CONFERENCE PROGRAM
**Hands-On Course & Conference Reception Agenda**

**Friday, January 17**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>12:30-1:00pm</td>
<td>Course Registration/Lunch</td>
<td>Hutchinson 6001</td>
</tr>
<tr>
<td>1:00-1:50pm</td>
<td>Course Lectures</td>
<td>Hutchinson 6001</td>
</tr>
<tr>
<td>1:50-2:00pm</td>
<td>Coffee Break</td>
<td>Hutchinson 6001</td>
</tr>
<tr>
<td>2:00-5:00pm</td>
<td>Course Lab</td>
<td>Labs A-D (3rd Floor)</td>
</tr>
<tr>
<td>7:00-8:00pm</td>
<td>Cocktail Reception</td>
<td>Crescent View</td>
</tr>
<tr>
<td>8:00-10:00pm</td>
<td>Welcome Banquet</td>
<td>Crescent View</td>
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</tbody>
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**Course Faculty**

<table>
<thead>
<tr>
<th>Honored Guest:</th>
<th>R. Shane Tubbs, PhD</th>
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<tbody>
<tr>
<td>Daniel Barrow, MD</td>
<td>Tulane University</td>
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<td>Emory University</td>
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<tr>
<th>CJ Bui, MD</th>
<th>Peter Amenta, MD</th>
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<tr>
<td>Ochsner Health</td>
<td>Tulane University</td>
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<tr>
<th>Marcus Ware, MD, PhD</th>
<th>Joseph Keen, DO</th>
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<th>Gabriel Tender, MD</th>
<th>Jerome Volk, MD</th>
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<tr>
<td>LSUHSC-NO</td>
<td>LSUHSC-NO</td>
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<tr>
<th>Christopher Maulucci, MD</th>
<th>Aaron Dumont, MD</th>
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<tr>
<td>Tulane University</td>
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<th>Christina Notarianni, MD</th>
<th>Clarence Greene, MD</th>
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<tr>
<td>LSUHSC-Shreveport</td>
<td>LSUHSC-NO</td>
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<tr>
<th>Jorge Alvernia, MD</th>
<th>David Cavanaugh, MD</th>
</tr>
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<tbody>
<tr>
<td>Brain and Spine Associates</td>
<td>Spine Institute of Louisiana</td>
</tr>
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| Peter Amenta, MD                 |                                   |
|----------------------------------|                                   |
| Tulane University                |                                   |

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*Course location: Tulane SOM Hutchinson Memorial Building; 1430 Tulane Ave.; New Orleans, LA 70112.*

**Dinner location: The Ritz-Carlton, 921 Canal St.; New Orleans, LA 70112.*
<table>
<thead>
<tr>
<th>Time</th>
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<th>Location</th>
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<tbody>
<tr>
<td>7:00-8:00am</td>
<td>Registration &amp; Breakfast</td>
<td>Audubon</td>
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<tr>
<td>7:30-8:20am</td>
<td>Oral Poster Session</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>8:20-9:30am</td>
<td>Functional &amp; Socioeconomics Session</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>9:30-9:40am</td>
<td>Coffee Break I/ Exhibitors</td>
<td>Audubon</td>
</tr>
<tr>
<td>9:40-10:00am</td>
<td>Coding Update</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>10:00-11:10am</td>
<td>Vascular Session</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>11:10-11:20am</td>
<td>Coffee Break II/ Exhibitors</td>
<td>Audubon</td>
</tr>
<tr>
<td>11:20am-12:00pm</td>
<td>Spine Session I</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>12:00-1:00pm</td>
<td>Lunch</td>
<td>Fountainbleau</td>
</tr>
<tr>
<td>12:10-1:00pm</td>
<td>KEYNOTE SPEAKER: Daniel Barrow, MD</td>
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<tr>
<td></td>
<td>&quot;Pedagogy: Foundations and Future&quot;</td>
<td></td>
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<tr>
<td>1:00-1:40pm</td>
<td>Spine Session II</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>1:40-2:40pm</td>
<td>General Neurosurgery Session</td>
<td>Broadmoor</td>
</tr>
<tr>
<td>2:40-2:50pm</td>
<td>Closing Remarks</td>
<td>Broadmoor</td>
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<tr>
<td>2:50-3:15pm</td>
<td>Business Meeting</td>
<td>Fountainbleau</td>
</tr>
<tr>
<td>3:30-7:00pm</td>
<td>7th Annual Softball Tournament</td>
<td>The Fly, Audubon Park</td>
</tr>
</tbody>
</table>
Joint Providership Accreditation Statement

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the AANS and LANS. The AANS is accredited by the ACCME to provide continuing medical education for physicians.

The AANS designates this live activity for a maximum of 9.50 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Joint Providership Disclaimer

The material presented at the 45th Annual Meeting has been made available by the LANS and the AANS for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method or procedure appropriate for the medical situations discussed, but rather it is intended to present an approach, view, statement or opinion of the faculty, which may be helpful to others who face similar situations.

Neither the content (whether written or oral) of any course, seminar or other presentation in the program, nor the use of a specific product in conjunction therewith, nor the exhibition of any materials by any parties coincident with the program, should be construed as indicating endorsement or approval of the views presented, the products used, or the materials exhibited by the LANS and jointly provided by the AANS, or its Committees, Commissions or Affiliates.

