material in expandable or non-expandable interbody cages; and single and multi-level fusion. Patients with chronic bone formation disorders were excluded.

#### **Results**

No significant differences in patient demographics, operative outcomes, or post-operative course was seen based on expandable versus non-expandable cages in allograft or autograft groups. Patients who underwent multilevel surgery experienced increased operative time, and estimated blood loss despite graft type used. No significant differences were seen in fusion outcomes or complications.

#### **Conclusion**

There has been a historical hesitancy to use autograft materials in spinal fusion surgeries secondary to increased donor site morbidity. Heterogeneity in study variables have shown conflicting results based on the site of fusion, number of levels fused and interbody device used. Utilizing highly specific selection criteria we found no statistical differences in lumbar spine fusion in patient demographic or operative outcomes. As a result, there should no longer be a hesitancy to consider autograft bone in specific situations based on patient or peri-operative variables.

## **Kevin Morrow, MD (LSUHSC-NO)**

### **Minimally Invasive Management of Civilian Gunshot Wounds to the Lumbar Spine: Case Series**

Clifford L. Crutcher II, MD, Erin S. Fannin, MSPH, Kevin D. Morrow, MD, Anthony M. DiGiorgio, DO, Gabriel C. Tender, MD.

<sup>1</sup> Department of Neurosurgery, Louisiana State University Health Science Center, New Orleans, Louisiana.

#### **Abstract**

##### **Background**

Treatment of penetrating gunshot wounds (GSW) to the spine remains controversial. The decision to operate is often based on the surgeon's preference and experience. We present a series of 5 patients who underwent minimally invasive (MI) lumbar decompression and bullet removal at a Level 1 Trauma Center.

##### **Case Description**

From 2010 to 2017, five male patients with spinal GSW were treated at our institution. Their ages ranged from 20-55 years (mean: 32 years). The mechanisms of injury were GSW to the abdomen (n=4) and direct GSW to the spine (n=1). Based on the neurological examination, the injuries were characterized as complete (n=1) or incomplete (n=4). Decompression and bullet removal were performed using a tubular retractor system. All but the complete patient showed good neurologic recovery. Four patients described improvement of varying degrees in their lower extremity strength and improvement in their lower extremity pain/paresthesia. One patient presented with cauda equina and postoperatively reported improvement in saddle anesthesia and ability to voluntarily void. One patient had extensive dural damage and required intraoperative dural repair and insertion of a lumbar drain. There were no post-operative wound infections, cerebrospinal fluid leaks, or other complications related to the procedure.

##### **Conclusions**

Minimally invasive decompression and bullet removal is a safe technique that can help reduce the risk of post-operative infections and CSF leaks in patients with GSW to the lumbar spine. This approach appears to be particularly beneficial in patients with incomplete injuries and neuropathic pain refractory to medical treatment.

## **Current Worldwide Evidence, Application, and Future of Cervical Total Disc Replacement**

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<sup>1</sup>Spine Institute of Louisiana, Shreveport, LA

### **Abstract**

### **Introduction**

The widespread clinical use of cervical total disc replacement (cTDR) began in the early 2000's. Despite the abundance of literature and common use, cTDR is still considered a developing technology. Here, we review the current evidence on cTDR, and discuss the future of cTDR.

### **Methods**

To report the global research and clinical use of cTDR, a thorough literature review was conducted of publications in the United States (US) and outside the US (OUS). Search criteria were restricted to publications with a clinical patient population, excluding finite element analyses, biomechanical studies, cadaver studies, surgical technique specific papers, and case studies.

### **Results**

The US publications are the preponderance of the level 1 evidence supporting cTDR. These level 1 evidence publications are a result of the highly controlled Food and Drug Administration (FDA) Investigational Device Exemption (IDE) trials. Currently the US indications support the use of cTDR at one and two surgical levels. Generally, the OUS publications report smaller patient populations, without controls, and with broader surgical indications. These studies, although lower levels of evidence, they serve to advance patient indications in the use of cTDR. Studies in the US and OUS also continue to focus on potential complications of cTDR; secondary surgery, heterotopic ossification, and adjacent segment degeneration. There continue to be other external challenges for cTDR technology including regulatory restrictions and health economics.

### **Conclusion**

The evidence for cTDR is robust, and supports a variety of clinical indications. Complications remain a consideration for cTDR and need to continue to be studied, especially in the long term. The US regulatory landscapes, health economics, and other factors slow the widespread adoption and expanded indications of cTDR in the US when compared to OUS.

## Richard Menger, MD, MPA (LSUHSC-S)

### Adolescent idiopathic scoliosis: risk factors for complications and the effect of hospital volume on outcomes

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#### Abstract

#### Objective

Adolescent idiopathic scoliosis (AIS) is the most common form of scoliosis. Limited literature exists defining risk factors associated with outcomes during initial hospitalization in these patients. In this study, the authors investigated patient demographics, clinical and hospital characteristics impacting short-term outcomes, and costs in adolescent patients undergoing surgical deformity correction for idiopathic scoliosis. Additionally, the authors elucidate the impact of hospital surgical volume on outcomes for these patients.

#### Methods

Using the National Inpatient Sample database and appropriate International Classification of Diseases, 9th Revision codes, the authors identified adolescent patients (10–19 years of age) undergoing surgical deformity correction for idiopathic scoliosis during 2001–2014. For national estimates, appropriate weights provided by the Agency of Healthcare Research and Quality were used. Multivariable regression techniques were employed to assess the association of risk factors with discharge disposition, postsurgical neurological complications, length of hospital stay, and hospitalization costs.

#### Results

Overall, 75,106 adolescent patients underwent surgical deformity correction. The rates of postsurgical complications were estimated at 0.9% for neurological issues, 2.8% for respiratory complications, 0.8% for cardiac complications, 0.4% for infections, 2.7% for gastrointestinal complications, 0.1% for venous thromboembolic events, and 0.1% for acute renal failure. Overall, patients stayed at the hospital for an average of 5.72 days (median 5 days) and on average incurred hospitalization costs estimated at \$54,997 (median \$47,909). As compared with patients at low-volume centers ( $\leq 50$  operations/year), those undergoing surgical deformity correction at high-volume centers ( $> 50$ /year) had a significantly lower likelihood of an unfavorable discharge (discharge to rehabilitation) (OR 1.16, 95% CI 1.03–1.30,  $p = 0.016$ ) and incurred lower costs (mean \$33,462 vs \$56,436,  $p < 0.001$ ) but had a longer duration of stay (mean 6 vs 5.65 days,  $p = 0.002$ ). In terms of neurological complications, no significant differences in the odds ratios were noted between high and low-volume centers (OR 1.23, 95% CI 0.97–1.55,  $p = 0.091$ ).