Neither the AANS nor the LANS makes any statements, representations or warranties (whether written or oral) regarding the Food and Drug Administration (FDA) status of any product used or referred to in conjunction with any course, seminar or other presentation being made available as part of the 45th Annual Meeting. Faculty members shall have sole responsibility to inform attendees of the FDA status of each product that is used in conjunction with any course, seminar or presentation and whether such use of the product is in compliance with FDA regulations.

CME Evaluation & Verification

Please go to https://www.surveymonkey.com/r/2020LANSEVAL to complete the meeting evaluation, we appreciate a few minutes of your time in completing the evaluation as they are reviewed and utilized for future planning. Once you have completed the evaluation you will be directed to complete your CME verification form. Once both items are complete, your CME certificate will be emailed to you within 3-4 weeks of the completion of the meeting.
State new techniques in cranial and spinal neurosurgery by highlighting new and less invasive surgical techniques.

Discuss pertinent socioeconomic topics impacting Louisiana neurosurgeons and their region as well as the United States by describing current issues.

Appraise residents and fellows on the current state of private practice neurosurgery by involving private neurosurgeons in the state and allowing them to share the evolution of their practice.

The following persons planned or contributed to the planning of this CME activity:

Erin Fannin  
CJ Bui, MD

Laney Robein  
Aaron Dumont, MD

Bharat Guthikonda, MD  
R. Shane Tubbs, PhD

The Louisiana Neurosurgical Society would like to thank the following companies for their support of the 45th Annual Meeting:

Abbott  
Aesculap, Inc.  
Boston Scientific  
Brain Lab  
DePuy Synthes  
Duramed, Inc.  
Globus Medical

Integra LifeSciences  
Integrity Surgical  
LA Rehab Products  
Medtronic  
NeuroAlert  
Ochsner  
Penumbra

PMT Corporation  
SI-Bone  
Southern Neuro Specialty  
Spine Wave  
Stryker  
The Armamentarium, Inc  
ZimmerBioMet/Relentless

The Louisiana Neurosurgical Society would like to thank the following company for their support of the 45th Annual Meeting:

The Armamentarium, Inc.  
Stryker
CME Accreditation

The AANS and the Louisiana Neurosurgical Society control the content and production of this CME activity and attempt to ensure the presentation of balanced, objective information. In accordance with the Standards for Commercial Support established by the Accreditation Council for Continuing Medical Education (ACCME), faculty, abstract reviewers, paper presenters/authors, planning committee members, staff, and any others involved in planning the educational content and the significant others of those mentioned must disclose any relationship they or their co-authors have with commercial interests which may be related to their content. The ACCME defines “relevant financial relationships” as financial relationships in any amount occurring within the past 12 months that create a conflict of interest.

Those who have disclosed a relationship* with commercial interests are listed below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Disclosure</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jared Brougham, MD</td>
<td>Stock or Shareholder</td>
<td>Medtronic</td>
</tr>
<tr>
<td>Daniel Denis, MD</td>
<td>Globus Medical</td>
<td>Consultant Fee</td>
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<tr>
<td>Lora Kahn, MD</td>
<td>Medtronic</td>
<td>Industry Grant Support</td>
</tr>
<tr>
<td>Christopher Maulucci, MD</td>
<td>Globus Medical</td>
<td>Consultant Fee</td>
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</table>

Those who reported they do not have any relationships with commercial interest:

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<thead>
<tr>
<th>Name</th>
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<tr>
<td>Joseph Adedigba</td>
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<tr>
<td>Christopher Carr, MD</td>
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<td>Matthew Hefner, MD</td>
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<td>Kevin Morrow, MD</td>
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<td>Anthony Sin, MD</td>
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<td>Cassidy Werner</td>
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<td>Nimer Adeeb, MD</td>
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<td>David Cavanaugh, MD</td>
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<td>Roger Smith, MD</td>
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<td>Garrett Whipple, MD</td>
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<td>Jason Cormier, MD</td>
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<td>Joe Iwanaga, PhD</td>
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<td>Rachael Peterson, MD</td>
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<tr>
<td>Casey Spinelli</td>
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<td>Elizabeth Wild, MD</td>
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<td>Clifford Crutcher, MD</td>
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<td>Andrew Janssen, MD</td>
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<td>Adam Podet, MD</td>
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<td>Jeffrey Stewart, MD</td>
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<td>Pervez Khan, MD</td>
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<td>John Wilson, MD</td>
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<td>James Barry, MD</td>
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<td>Erin Fannin, MSPH</td>
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<td>Mansour Mathkour, MD</td>
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<td>Tyler Scullen, MD</td>
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<td>Derrick Umansky, MD</td>
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<td>CJ Bui, MD</td>
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<td>Joshua Hanna, MD</td>
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<td>Erin McCormack, MD</td>
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<td>Jessica Shields, MD, PhD</td>
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<td>Jerome Volk, MD</td>
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*Relationship refers to receipt of royalties, consultanship, funding by research grant, receiving honoraria for educational services elsewhere, or any other relationship to a commercial interest that provides sufficient reason for disclosure.
Past Presidents

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Name</th>
<th>Years</th>
<th>Name</th>
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<tbody>
<tr>
<td>1975</td>
<td>1993</td>
<td>Lloyd Megison, MD</td>
<td>1975-1994</td>
<td>Donald Smith, MD</td>
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<td>1977</td>
<td>1997</td>
<td>Thomas Flynn, MD</td>
<td>1977-1998</td>
<td>Thomas Bertuccini, MD</td>
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<td>1978</td>
<td>1999</td>
<td>David Kline, MD</td>
<td>1978-2000</td>
<td>David Cavanaugh, MD</td>
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<td>1980</td>
<td>2001</td>
<td>George Beach, MD</td>
<td>1980</td>
<td>Babson Fresh, MD</td>
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<td>1983</td>
<td>2003</td>
<td>Anthony Loppolo, MD</td>
<td>1983-2003</td>
<td>Deepak Awasthi, MD</td>
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<tr>
<td>1984</td>
<td>2006</td>
<td>John Schumacher, MD</td>
<td>1984-2006</td>
<td>Anil Nanda, MD, MPH, FACS</td>
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<tr>
<td>1985</td>
<td>2008</td>
<td>Heinz Faludi, MD</td>
<td>1985-2008</td>
<td>Patrick Juneau, MD</td>
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<tr>
<td>1986</td>
<td>2009</td>
<td>John Clifford, MD</td>
<td>1986-2009</td>
<td>Erich Wolf, MD, PhD, FACS</td>
</tr>
<tr>
<td>1987</td>
<td>2012</td>
<td>Carlos Gorbitz, MD</td>
<td>1987-2012</td>
<td>Brian Willis, MD, FACS</td>
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<td>1988</td>
<td>2014</td>
<td>Raeburn Llewellyn, MD</td>
<td>1988-2014</td>
<td>Frank Culicchia, MD</td>
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<td>1989</td>
<td>2016</td>
<td>Richardo Leoni, MD</td>
<td>1989-2016</td>
<td>Najeeb Thomas, MD</td>
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<tr>
<td>1990</td>
<td>2017</td>
<td>Jose Bermudez, MD</td>
<td>1990-2017</td>
<td>Bharat Guthikonda, MD</td>
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<td>1991</td>
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7th Annual “Battle of the Brains” Softball Tournament

All attendees are invited to gather at ‘The Fly’ immediately following the conference for the 7th Annual “Battle of the Brains” Softball Tournament. Games will start between 3:00-3:30pm.

Directions from the Ritz-Carlton to ‘The Fly’ (6500 Magazine St)

- From the Ritz, take a right on Canal St.
- Take a left on Elk Place
- Take the second right onto Tulane Ave.
- Make a U-turn at S. Derbigny St. onto Tulane Ave.
- Take the first right onto S. Claiborne Ave.
- Keep left at the fork to continue on US-90W/ S. Claiborne Ave.
- Turn left onto State St.
- Turn right onto Magazine St.
- The Audubon Zoo will be on your left.
- Pass the zoo and take the first left—this road wraps around behind the zoo and will lead you to the softball fields.

LANS softball is located on Field B or E.
Guest Speaker: Nicole Reed, CPC, CPMA, COSC  
**Ochsner Health System**

Nicole has seventeen years of experience in the healthcare industry, with fourteen years of coding experience and ten years in neurosurgery coding. She has worked in front office, medical records, coding and currently a Coding educator consultant for Ochsner Health system. She is a certified medical coder, with a certification in orthopedic surgery and a certified professional medical auditor.

Nicole works with physicians on documentation, correct coding of complex surgical cases, and preventing denials. She reviews and educates coders on accurate and quality coding. She also reviews coding denials and provides education to physicians and coders on payor specific coding issues.

Keynote Speaker: Daniel Barrow, MD  
**Emory University**

Daniel Louis Barrow graduated magna cum laude from Westminster College and received his MD degree from Southern Illinois University School of Medicine. He completed his general surgery internship and neurosurgical residency at Emory University Affiliated Hospitals and obtained his neurology training at Massachusetts General Hospital. Upon completing his neurosurgical residency, he completed a fellowship in cerebrovascular surgery at the Mayo Clinic in Rochester, Minnesota, and obtained additional training at the Barrow Neurological Institute in Phoenix, Arizona. He is the MBNA/Bowman Professor and Chairman of the Department of Neurosurgery and Director of the Emory Stroke Center at Emory University School of Medicine.

Dr Barrow has authored more than 250 scientific articles and chapters in medical textbooks. He has authored or edited 14 monographs, including a major textbook of neurosurgery, The Practice of Neurosurgery. He has been a visiting professor at major universities throughout North America, Europe, Africa, and Asia. His research interests have focused on cerebrovascular disease and stroke. During his career in medicine, he has won many awards, including induction into the honorary medical society, Alpha Omega Alpha. In 1997, Dr Barrow received the Distinguished Alumnus Award from Southern Illinois University School of Medicine, and in 1998, he received the Alumni Achievement Award from Westminster College. He was the 2010 Honored Guest of the Congress of Neurological Surgeons.