#### Conclusions

This study provides insight into the clinical characteristics of AIS patients and their postoperative outcomes following deformity correction as they relate to hospital volume. It provides information regarding independent risk factors for unfavorable discharge and neurological complications following surgery for AIS. The proposed estimates could be used as an adjunct to clinical judgment in pre-surgical planning, risk stratification, and cost containment.

## Clifford Crutcher II, MD (LSUHSC-NO)

### The Safety and Efficacy of CT-Guided, Fluoroscopy-Free Vertebroplasty in Adult Spinal Deformity Surgery

Corinna C. Zygourakis, M.D.,<sup>1,2</sup> Anthony M. DiGiorgio, D.O., M.H.A.,<sup>1,3</sup> Clifford L. Crutcher II, M.D.,<sup>3</sup> Michael Safaee, M.D.,<sup>2</sup> Fred H. Nicholls, M.D.,<sup>4</sup> Cecilia Dalle Ore, B.A.,<sup>1,5</sup> Vedat Deviren, M.D.,<sup>6</sup> Christopher P. Ames, M.D.<sup>1</sup>

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#### Abstract

#### Object

Proximal junctional kyphosis (PJK) is one of the most common, morbid, and costly complications of adult spinal deformity surgery. We sought to analyze the safety and efficacy of a novel technique of CT-guided, fluoroscopy-free vertebroplasty to help prevent PJK in long-segment posterior spinal fusions.

#### Methods

We performed a retrospective analysis of 118 consecutive adult spinal deformity patients who underwent long-segment fusion with vertebroplasty from 2013-2016 at a single institution. For each patient, we collected demographics, surgical information (anterior/posterior versus posterior, interbody fusion device usage, ligamentoplasty usage, and decompression status), length of stay, discharge disposition, and complications, including reoperation, PJK, and PJK requiring reoperation. We reviewed all post-operative radiographs to assess for cement leakage. These patients were compared to a historical control of 253 patients who underwent adult spinal deformity surgery without vertebroplasty from 2004-2013 at our institution.

#### Results

118 patients (77 females) underwent posterior spinal instrumentation with fluoroscopy-free vertebroplasty, the majority with ligamentoplasty, interbody fusion, and decompressions. More than half of the patients (52%) had no radiographic evidence of cement leakage, and none of the patients were symptomatic from this leakage. The PJK rate of 14% and the PJK requiring re-operation rate of 3% in patients who underwent vertebroplasty-augmented fusion was significantly lower than that of the 253 historical controls at our institution who did not undergo vertebroplasty (40% PJK rate, 17% PJK-rate requiring re-operation; both  $p < 0.001$ ). After controlling for patient and other surgical factors in multivariate analyses, vertebroplasty was significantly associated with lower rates of PJK and PJK requiring re-operation ( $p < 0.001$  and  $p = 0.003$ ).

#### Conclusions

Our novel vertebroplasty technique is safe and eliminates the need for additional fluoroscopy in cases already utilizing the O-arm to verify screw placement. It is an effective technique for reducing PJK in adult spinal deformity surgery when compared to historical institutional controls.

## **Minimally Invasive Spine Surgery in the Pediatric Population: a Case Series**

Matthew Hefner, MD

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### **Abstract**

#### **Objectives**

Understand the safe and effective use of minimally invasive techniques in pediatric spine surgery.

Appreciate the technical nuances of pediatric minimally invasive spinal surgery.

Understand the role obesity places in pediatric spinal pathology.

#### **Methods**

Consecutive pediatric patients undergoing elective MIS lumbar spine procedures were retrospectively analyzed from a single fellowship trained academic spinal neurosurgeon from 2008 to 2016. Information was retrieved regarding procedure and disease pathology. Descriptive data was obtained including age, sex, body mass index, insurance coverage, smoking status, and co-morbidities. Outcome measures were recorded including intraoperative complications, revision surgery, and return to function.

#### **Results**

16 individual patients underwent 17 procedures. The median BMI was 29.2. The range of BMI scaled from 20.8 to 41.5. Ages ranged from 12- 19. Nearly 20% of the pediatric patients in our series were smokers. Most patients underwent discectomy, with L5-S1 being the most common level. One patient underwent direct pars defect repair, and another underwent recurrent discectomy. Nearly 90% of patients were complication free. One patient had a recurrent disc herniation, and another had a superficial wound infection. 82.4% patients enjoyed a full return to sports such as weight lifting, gymnastics, and contact sports. One patient required pain management to help alleviate ongoing pain. Another patient required a course of outpatient rehab to help with a foot drop pathology.

#### **Conclusions**

Advances in MIS surgery allow for application to a wider population. Our series illustrates the effective application of MIS techniques to carefully selected pediatric patients. Emphasis is on minimal disruption. The average patient in our series was overweight and nearly 20% of the patients were smokers.

## **Elizabeth Wild, MD, MS (LSUHSC-S)**

### **Chiari Malformation Associated Scoliosis: the Shreveport experience**

Elizabeth Wild, MD

<sup>1</sup>Department of Neurosurgery, LSU Health Sciences Center, Shreveport, Louisiana, USA.

#### **Abstract**

Chiari-associated spinal deformities are relatively common, with scoliosis occurring in as many as 60% of Chiari malformation (CM) patients with syringomyelia. Despite this frequent association, CM associated spinal deformity remains poorly understood. We present here our case series of six patients presenting with Chiari type 1 malformation and scoliosis. We specifically explore the clinical presentation including age, skeletal maturity, curve morphology, Cobb angle, and thoracic kyphosis; management strategies employed including posterior fossa decompression with and without duraplasty, bracing, and spinal fusion for curve correction; and treatment outcomes including curve progression after posterior fossa decompression, curve correction after spinal fusion, neurologic outcomes, and surgical complications in our patient population. We additionally review the existing literature regarding the pathophysiology, clinical presentation, evaluation, and management of CM associated scoliosis.

## **Anthony DiGiorgio, DO, MHA (LSUHSC-NO)**

### **A less restrictive overlapping surgery policy decreases length of stay in an academic, safety-net hospital.**

Anthony M DiGiorgio, DO, MHA<sup>1,3</sup>; Jonathan L Fisher, BS<sup>2</sup>; Adam G Podet, MD<sup>1</sup>; Clifford L Crutcher II, MD<sup>1</sup>; Michael S Virk, MD, PhD<sup>3</sup>; Jason D Wilson, MD<sup>1</sup>; Gabriel C Tender, MD<sup>1</sup>; Praveen V Mummaneni, MD<sup>3</sup>

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<sup>3</sup> Department of Neurosurgery, University of California, San Francisco, CA, USA

#### **Abstract**

#### **Background**

The practice of surgeons performing overlapping surgery has recently come under scrutiny.