Dr Barrow has been active in organized neurosurgery, holding a variety of leadership and editorial positions. He was on the Executive Committee of the CNS from 1989-2001 and served as Scientific Program Committee chairman (1991), Annual Meeting Committee chairman (1992), Secretary (1992-1995), and President (1999-2000). He was President of the Georgia Neurosurgical Society and member of the AANS/CNS Washington Committee. Dr Barrow has been on the editorial boards of Clinical Neurosurgery, NEUROSURGERY, Neurosurgical Consultations, Neurologia Medico Chirurgica, The Journal of the Korean Neurosurgical Society; has coedited Contemporary Neurosurgery (1985-1995); edited Perspectives in Neurological Surgery (1989-1992); and chaired the AANS Publications Committee. He has served as Director of the American Board of Neurological Surgery and as Secretary (2008-2011) as well as chairman of the ABNS. He is past Vice President and Treasurer of the American Academy of Neurological Surgeons.

Dr Barrow is an avid outdoorsman who enjoys hunting, fishing, and other outdoor sporting activities. He is married to Mollie Winston Barrow, a practicing oral and maxillofacial surgeon. They live in Atlanta and have three children.

Source: The Congress of Neurological Surgeons
LANS Board of Directors

In 2019, LANS members voted to amend the bylaws to establish a Board of Directors. Each member will serve a two-year term. Advantages of having a LANS BOD include:

1: Quick decision making capabilities regarding socioeconomic and other issues that would affect neurosurgeons in Louisiana

2: Institutional memory that would allow some continuity as the officers rotate

3: Representation from throughout the state

4: Administrative continuity, including the development of a headquarters (actual or electronic) that would allow all important documents, budget, and other pertinent information to be stored in a particular consistent location

The BOD consists of the following members:

- **President** CJ Bui, MD
- **Secretary-Treasurer** Aaron Dumont, MD
- **LANS Past President** Bharat Guthikonda, MD
- **Member at Large** Anthony Sin, MD
- **Resident Member** J. Frank Berry, MD

Dr. Bui is in his first term as President of LANS, previously serving as Secretary of LANS from 2017 to 2019. He is currently System Chairman of Neurosurgery for Ochsner Health System, Co-Director of Ochsner Neuroscience Institute, and Program Director of the Ochsner Clinic Foundation-Tulane University Neurosurgery Program. Dr. Bui is board certified by the American Board of Neurological Surgery. He is also an elected board member on the Ochsner Health System’s Board of Directors.

Dr. Bui was born in Vietnam, but grew up in New Orleans, graduating from the University of New Orleans and LSU Health Sciences Center School of Medicine. He completed his neurosurgical residency from SUNY Upstate Medical Center in Syracuse, New York. Dr. Bui is fellowship-trained in pediatric neurosurgery from the University of Alabama Birmingham Children’s Hospital. He has academic appointments of Associate Professor of Neurosurgery at Tulane University and University of Queensland. He joined Ochsner Health System in 2007.

Dr. Bui’s clinical interests include pediatric neurosurgery, neuro-endoscopy, epilepsy, cranial robotics, and minimally invasive spine surgery. He performed the first in-utero spina bifida repair in the Gulf South region. Dr. Bui has published and presented extensively on congenital neuro-pathologies such as spina bifida, Chiari I malformations, tethered cord, and encephaloceles. Additional interests include global neurosurgery development; he is involved in educational exchange programs with multiple neurosurgery departments in Asia.

Source: CJ Bui, MD
Secretary-Treasurer: Aaron Dumont, MD
President-Elect

Dr. Dumont serves as the Director of The Tulane Center for Clinical Neurosciences as well as the Charles B. Wilson Professor and Chair of the Department of Neurosurgery at Tulane University School of Medicine. He is a board-certified neurosurgeon who completed his residency at the University of Virginia as well as a fellowship in cerebrovascular, skull base and endovascular neurosurgery at the University of Virginia. He has interests in all areas of pediatric and adult neurosurgery including spine disorders, movement disorders, epilepsy, stroke and cerebrovascular disease, peripheral nerve disease, radiosurgery and tumors of the brain and spine. He is dually trained in open traditional microsurgery and minimally invasive endovascular surgery for vascular disorders of the brain and spine. He has active neurosurgical research interests and has published and presented extensively with more than 200 publications and more than 175 national and international presentations. He is a member of the Editorial Board of the Journal of Neurosurgery (the specialty’s leading scientific journal) and serves on the Editorial Boards of several other academic journals. Dr. Dumont received his MBA in 2016 from the University of Texas at Dallas/UT Southwestern Medical Center focused on Medical Management and has interests in addressing obstacles and challenges to ensure that academic medicine can sustainably thrive in the future.

Source: https://medicine.tulane.edu/departments/neurosurgery-tulane-center-clinical-neurosciences-debakey/faculty/aaron-s-dumont-md-mba

Member: Bharat Guthikonda, MD
Past President

Dr. Guthikonda was President of LANS in 2018-2019. Currently, he is Professor and Chairman of Neurosurgery at University Neurosurgery, which he joined in 2007. He received a Bachelor of Science in Biology and a Bachelor of Arts in Mathematics from Cornell University, where he graduated Magna cum Laude and in the top three percent of his class. He received his professional training at Baylor College of Medicine. He served as a fellow and instructor at the University of Cincinnati. He is the Director of the Department of Neurosurgery Division of Skull Base Surgery. Dr. Guthikonda taught a Minimally Invasive Cranial Microsurgery Course and Codman Cranial Training Course. He has conducted extensive research in the use of radioactive substances in research, diagnosis, and treatment of brain tumors.