#### **Objective**

We sought to examine the impact of overlapping rooms on surgery wait time and length of stay in patients admitted to a tertiary care, safety-net hospital for urgent neurosurgical procedures.

#### **Methods**

The neurosurgery service at the hospital being studied transitioned from routinely allowing one room per day (period 1) to overlapping rooms (period 2), with the second room being staffed by the same attending surgeon. Patients undergoing neurosurgical intervention in each period were retrospectively compared. Case urgency, patient demographics, case type, indication, length of stay and time from admission to surgery were tracked.

#### **Results**

452 total cases were reviewed (201 in period 1 & 251 in period 2), covering 7 months in each period. 122 of the cases were classified as "urgent" (59 in period 1 and 63 in period 2). In these patients, length of stay was significantly decreased in period 2 (13.09 days vs 19.52,  $p=.043$ ) and the time from admission to surgery for urgent cases trended towards a shorter time (5.12 vs 7.00,  $p=.133$ ). Insurance status of these patients was 26.2% uninsured, 39.3% Medicaid, 18.9% Medicare, 9% commercial and the remainder workers compensation, liability or prisoner care. Wait time significantly correlated with length of stay ( $R^2=.37$ ,  $p<.001$ ).

#### **Conclusion**

Recent studies suggest overlapping surgeries are safe for patients. In the case of this safety-net hospital, allowing overlapping rooms significantly reduces length of stay in a vulnerable population in need of urgent surgery.



## **James Barry, MD (LSUHSC-S)**

### **Neurosurgery Political Involvement: Participation, Finances, and Politics**

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1 Department of Neurosurgery, Louisiana State University Health Sciences Center, Shreveport LA

#### **Abstract**

#### **Introduction**

The purpose of this study is to illustrate and compare the dynamic involvement of neurosurgeons in the political theatre. Comparison is made between different specialties through the participation, financial contribution, and political leanings of their respective political action committees.

#### **Methods**

Data was acquired related to funds donated, participation, donor status, donation destination, and political party designation. Information was retrieved through [opensecrets.org](http://opensecrets.org), open source Federal Election Commission website, and the public information through organized neurosurgery. Neurosurgery PAC was compared to 24 other of the top contributing medical specialty and physician PACs. These contributions were trended over Fiscal year 2016.

#### **Results**

Neurosurgery ranks 21st in total expenditure among the different medical specialty political action committees with \$317,964 spent in 2016. Of practicing American neurosurgeons, 344 members have donated to NeurosurgeryPAC in 2011, or 6.4% participation. This is compared with 21% of orthopedic surgeons. 89% of neurosurgical political money went to republican candidates. This was the most unilateral of all PACs. Our colleagues in family practice showed 59% donations going to Democratic candidates.

#### **Conclusion**

Neurosurgeon's enjoy a vibrant political voice through the Neurosurgery PAC in order to best serve our patient's interests. Neurosurgeon's are the 21th ranked PAC in terms of total contribution, the 11th in donor participation, and 1st in political ideology. It remains vitally important for neurosurgeons to engage and remain active in the Neurosurgery PAC.

## **Devon LeFever, MD (LSUHSC-S)**

### **Analysis of Factors and Conditions Influencing Military Neurosurgery Recruitment**

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<sup>3</sup>Uniformed Services University of Health Sciences, Bethesda, Maryland

#### **Abstract**

#### **Background**

Neurosurgery remains a critical wartime specialty for the United States military. Here we investigate the objective and subjective factors impacting recruitment and retention of military neurosurgeons.

#### **Methods**

The Council of State Neurosurgical Societies in conjunction with the Joint Military Committee surveyed military neurosurgeons regarding objective and subjective factors related to military service. This included the objective data; branch, years of service, commissioning source, military commitment, and duty status. It also included subjective data such as; career satisfaction, intention to stay past initial commitment, patriotism, camaraderie, compensation and benefits, and gratification in treating the military patient population. Military neurosurgeons were directly queried as to whether they would or would not recommend military neurosurgery to a neurosurgery colleague. This question served as a surrogate marker for military neurosurgery recruitment.

#### **Results**

A total of 121 current or previously affiliated military neurosurgeons responded to the question regarding whether they would recommend military neurosurgery to a colleague. The branch most represented was the Navy (42.5%), followed by the Army (39.2%), and finally the Air Force (18.3%). The most common ranks were O-5 (35.3%) or O-6 (29.3%). The majority of the respondents were either separated (35.5%) or retired (36.4%) from the military. A total of 76.9% (93/121) would recommend military service to a fellow neurosurgeon. Of these the most rewarding factors in their service were: pride and patriotism (93.6%, 87/93), camaraderie (78.5%, 73/83), treating military patients (72.0% 67/93), and focus on clinical care/not the business of medicine (66.7%, 62/93).

On multivariate analysis those who felt empowered by their military service with a sense of patriotism were 4.3 times more likely to recommend military service to another neurosurgery ( $p = 0.027$ , CI 1.19 - 16.82). Likewise, those who developed a sense of camaraderie within their military service showed a statistical trend to being more likely to recommend military service to their peers ( $p = 0.058$ , CI 0.95 - 9.78). Those with a current military obligation were .28 times as likely to recommend service as a military neurosurgeon as compared to those neurosurgeons who are separated or retired. Branch served in and rank obtained was not found to be statistically significant in predicting the likelihood of referring a neurosurgery colleague into military neurosurgery.

#### **Discussion**

Service in the United States military is a positive experience with camaraderie, patriotism, and unique military experiences being stated as positive and predictive of military neurosurgery recruitment. These factors should be explored and fostered regarding recruitment and ultimately retention of military neurosurgeons. It remains vitally important to continue to have a strong military neurosurgery corps.

## **Jared Robichaux, MD (LSUHSC-NO)**

### **Cervical Spondylotic Myelopathy and its Association with Increased Healthcare Cost and Utilization after Surgery**

Crutcher CL<sup>1</sup>, Travers S<sup>2</sup>, Hundley K<sup>3</sup>, Robichaux JM<sup>1</sup>, Wilson J<sup>1</sup>

<sup>1</sup>Louisiana State University Department of Neurological Surgery

<sup>2</sup>University of Missouri Department of Neurological Surgery

<sup>3</sup>University of Arkansas Department of Neurological Surgery

#### **Abstract**

#### **Introduction**

Cervical spondylotic myelopathy (CSM) is often a progressive, debilitating neurological condition, resulting from chronic compression of the spinal cord. Surgical decompression and fusion is safe and associated with improved neurological function postoperatively for select patients. Recent studies investigating the recent trends in hospitalizations, healthcare cost, and healthcare utilization for CSM are lacking.

#### **Methods**

We retrospectively reviewed all UMCNO hospital encounters from January 2011 to December 2014 for ICD-9-CM principal diagnosis code 721.1, which codes for CSM. 488 admissions were identified, and of those patients, 76 patients underwent surgery and met inclusion criteria. Nurick grade was used to assess disease severity. Age, sex, race, body mass index (BMI), previous cervical surgery, and Nurick grade were evaluated in relation to hospital length of stay (LOS) and discharge disposition. At UMCNO, the cost for a med/surg room is approximately \$1500 per day. We assumed that patients requiring longer hospital stays and discharge to inpatient rehab utilized greater healthcare resources than their counterparts.

#### **Results**

The average patient was 51.5 years of age. Higher Nurick grades were associated with increased hospital LOS by an average of 23 days ( $p = 0.01$ ). Higher Nurick grades were also associated with discharge to inpatient rehab rather than discharge to home ( $p < 0.01$ ). Age, sex, race, BMI, and previous fusion were not associated with increased hospital LOS or discharge to inpatient rehab.

#### **Conclusion**

Our data shows that patients with higher Nurick scores had longer LOS and were more likely to be discharged to inpatient rehab rather than home resulting in increased healthcare cost and utilization. The findings of this study are useful in pre-operative counseling of CSM patients regarding expected LOS and discharge disposition. Regardless of Nurick score, patients with CSM deemed to be surgical candidates can benefit from surgical decompression and fusion despite the added cost.

## **Ann Marie Flannery, MD (Women's & Children's)**

### **Development of Multidisciplinary Conferences for the Care of Pediatric Neurosurgery Patients in the Community Hospital Setting**

Ann Marie Flannery, MD

<sup>1</sup>Women's and Children's Hospital, Lafayette, Louisiana, USA.

#### **Abstract**

#### **Introduction**

Multidisciplinary care committees are typically found in academic medical centers. Community Medical Centers have barriers and opportunities when it comes to the organization of such conferences. This presentation will discuss the creation of a fetal high-risk conference and a pediatric tumor board.

#### **Materials and methods**

Womens and Children's Hospital is an obstetric /gynecologic and pediatric hospital. It has a long-standing mission to serve the women and children of Acadiana. The hospital has numerous resources, but most of the practitioners are in private practice and have little opportunity for collaboration. Because of the patient populations, there were opportunities to coordinate care and discuss patient management questions at a collaborative conference. Barriers to achievement of the conference included financial support, coordination of schedules, and concerns about Stark law violations. After an initial several months of planning and negotiation, for the past two and a half years there has been a monthly fetal conference. For the past 2 years, we have held a monthly pediatric tumor board. Each conference includes Physicians nurse practitioners and other interested parties and serves to discuss difficult cases and coordinate care for medical medically complex infants, such as prenatally diagnosed open neural tube defects, and hydrocephalus and children including brain and spine tumors. A side benefit has been the development of new services such as fetal MRI.

#### **Conclusion**

If physicians are willing to prioritize the conference, and there is administrative support to create the conference, multidisciplinary conferences can occur and can be beneficial in the community practice setting.

## **Philip Utter, MD (Spine Institute of Louisiana)**

### **Medicare DRG Reimbursement for Adult Spinal Deformity Surgery – The Impact of Case Type, Length of Stay, Institution Type, and Comorbidities**

Phillip A. Utter, M.D.<sup>1</sup>, Pierce D. Nunley, M.D.<sup>1</sup>, Gregory M. Mundis, M.D.<sup>2,3</sup>, Richard G. Fessler, M.D.<sup>4</sup>, Paul Park, M.D.<sup>5</sup>, Joseph M. Zavatsky, M.D.<sup>6</sup>, Juan S. Uribe, M.D.<sup>7</sup>, Robert K. Eastlack, M.D.<sup>3</sup>, Dean Chou, M.D.<sup>8</sup>, Michael Y. Wang, M.D.<sup>9</sup>, Neel Anand, M.D.<sup>10</sup>, Kelly A. Frank, M.S.<sup>1</sup>; Marcus B. Stone, PhD<sup>1</sup>; Adam S. Kanter, M.D.<sup>11</sup>, Christopher I. Shaffrey, M.D.<sup>12</sup>, Praveen V. Mummaneni, M.D.<sup>8</sup>, and International Spine Study Group.

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### **Abstract**

#### **Introduction**

Diagnosis-related group (DRG) reimbursement is not well understood for minimally invasive surgery (MIS) for adult spinal deformity (ASD) procedures. The purpose of this study is to educate medical professionals about potential financial impacts of improper DRG coding in ASD surgery.

#### **Methods**

Reimbursement data from 2015 was collected from Medicare's Inpatient Prospective Payment Pricer database for 12 hospitals. Case type, hospital type/location, number of operative levels, proper coding, length of stay, and complications/comorbidities (CCs) were analyzed for effects on reimbursement. Cases were categorized into 3 DRG types: 1) anterior or posterior only fusion, 2) anterior fusion with posterior percutaneous fixation with no dorsal, and 3) combined anterior and posterior fixation and fusion.

#### **Results**

All case types were reimbursed the same for single level and multilevel across institutions. Increasing the length of stay from 3 to 8 days, resulted in an additional \$1400/stay. Including coding posterior fusion was an additional \$6588, and CCs coding increased reimbursement approximately \$13,000. Academic institutions are reimbursed higher than private institutions; case types 1 and 2 are approximately \$14,000 higher, and case type 3 is approximately \$16,000 higher.

Urban institutions received higher reimbursement than suburban institutions; case types 1 and 2 are approximately \$3,000 higher, and case type 3 is approximately \$3,500 higher.

Longer stay, from 3 to 8 days, increased reimbursement between \$208 and \$494 for private institutions and between \$1397 and \$1879 for academic institutions per stay.

#### **Conclusions**

Reimbursement is based on many factors not controlled by surgeons or hospitals, however, properly coding can significantly impact the financial health of hospitals and the availability of quality patient care.