Source: https://www.lsuhs.edu/departments/school-of-medicine/neurosurgery/faculty

Member At Large: Anthony Sin MD
Practicing Neurosurgeon

Dr. Anthony Sin joined University Neurosurgery in 2008 after completing his Neurosurgery Residency at LSU Health Shreveport and a spine fellowship at the University of Tennessee in Memphis. He has also completed a fellowship in Neurotrauma at Mount Sinai School of Medicine, an internship in Internal Medicine at Emory University, and an additional internship in General Surgery at the State University of New York in Stony Brook. His clinical interests include minimally invasive spinal instrumentations and complex spinal disorders, including deformity corrections and spinal tumors.

Source: https://www.lsuhs.edu/departments/school-of-medicine/neurosurgery/faculty
Preliminary Observations of a Murine Mesial Temporal Lobe Epilepsy Model Using Kainic Acid

Matthew Hefner, MD (LSUHSC-S)  
Department of Neurosurgery, Louisiana State University Health Sciences Center, Shreveport, Louisiana

Introduction

Mesial temporal lobe epilepsy (mTLE) is the most common form of focal epilepsy in adults, and is particularly difficult to treat pharmacologically. As a result, animal models have been developed to study the pathology of this disease by various methods. Intrahippocampal kainic acid (KA) administration is a known method, which induces spontaneous epileptogenesis by acting as an agonist for neuronal kainate receptors.

Objectives

The aim of this project is to develop a reliable murine model for mTLE which induces persistent epileptogenesis. We currently use 4-aminopyridine (4-AP) to pharmacologically induce seizure activity, which results in a predictable but temporary seizure response. The persistent epileptogenesis provided by KA administration will more closely mimic the spontaneous seizure activity associated with mTLE. In addition, we aim to examine KA induced seizures with respect to time and total events.

Methods

To establish a mTLE murine model, kainic acid was injected to attempt to induce epileptogenesis in two Kv1.1 (voltage-gated potassium channel 1.1) heterozygous mice. Intrahippocampal injections were done in conjunction with depth electrode implantation for recording. Solutions of kainic acid were made by dissolving KA in 0.9% sterile saline (10mM). For each mouse, a single 100nL dose of kainic acid was stereotactically injected into the dorsal hippocampus under general anesthesia. Mouse 1 was injected in the right hippocampus, and mouse 2 was injected in the left hippocampus. Post-injection electroencephalography (EEG) coupled with video monitoring was done for a total of 11 sessions, each session lasting 3-4 hours. Recording sessions were done out to 35 days post-injection. Seizure activity was classified as electrographic seizures (ES), which do not demonstrate behavioral changes, while seizures with behavioral changes (convulsive) were classified according to Racine’s scale (RS 1-5).

Results

Following hippocampal KA injection, a total of 80 seizure events were recorded. 65 seizures (81%) were electrographic seizures, and most convulsive seizures were RS-3 seizures (single forelimb clonus). Only one seizure was captured in early recordings (post-injection day 1). All other seizures were captured after day 20. Mouse 1 had a total of 64 seizures, while Mouse 2 had a total of 16 seizures.

Conclusion

Through the direct hippocampal injection of kainic acid into Kv1.1 mice, we were able to successfully observe seizure activity on video-EEG. Moreover we have demonstrated a sufficient dose to inject and have observed a general temporal timeline for expected seizure activity. Mice will be sacrificed and histology will be done to confirm injection location as well as changes on the cellular and molecular level. Upcoming endeavors should include injecting more mice, specifically the parvalbumin (PV) expressing mice. In addition, we plan to inject serially higher doses of kainic acid (150, 200nL) to determine the most effective dose. Ultimately, we plan to couple this technique with optogenetic techniques to better study mTLE and identify potential therapeutic targets. This could, in turn, better guide both pharmacologic and surgical treatment of mTLE.
Nimer Adeeb, MD (LSUHSC-S)

The utility of platelet function testing prior to Pipeline Embolization Device placement: A multicenter cohort study

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

Abstract

Introduction

Thromboembolic complications constitute a significant source of morbidity following neurointerventional procedures. Flow diversion utilizing the Pipeline Embolization Device (PED) for the treatment of intracranial aneurysms necessitates the use of dual anti-platelet therapy to reduce this risk. The utility of platelet function testing prior to PED placement remains controversial.

Methods

A retrospective review of prospectively maintained databases at three academic institutions was performed from the years 2009 to 2016 to identify patients with intracranial aneurysms treated with PED placement. Clinical and radiographic data were analyzed with emphasis on thromboembolic complications and clopidogrel responsiveness.

Results

A total of 402 patients underwent 414 PED procedures for treatment of 465 intracranial aneurysms. Thromboembolic complications were encountered in 9.2% of procedures and were symptomatic in 5.6%. Clopidogrel non-responders suffered a significantly higher rate of thromboembolic complications compared to clopidogrel responders (17.4% vs 5.6%). This risk was significantly lower in non-responders who were switched to ticagrelor when compared to patients who remained on clopidogrel (2.7 vs 24.4%). In patients who remained on clopidogrel, the rate of thromboembolic complications was significantly lower in those who received a clopidogrel boost within 24 hours pre-procedure when compared to those who did not (9.8% vs 51.9%). There was no significant difference in the rate of hemorrhagic complications between groups.

Conclusion

Clopidogrel non-responders suffered a significantly higher rate of thromboembolic complications when compared to clopidogrel responders. However, this risk appears to be mitigated in non-responders that were switched to ticagrelor or received a clopidogrel boost within 24 hours pre-procedure.
12:30-1:00 pm  Course Registration/Lunch

1:00-1:05 pm  Welcome/Introduction of Keynote Speaker: Daniel Barrow, MD
              Aaron Dumont, MD

1:05-1:50 pm  KEYNOTE SPEAKER:
              Cranial Approaches for Aneurysm
              Daniel Barrow, MD

1:50-2:00 pm  Coffee Break / Proceed to Lab

2:00-5:00 pm  Lab:

              2:00-3:30 pm
              Group 1: Stations 1, 2, 3 (Pterional and OZ Craniotomy)
              Group 2: Stations 4, 5, 6 (Anterior/Posterior Clinoidectomy)

              3:30-5:00 pm
              Group 1: Stations 1, 2, 3 (Anterior/Posterior Clinoidectomy)
              Group 2: Stations 4, 5, 6 (Pterional and OZ Craniotomy)
7:00-8:00 am: Check-in/Breakfast

7:30-7:35 Welcome: CJ Bui, MD

7:35-8:20 am: Oral Poster Presentations
Moderators: Aaron Dumont, MD; Clarence Greene, MD; Jerome Volk, MD

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8:20-9:30 am: **Functional & Socioeconomics Session**
Moderators: CJ Bui, MD; Lora Kahn, MD; Christina Notarianni, MD

**Christopher Carr, MD (Tulane-Ochsner)**
The Global Burden of Epilepsy: Disparities and Increasing Demand for Neurosurgical Care

**Tyler Scullen, MD (Tulane-Ochsner)**
Utilization of stereoelectroencephalography beyond epilepsy: a systematic review

**Matthew Hefner, MD (LSUHSC-S)**
Focal epilepsy caused by single cerebral cavernous malformation (CCM) is associated with regional and global resting state functional connectivity (FC) disruption

**Lora Kahn, MD (Ochsner)**
Revision of Responsive Neurostimulation Devices for Neuromodulation of Epilepsy

**Brendan Huang (Tulane)**
The Global Burden of Central Nervous System Infections: Disparities in Neurosurgical Care

**Elizabeth Wild, MD (LSUHSC-S)**
Iatrogenic Neurologic Deficits Following Neurosurgical Intervention at an Academic Medical Center

**Jared Brougham, MD (LSUHSC-S)**
National Neurosurgery Residency Stipend Analysis 2019-2020

**Devon LeFever, MD (LSUHSC-S)**
The Medical Review Panel in Louisiana Neurosurgery and Beyond

9:30-9:40 am: **Coffee Break I With Exhibitors**

9:40-10:00 am: **Guest Speaker: Nicole Reed**
Coding Update
10:00-11:10 am: **Vascular Session**
Moderators: Peter Amenta, MD; Daniel Barrow, MD; Jason Cormier, MD

**Racheal Peterson, MD (LSUHSC-S)**
Evaluating the Safety of Ligating the Anterior Superior Sagittal Sinus

**Cassidy Werner (Tulane)**
A Review of the Cost-effectiveness of Population-based Screening for Unruptured Intracranial Aneurysms

**Mansour Mathkour (Tulane-Ochsner)**
Hybrid Open and Endovascular Approach for Occipital Arteriovenous Fistula, Borden III Cognard IV, with Complete Obliteration

**Tyler Scullen, MD (Tulane-Ochsner)**
Mechanical thrombectomy for a right hemispheric stroke syndrome due to an acute left A1-A2 junction thromboembolic occlusion

**Garrett Whipple, MD (LSUHSC-S)**
Middle Meningeal Artery Embolization: a brief history and institutional experience

**Tyler Scullen, MD (Tulane-Ochsner)**
Stroke Patients with a TOAST Category of Cardioembolic who Receive Pre-Operative tPA have Increased Odds of Total Recanalization Following Mechanical Thrombectomy

**Tyler Zeoli (Tulane)**
Acute Ischemic Stroke Due to Free Floating Thrombus of the Carotid Artery: A Case Series and Review of the Literature

**Nimer Adeeb, MD (LSUHSC-S)**
Repeat Flow Diversion for Previously Failed Flow Diversion in a Multicenter Cohort

**Tyler Scullen, MD (Tulane-Ochsner)**
Arteriovenous Fistula of the Filum Terminale: A case report and review of the literature

**James Barry, MD (LSUHSC-S)**
Neuroform Atlas Stenting in Cases of Refractory Intracranial Stenosis
11:10-11:20 am: Coffee Break II With Exhibitors