## **Wale Sulaiman, MD, PhD (Ochsner Health)**

### **Establishing Neurosurgery Program of the Future in a Value-driven Healthcare Environment**

Wale A.R. Sulaiman, MD, PhD

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#### **Abstract**

##### **Background**

The healthcare environment in the USA is rapidly changing in many ways and faster than most physicians can prepare them. The emerging concepts place more emphasis on quality than quantity of care, patient-centered and team-based care than single practice. Payers are also restructuring their reimbursement to align with the changing trends.

##### **Objectives**

Surgical specialties such as Neurosurgery and orthopedic are very vulnerable to being adversely affected by these healthcare changes unless the physicians get engaged and be part of the changes, perhaps even lead the changes. This talk will provide an overview of the healthcare changes and propose strategies to stay ahead of them.

## **Nimer Adeeb, MD (LSUHSC-S)**

### **Proposal of a Follow-Up Imaging Strategy Following Pipeline Flow Diversion Treatment of Intracranial Aneurysms**

Nimer Adeeb

<sup>1</sup>Department of Neurosurgery, Louisiana State University, Shreveport, LA

#### **Abstract**

#### **Introduction**

There is currently no standardized follow-up imaging strategy for intracranial aneurysms treated with the Pipeline embolization device. Here, we use long-term follow-up imaging data on aneurysms treated with the PED to propose a standardizable follow-up imaging strategy.

#### **Methods**

A retrospective review of all patients who underwent treatment for ruptured or unruptured intracranial aneurysms with the PED, between March 2013 and March 2017, at two major academic institutions in the U.S., was performed.

#### **Results**

A total of 218 patients underwent treatment for 259 aneurysms with the PED, and had undergone  $\geq 1$  follow-up imaging study to assess aneurysm occlusion status. There were 235 (90.7%) anterior and 24 posterior (9.3%) circulation aneurysms. On Kaplan-Meier analysis, the cumulative incidence of aneurysm occlusion at 6, 12, 18, and 24 months was 38.2%, 77.8%, 84.2%, and 85.1%, respectively. No differences in the cumulative incidence of aneurysm occlusion according to aneurysm location ( $p=0.39$ ) or aneurysm size ( $p=0.81$ ) were observed. A trend towards a decreased cumulative incidence of aneurysm occlusion in patients  $\geq 70$  years old was observed ( $p=0.08$ ). No instances of aneurysm rupture after PED treatment or aneurysm recurrence after occlusion, were noted. Sixteen (6.2%) aneurysms were retreated with the PED; eleven of these had imaging follow-up data available, demonstrating occlusion in 3 (27.3%).

#### **Conclusion**

We propose a standardizable follow-up imaging strategy which incorporates a 12-month DSA and a 24-month MRA for patients  $<70$  years old, and a 6-month DSA and a 12-month MRA, for patients  $\geq 70$  years old. If occluded at last follow-up, we believe no further imaging studies are necessary. For recurrent or persistent aneurysms, retreatment with the PED or use of an alternative treatment modality, may be considered.

## **Garrett Bennett, MD (Ochsner)**

### **First Case of Pulse Rider Assisted Coiling of a Basilar Tip Aneurysm in Louisiana**

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#### **Abstract**

#### **Introduction**

Basilar tip aneurysms are difficult to treat surgically and often require an endovascular approach. However, their frequent wide neck configuration makes them challenging often requiring stent or balloon assistance. With stent-assistance there is an increased risk of thrombosis despite treatment with dual antiplatelet agents. A new device called Pulse Rider (Pulsar Vascular) has recently been introduced to assist in treatment of these aneurysms. We describe the first case of the Pulse Rider device being used in the state of Louisiana.

#### **Methods**

A 50 year old female with recurrent left sided headache found to have basilar tip aneurysm on CT scan was referred for evaluation and treatment of her aneurysm. Cerebral angiography showed a 4.7 x 4.9 mm basilar tip aneurysm with a 4.4 mm neck. The patient returned for treatment of the aneurysm. The left vertebral artery was catheterized with a 6 French Envoy catheter (Codman Neurovascular) and a Prowler Select Plus microcatheter (Codman Neurovascular) was advanced to the level of the aneurysm and the Pulse Rider device was placed in the P1 segments of both posterior cerebral arteries. A second microcatheter was advanced into the aneurysm and four coils were placed. The Pulse Rider required intermittent readjustment to maintain optimal position and once the aneurysm was deemed satisfactorily occluded the Pulse Rider device was detached. Final angiography showed good occlusion of the aneurysm with support from the Pulse Rider device and no branch occlusions. The patient recovered without neurologic deficit and was discharged the following day.

#### **Discussion**

Our case described the first use of the Pulse Rider device in the state of Louisiana. This device can be selected to have a Y or T configuration with prongs that can be placed in the P1 segments while the remainder of the device resides in the distal basilar artery, and contains less metal than conventional stents therefore posing less risk of thrombosis.

#### **Conclusion**

Pulse Rider is a novel device used for treatment of wide neck bifurcation aneurysms. We present the first case of its use in the state of Louisiana.



## Racheal Wolfson, MD (LSUHSC-S)

### Single-center experience with lumbar drain use for cerebrospinal fluid leak following transsphenoidal surgery

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#### Abstract

#### Background

The rates of postoperative cerebrospinal fluid (CSF) leak following transsphenoidal resection (TSR) of sellar lesions has been reported to range from 1.1 to 9.6% in the literature (Gendeh et al., 2006). Management of CSF leak typically includes conservative measures to decrease intracranial pressure, lumbar drain placement to divert CSF flow, or operative repair. We reviewed our institution's experience with TSR to determine the rate of postoperative CSF leak requiring lumbar drainage. Secondly we investigated whether the use of endoscopy or patient demographics were influencing factors.

#### Methods

A retrospective review of patients at a single institution between 2012 and 2016 who underwent TSR via open microscopic or endoscopic approach was performed.

#### Results

148 patients were identified who underwent 149 TSRs during the specified period with an average follow up of 14 months. Average age of all patients was 54 (range 12-86) with 62 males and 87 females. One hundred eight (72.5%) patients underwent an open microscopic approach compared to 41 (27.5%) via an endoscopic endonasal approach. All patients received postoperative antibiotics for infection prophylaxis as well as strict sinus precautions and an aggressive bowel regimen to decrease straining. Twenty-nine patients (19%) had intraoperative CSF leak and 9 patients (6%) experienced a CSF leak an average of 41 days postoperatively (range 0-323 days). Of the patients who experienced postoperative CSF leak, 7 (78%) had lumbar drain placed for an average of 5.9 days (range 0-15). Five (55.6%) patients with postoperative leak required surgical repair. Rate of postoperative CSF leak was 5/108 (4.6%) in the open group with and 4/41 (9.8%) in the endoscopic group (RR = 0.47, 95% CI 0.13-1.68). Three (2.8%) patients required a lumbar drain in the open group compared to 5 (12%) in the endoscopic group (RR = 0.23, 95% CI 0.05-0.91). For both techniques combined, average BMI was 35.4 for patients who required lumbar drain compared to 31.6 for patients who did not require a lumbar drain ( $p=***$ ), and 1 (10%) patient in the drain group had a history of diabetes mellitus compared to 33 (23.7%) patients without a drain (OR 0.36, 95% CI 0.04-2.92).