11:20-12:00 pm: Spine Session I

Moderators: Christopher Maulucci, MD; Anthony Sin, MD; Gabe Tender, MD

Derrick Umansky, MD (Tulane-Ochsner)
Venous Drainage of the Lumbar Vertebral Bodies: An Anatomical Study with Application to Kyphoplasty, Vertebroplasty and Pedicle Screw Complications

Adam Beighley (Tulane)
A Review of Patient Reported Outcomes in Spine Surgery

Casey Spinelli (LSUHSC-NO)
Intraoperative Hip Flexion Facilitates Insertion of Larger Interbody Spacers During Transforaminal Lumbar Interbody Fusion Procedures

Pervez Khan, MD (Tulane-Ochsner)
Relationship of the Obturator Nerve and Psoas Major: Anatomical Study with Application to Avoiding Iatrogenic Injurie

Mansour Mathkour, MD (Tulane-Ochsner)
The Necessity of Dependency “functional health status” as a Constituent of the Modified 5-item Frailty Index in Spine Patients: Does It Make a Difference and Predict Outcomes?

David Cavanaugh, MD (Spine Institute of Louisiana)
Radiographic and Clinical Adjacent Segment Pathology Following Cervical Total Disc Replacement or Anterior Cervical Discectomy and Fusion Through 7-Year Follow-Up

12:00-1:00 pm: Lunch

12:10-12:15pm: Introduction of Keynote Speaker: Aaron Dumont, MD

12:15-1:00pm: KEYNOTE SPEAKER: Daniel Barrow, MD
“Pedagogy: Foundations and Future”
**1:00-1:40 pm:**

**Spine Session II**

Moderators: Christopher Maulucci, MD; Anthony Sin, MD; Gabe Tender, MD

Cassidy Werner (Tulane)
Reperfusion “White Cord” Syndrome in Cervical Spondylotic Myelopathy: Does Mean Arterial Pressure Goal Make a Difference?

John Wilson, MD (LSUHSC-NO)
The Safety Profile of Bone Marrow Aspirate Harvest for Concentration and Application in Cervical Spine Surgery and a Technical Note

Mansour Mathkour, MD (Tulane-Ochsner)
Successful Correction of Sagittal Imbalance by Single-segment Minimally Invasive Anterior Column Release with Anterior-to-the-Psoas Interbody Fusion Using Hyperlordotic Expandable Cage and Posterior Instrumentation: Case Series

Andrew Janssen, MD (Tulane-Ochsner)
Does the L5 Spinal Nerve Move Anatomical Evaluation with Implications for Postoperative L5 Nerve Palsy

Clifford Crutcher II, MD (LSUHSC-NO)
Does the Use of Bone Marrow Aspirate Concentrate Affect Fusion Rates In Myelopathic Smokers Undergoing Anterior Cervical Discectomy and Fusion

J. Frank Berry, MD (Tulane-Ochsner)
Management of Recurrent Chondrosarcoma: Complex Tumor Management at a Multidisciplinary Comprehensive Skull Base Center

Jessica Shields, MD, PhD (LSUHSC-NO)
Use of transcranial magnetic stimulation to track functional improvement following surgical decompression in patients with cervical myelopathy

**1:40-2:40 pm:**

**General Neurosurgery Session**

Moderators: Jorge Alvernia, MD; David Cavanaugh, MD; Aaron Dumont, MD

Robert Ross, MD (Tulane-Ochsner)
Anatomy and Surgical Relationships of the Falciform Ligament

Mitchell Kilgore (Tulane)
A Review of Lumbar and External Ventricular Drainage in the Management of Meningitis
1:40-2:40 pm: General Neurosurgery Session

**Cassidy Werner (Tulane)**
Feasibility and Effectiveness of Minimally Invasive Craniotomy and Cesium-131 Brachytherapy for Treatment of Brain Oligometastases: Preliminary Report

**Kevin Morrow, MD (LSUHSC-NO)**
Evaluation of MRI Safety for Civilian Gunshot Wounds with Retained Bullet

**Joseph Lockwood, MD (Tulane-Ochsner)**
The Inferior Intercavernous Sinus: An Anatomical Study with Application to Trans-sphenoidal Approaches to the Pituitary Gland

**Tyler Scullen, MD (Tulane-Ochsner)**
Chordae Willisii within the Transverse Sinus: A Morphological Study

**Adam Podet, MD (LSUHSC-NO)**
Hearing preservation and facial function after hearing preservation surgery for acoustic neuromas

**Erin McCormack, MD (Tulane-Ochsner)**
Space-occupying lesions of the retropharyngeal space: An anatomical study with application to post-operative retropharyngeal hematomas

**Jo Iwanaga, PhD (Tulane)**
Anatomical study of the pterygospinous and pterygoalar ligaments and their relationship to the mandibular nerve (V3): Neurosurgical implications for treating trigeminal neuralgia

**Shane Tubbs, PhD (Tulane)**
New superficial surgical landmark for the sigmoid sinus: application to retrosigmoid approaches to the posterior cranial fossa

2:40-2:50 pm: Closing Remarks: Aaron Dumont, MD

2:50-3:15 pm: Business Meeting

3:30-7:00 pm: 7th Annual Softball Tournament
Moderators: Aaron Dumont, MD; Clarence Greene, MD; Jerome Volk, MD