#### Conclusion

The rate of CSF leak is relatively low for all patients undergoing TSR. There was a significant difference between open microscopic and endoscopic approaches and the relative risk of lumbar drain placement. The use of lumbar drains at our institution is infrequent but can contribute to prolonged hospitalization as well as the possibility of increased rates of meningitis. BMI and surgical technique are potential factors influencing the likelihood of lumbar drain placement in patients undergoing transsphenoidal surgery.

**Temporal craniotomy for repair of cerebrospinal fluid fistula and encephalocele: the Ochsner experience**

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<sup>2</sup>Ochsner Health System, Department of Neurosurgery, New Orleans, LA, USA

**Abstract**

**Object**

To evaluate temporal craniotomy as a means of treatment for persistent cerebrospinal fluid (CSF) otorrhea.

**Methods**

A retrospective case series of all patients operated by the senior author between April 2008-September 2017 was compiled and reviewed.

**Results**

Twenty-one unique patients underwent a total of 24 temporal craniotomies for repair of CSF leak. Twenty patients had resolution of the otorrhea; one patient had persistent leak requiring reoperation, and another required re-operation for wound breakdown. Defects were most commonly found in the tympanic attic. The average body mass index (BMI) was 32.36, suggesting there may be a correlation between obesity and CSF otorrhea.

**Conclusions**

Patients treated with a middle cranial fossa approach for CSF otorrhea due to fistula and/or encephalocele have a favorable outcome. The technique is a serviceable addition to the neurosurgeon's armamentarium.

## **Christopher Storey, MD, PhD (LSUHSC-S)**

### **No significant difference postoperative stroke between academic and nonacademic centers after carotid endarterectomy or carotid artery stenting in high volume centers.**

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<sup>1</sup>Department of Neurosurgery, Louisiana State University Health Sciences Center, Shreveport, LA

#### **Abstract**

##### **Background**

Carotid revascularization surgery methods, carotid endarterectomy (CEA) and carotid angioplasty and stenting (CAS) carry a rare but serious complication profile. Stroke<sup>1</sup> and intracranial hemorrhage (ICH)<sup>2</sup> are two such examples of negative consequences following a carotid revascularization.

##### **Methods**

The NIS databases from 2005 to 2012 were analyzed. Our patients were selected for carotid endarterectomy and carotid angioplasty and stenting using ICD-9 codes: 38.12 and 00.63, respectively. Our primary endpoint was hemorrhagic or ischemic postoperative complications coded by ICD-9 code: 431, 432.9, and 997.02. A multivariate analysis was performed.

##### **Results**

There was no significant difference between in teaching and nonteaching hospitals or between carotid endarterectomy or angioplasty and stenting. No differences in complications of pulmonary embolism, deep venous thrombosis, pneumonia, urinary tract infection, cardiac complications.

##### **Conclusion**

Carotid artery stenting and endarterectomy can be performed at high volume centers regardless of teaching status without altering the risk profile.

**Trends in the National Resident Matching Program (NRMP) Data for graduating United States medical students matching in Neurosurgery: is Neurosurgery becoming more competitive?**

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**Abstract**

**Background**

Since neurosurgery joined the National Residency Matching Program (NRMP) in 2009, no objective analysis of neurosurgery match data and applicant characteristics has been performed.

**Objective**

To highlight trends in the neurosurgery match and to document characteristics of matched graduating U.S. medical students.

**Methods**

A retrospective observational analysis of neurosurgery match data obtained from NRMP from 2009-2017.

**Results**

During the time period studied, the number of neurosurgery programs increased from 97 to 107 ( $r = 0.95$ ) and number of offered positions increased from 191 to 218 ( $r = 0.95$ ). The number of applicants remained stable ( $r = 0.54$ ). There was no significant change in the applicant to position ratio ( $r = 0.12$ ) or match rate ( $r = -0.18$ ), both of which are measures of match competitiveness. Although the average USMLE Step 1 score for matched neurosurgery applicants increased from 239 (2009) to 249 (2016), there was a parallel increase in the average score for matched applicants across all specialties from 225 (2009) to 233 (2016). A comparison of matched and unmatched neurosurgery applicants showed that higher USMLE Step 1 scores, AOA status, and graduation from Top 40 NIH-funded schools are significant predictors of matching.

**Conclusions**

Since 2009, neurosurgery match rates have remained stable for graduating U.S medical students. Although matched neurosurgery applicants are scoring higher on USMLE Step 1 and ranking more programs, these increases have kept pace with those of overall matched applicants. Prospective applicants and student advisors will benefit from these data as they prepare for upcoming matches.

## **Incorporation of a Wellness Program in Neurosurgical Training**

A. Podet, MD, J. Wilson, MD

<sup>1</sup>Department of Neurosurgery, LSUHSC New Orleans, Louisiana, USA.

### **Abstract**

#### **Introduction**

Resident well-being has come under scrutiny in recent literature. Research emphasis has been placed on the work hour restrictions implemented by the Accreditation Council for Graduate Medical Education (ACGME) in July 2003. Unfortunately, very little research has been focused on physician health through exercise, sleep, and nutrition. Several surveys have been published confirming psychological stress and burnout encountered during training. Surgical residents have identified the reduction in exercise activities and sleep as the major detractors from job satisfaction. We sought to implement a formal physical fitness and well-being curriculum within the neurosurgery department at our institution. After 4 months of gradual implementation, we assessed the feasibility, benefits, and effectiveness of the program, as well as barriers to participation.

#### **Methods**

The well-being curriculum was implemented gradually, starting with monthly 'wellness days' consisting of leisure team-building and social activities (kayaking, yoga) in order to strengthen resident cohesion and ensure program stability. We then incorporated weekly on-site low impact aerobic activities (ex. spin class) following our blocked conference time. Fitbit actigraphy monitors were distributed to all residents to promote physical activity and sleep hygiene. Anonymous surveys consisting of multiple choice and open response questions were administered to all nine residents after four months.

#### **Results**

100% (9/9) of residents agreed or strongly agreed that resident wellness is important for neurosurgical training. 89% (8/9) agreed or strongly agreed that physical fitness is important for neurosurgical training. 78% (7/9) of residents felt that the wellness program had a beneficial effect on their neurosurgical training, while 66% (6/9) reported improved job satisfaction since initiation of the wellness curriculum. Participation in monthly 'wellness days' was >90%, while participation in weekly fitness activities was <50%. Among female residents, participation was <10% in weekly fitness activities. Clinical responsibilities (66%) and fatigue (55%) were the most cited barriers to participation.

#### **Discussion**

Despite unanimous support of the wellness program, voluntary resident participation in fitness activities was inconsistent. Still, our results indicate that incorporation of a formal wellness program in neurosurgical training is feasible, even for such a small (nine residents) and diverse group of residents (33% women, 55% married). Finding activities suitable to a wide range of athletic abilities and interests was challenging. Other challenges included coverage across various clinical sites during activities and limited faculty participation. A strategy for the success of our program was to involve residents' significant other in wellness activities. Program cohesion and optimal resident health were felt to be the most important aspects of the wellness curriculum. The results of our pilot program indicate incorporation a formal resident wellness program may be an effective measure in preventing resident isolation and burnout, while promoting overall health and physical fitness.

**Morphometrical and Radiological Predictive Feasibility in Clipping of the Superior Hypophyseal Segment Aneurysms from Contralateral Subfrontal and Supraorbital approach: Pilot Study**

Jai Deep Thakur, Devi Prasad Patra, Amey R Savardekar, Mai Vu, Anil Nanda, Bharat Guthikonda

<sup>1</sup>Department of Neurosurgery, Louisiana State University Health Science Center, Shreveport.

**Abstract**

**Introduction**

Superior Hypophyseal segment aneurysms are medially (Superior/Inferior) projecting aneurysms. Microsurgical clipping of the aneurysms from the ipsilateral side is often encountered with incomplete visualization of the aneurysm anatomy thereby necessitating a blind clipping approach. Visualization of this segment from the contralateral side has been described to show the anatomy much better however selection process of such cases has to be streamlined. The literature does not describe the synchronicity of the morphometric and radiological parameters used for such approaches. The objective of our pilot study was to elucidate if any radiological features could assist the surgeon in decision making and obtain morphometrics of the contralateral approach.

**Methods**

Ten sides of Normal brain MRI's were analyzed for radiological parameters and similar extrapolation of the later was done on fixed injected cadaveric heads. Clipping angle was defined by the angle made between the inferior tangent of contralateral optic nerve, superior tangent of the ipsilateral ON, both of which were incorporating the contralateral hypophyseal segment of the ICA. In addition we measured interoptic triangle area, retraction feasible after mobilization of the contralateral optic nerve by drilling the superior optic canal and releasing the falciform ligament. Measurements were made using digital calipers.

**Results**

In the radiological assessment, means of the interoptic distance, Chiasm-Sphenoidale distance, area of triangle, clipping angle right/left side, optic/carotid distance from midline ratio right/left were 28.12 (25.5-30) mm, 4.9 (3.3-7.6) mm, 69.13 (48.96-96.14) mm<sup>2</sup>, 22.32/21.54 degrees, 0.66/0.62 respectively. Clipping angle relationship with the area of triangle and Optic Carotid ratio was computed using line chart analysis as well as linear chart plot regression analysis. Increased clipping angle was noted with increasing area of interoptic triangle. No prominent relationship was noted between clipping angle and Optic carotid ratio.

Cadaveric morphometric analysis revealed the interoptic distance, Chiasm-Sphenoidale distance, area of triangle to be 18.59 mm, 3.9 mm, 36.25 mm<sup>2</sup> respectively. Clipping angle pre and post mobilization of the optic nerve as 9.5 and 17.5 degrees respectively. Drilling of the medial roof of optic canal along with the tuberculum sellae and limbus sphenoidale increased the chiasmatic-sphenoidale distance from 3.9 mm to 6.7 mm. Hypophyseal segment ICA exposed in Antero posterior dimension and circumferential exposure before and after optic nerve mobilization was 4.53 vs 9.3 mm and 4.06 vs 5.78 mm respectively. Supraorbital approach was followed with sub frontal approach which did not increase the surgical corridor of clipping however there was a subjective ease of skull base bone drilling with the sub frontal craniotomy.

**Conclusion**

Preliminary data suggests a relationship of the area of triangle with the potential angle of clipping measured radiologically. Adequate mobilization of the optic nerve is feasible from the contralateral approach to improve the surgical access of the contralateral hypophyseal segment. Drilling of the tuberculum sellae/limbus sphenoidale may increase the aneurysm clip landing zone.

## **Ultrasound of Optic Nerve Sheath Diameter to Monitor Intracranial Pressure**

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### **Abstract**

#### **Introduction**

Optic nerve sheath diameter (ONSD) has been established as a reliable means of detecting elevated intracranial pressure (EICP). The gold standard for diagnosis of EICP is invasive intracranial monitoring. Comparatively, sonographic studies to determine ONSD are easily performed, cost-effective, and widely available. Many studies have established the safety and efficacy of optic nerve ultrasonography as a rapid, reliable, and accurate diagnostic tool for triaging patients. There is little data available on how fluctuations in ICP translate to changes in ONSD. This study aims to determine how the dynamic physiology of ICP affects ONSD in attempts to develop potential clinical applications of this diagnostic tool.

#### **Methods**

This single-site, prospective cohort study of adult patients at UMCNO is evaluating effects of fluctuating ICP on ONSD. Patients over the age of 18 requiring placement of a ventriculostomy or ICP monitor were included. Patient data was collected at 30 minute intervals for at least 4 consecutive measurements, and data points included ICP, bilateral ONSD, and any intervention causing fluctuations in ICP.

#### **Results**

A total of 10 patients underwent an average of 6.3 consecutive measurements of ONSD. The average ONSD was 4.18mm. 4 patients had at least one measurement of an increased ONSD >5mm; 1 patient had normal ICPs, but the other 3 patients with ONSD ranging from 5.5mm- 6.5mm had EICP. 6 patients had at least one EICP >20mmHg. 2 of the 6 patients displayed sustained EICP secondary to intracranial pathology; the other 4 only experienced transient EICP during an episode of agitation/manipulation with expedient ICP normalization. Both patients with sustained EICP displayed increased ONSD (5.9mm and 6.5mm). Of the 4 patients with transient EICP, 3 had normal ONSD, while 1 had a slight increase in ONSD (5.5mm) immediately following the episode of agitation that subsequently normalized. The transient EICPs in these four patients were attributed to physiologic, not pathologic, events.

#### **Conclusions**

Our preliminary results confirm: pathologic, sustained EICPs are associated with increased ONSD >5mm while transient, physiologic EICP do not significantly impact ONSD. Further study is warranted to understand the variability of anatomy and physiology of ONSD. Although ultrasonography of ONSD will not replace gold standard invasive ICP monitoring, it remains a potentially rapid, reliable, and cost-effective means of screening for EICPs in an emergency setting.

## **Tina Phan (LSUHSC-S)**

### **Structural Connectivity and DTI Metrics in Temporal Lobe Epilepsy**

Tina Phan<sup>1</sup> ; Kevin S. Holly<sup>1</sup> , PhD; Phillip T. Holly<sup>1</sup> ; Christina Ledbetter<sup>1</sup> , PhD; Eduardo Gonzalez-Toledo<sup>3</sup>, MD, PhD; and Hai Sun<sup>1\*</sup> MD, PhD

<sup>1</sup> Department of Neurosurgery, <sup>2</sup>Department of Biological Sciences,<sup>3</sup>Department of Radiology, Louisiana State University Health Sciences Center Shreveport, Shreveport, LA, USA

#### **Abstract**

##### **Background**

Epilepsy is a disorder of the brain that is characterized by transient and recurrent seizures. The most common form of partial epilepsy is temporal lobe epilepsy (TLE). Chronic seizures not only affect patients cognitively but also lead to neurobiological, psychological, and social consequences. Patients with TLE are often at risk for memory loss and mood difficulties if early diagnosis and suitable treatment are not provided.

##### **Methods**

A retrospective study was done with a novel diffusion tensor imaging (DTI) analysis and deterministic tractography to assess the structural connectivity of white matter tracts within 132 regions of interest for TLE. We compared normal controls (N=39) and patients with TLE (N=25) along diffusion tensor imaging (DTI) metrics, such as fractional anisotropy (FA) and mean diffusivity (MD).

##### **Results**

Our research shows that there was a significant decrease in the microstructural integrity (FA) within the temporal lobe and cerebellum, which may represent axonal degeneration possibly due to excitotoxicity from excessive stimulation. In addition, there was lower connectivity strength within temporal lobe when comparing patients with TLE to the control.

##### **Conclusion**

These results provide details on the structural and connectivity abnormalities within the brain secondary to long-term epileptic discharges. We were able to visualize the abnormalities with our method and hope to be able to standardize this noninvasive neuroimaging technique to aid in the screening and diagnosis of epilepsy.



**The maxillary artery and its variants: an anatomical study with neurosurgical applications**

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**Abstract**

**Background**

The maxillary artery (MA) has gained attention in neurosurgery particularly in cerebral revascularization techniques, intracranial endonasal approaches and endovascular procedures.

**Objectives**

To describe and illustrate the anatomy of the MA and its neurosurgical importance in a detailed manner. Methods Six cadaveric heads (12 MAs) were injected with latex. The arteries and surrounding structures were dissected and studied using microsurgical techniques. The dimensions, course and branching patterns of the MA were recollected. In addition, 20 three-dimensional reconstruction CT head and neck angiograms (3D CTAs) of actual patients were correlated with the cadaveric findings.

**Results**

The MA can be divided in three segments: mandibular, pterygoid and pterygopalatine. Medial and lateral trunk variants regarding its course around the lateral pterygoid muscle can be found. The different branching patterns of the MA have a direct correlation with the course of its main trunk at the base of the skull. Branching and trunk variants on one side do not predict the findings on the contralateral side.

**Conclusion**

In this study the highly variable course, branching patterns and relations of the MA are illustrated and described in human cadaveric heads and 3D CTAs. MA 3D CTA with bone reconstruction can be useful preoperatively for the identification of the medial or lateral course variants of this artery, particularly its pterygoid segment, which should be taken into account when considering the MA as a donor vessel for an EC-IC bypass.

## **Hugo St-Hilaire, MD, DDS (LSUHSC-NO)**

### **Contemporary management of complex composite cranial defects**

Hugo St-Hilaire, MD, DDS, FACS<sup>1</sup>, Gerhard "Sol" Mundinger, MD <sup>1</sup>; Mark W. Stadler, MD<sup>1</sup>

<sup>1</sup> Plastic & Reconstructive Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, Louisiana, USA.

#### **Abstract**

Traditional calvarial reconstruction using autogenous bone graft and local flaps produce predictably good results. Acquired defects resulting from high velocity trauma, chronic infection, ablative or corrective surgery or therapeutic radiation presents a unique set of challenges. Evolution in the reconstructive philosophy with a low threshold for free tissue transfer, along with improvements in virtual surgical planning and fabrication of custom implants allows for new option in those difficult clinical scenarios. Furthermore, effective management of the paranasal sinuses is paramount to a successful reconstruction. This presentation will outline common free flaps used along with reconstructive strategies for success.

## Sebastian Koga, MD (Ochsner Health)

### Applications of White Matter Tractography in Subcortical Surgery

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<sup>1</sup> UQ-Ochsner Medical School

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#### Abstract

##### Background

To summarize the technological advances and limitations in surgical planning using dynamic three dimensional mapping of brain anatomy based on MRI and diffusion tensor imaging. Subcortical lesions present numerous challenges in diagnostic imaging and surgical approach. Conventional surgical techniques often cause neurological injury including motor, sensory, and cognitive deficits. This paper explores the use 3D DTI images in planning transsulcal parafascicular approaches and analyzes post-operative outcomes.

**METHOD:** A prospective study of 20 patients undergoing resection of subcortical lesions was undertaken using transsulcal parafascicular approaches. Three dimensional fiber tract maps were created from DTI MRI images and these were analyzed in a dynamic fashion using automated computational models and dynamic manipulation of the fiber tracts. The concept of "white matter tract recovery" was developed by studying post-operative radiographic appearance and clinical outcomes. **RESULTS:** High-fidelity tractography allowed the surgeon to simulate multiple approach and obtain the optimal corridor. Anatomical orientation and pre-operative planning were significantly enhanced. Recovery of white matter tracts was noted in all cases, even in congenital lesions. Computerized automation generated some erroneous labeling in the fibers of visual system, requiring the surgeon's input for neuroanatomical labeling and definitions. Overall, resection volume was increased, while surgical time and neurological deficits were reduced. **CONCLUSION:** The use of dynamic 3D tractography maps enhances spatial reasoning in neurosurgery. Current technology requires verification of the neuroanatomy by the surgeon but the software has the potential to increased procedural safety and reduce neurological deficits. The technology offers yet another way of quantifying post-operative success