Cassidy Werner (Tulane)
Spinal Adhesive Arachnoiditis Resulting in Recurrent Arachnoid Cysts Treated Successfully by Decompression and Ventriculoperitoneal Shunt

Dani Terrell, MD, MPH (LSUHSC-S)
Case Discussion: Three unique presentations of glioblastoma multiforme (GBM)

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Aneurysmal Subarachnoid Hemorrhage during pregnancy: Case Report and Literature Review

Mansour Mathkour, MD (Tulane-Ochsner)
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Joseph Adedigba (Tulane)
Conservative management of Cervical Spinal Cord Injury Without Radiological Evidence of Trauma (SCIWORET): Single Institution Study in Nigeria

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The Utility of Micro Vascular Plug in the Treatment Embolization of Vein of Galen Malformation: A Technical Consideration

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Non-Functional Pituitary Macroadenoma Presenting with Severe Headache, Retroclival Hematoma, and Subarachnoid Hemorrhage: A Case Presentation and Literature Review
Cassidy Werner (Tulane)

Spinal Adhesive Arachnoiditis Resulting in Recurrent Arachnoid Cysts Treated Successfully by Decompression and Ventriculoperitoneal Shunt

Cassidy Werner, MSc; Mansour Mathkour, MD, MSc; Tyler Scullen, MD; MD; Christopher Carr, MD, MPH; Robert F. Dallapiazza, MD, Ph.D.; Aaron S. Dumont, MD; Christopher M. Maulucci

Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA
Tulane University School of Medicine, New Orleans, LA

Abstract

Background:
Spinal adhesive arachnoiditis (SAA) with cyst formation secondary to infectious meningitis is a rare clinical entity. The inflammatory cascade set forth by the infectious process results in fibrous adhesions that can fill with cerebrospinal fluid (CSF) and create cysts. These cysts can compress the spinal cord leading to a decline in neurological function and need for surgery.

Case Presentation:
We present a challenging case of SAA in a 58-year-old man who presented with a one-day history of right leg pain, decreased sensation at the level of T10, and lower extremity weakness after undergoing multiple instrumented spinal procedures for spondylosis. Magnetic resonance imaging (MRI) of the lumbar spine demonstrated an intradural extramedullary spinal schwannoma at L3 which was subsequently resected. Postoperatively, his course was complicated by wound dehiscence, bacterial meningitis, and development of several recurrent thoracic arachnoid cysts. He presented clinically with sudden onset paraplegia, requiring multiple laminectomies, adhesiolyses, and debridements. After two thoracic decompressions with lysis of intradural adhesions, an external ventricular drain was placed for CSF diversion with good improvement in his neurological symptoms. Given its success, a permanent ventriculoperitoneal shunt (VPS) was placed with complete recovery of his weakness and he was discharged to a rehabilitation facility. Follow-up at 7 months showed no cyst recurrence or evidence of VPS infection. On the last follow up, his weakness improved and he was able to walk independently.

Conclusion:
SAA is a rare phenomenon that may lead to compressive subarachnoid cyst formation resulting in neurological deficits. Our review of the literature showed that CSF diversion has been successfully used to treat spinal fluid collections. As seen in our case presentation, cysts may recur after initial fenestration. CSF diversion may be a preferred initial approach for similar SAA presentations in order to simultaneously treat and prevent recurrence of symptoms.
Case Discussion: Three unique presentations of glioblastoma multiforme (GBM)

Danielle Terrell, MD, MPH, Bharat Guthikonda, MD

Abstract

Series of three patients with unique presentations of what pathologic studies revealed to be glioblastoma multiforme (GBM). 2 of the three patients had almost total regression of large contrast enhancing intracranial lesions with standard doses of dexamethasone (indicated for peritumoral edema). The third patient, had a relatively recent history of large right middle cerebral artery (MCA) infarct and was incidentally found to have a large contrast enhancing lesion in the infarction bed. The clinical course, diagnostic considerations, and treatment plans of these patients will be outlined and discussed.
Aneurysmal Subarachnoid Hemorrhage during pregnancy: Case Report and Literature Review

Glynn RM\textsuperscript{1}, Berry JF\textsuperscript{1}, Scullen T\textsuperscript{1}, Escobar R\textsuperscript{1}, Bui CJ\textsuperscript{1}

Neurosurgery Department, Tulane/Ochsner Medical Centers, LA, United States

Abstract

Introduction: Subarachnoid hemorrhage (SAH) is a neurosurgical emergency requiring rapid intervention and ICU monitoring. No definite recommendations exist regarding treatment of acute SAH in pregnancy. Questions include how best to secure a ruptured aneurysm and treatment in the peak vasospasm window remain including decision to deliver the fetus and optimal blood pressure control.

Methods: We performed a PubMed search of “subarachnoid hemorrhage” & “pregnancy”, identifying 242 articles between 01/2000-08/2019. 46 papers were relevant to our question including 51 total reported aneurysmal ruptures. We compiled management decision as well as reported outcomes and performed correlation with our unique case.

Results: A 31-year-old female, 24 weeks, 5 days pregnant, with history of polycystic kidney disease (PKD) and hypertension was transferred from community hospital after being found face-down with urinary incontinence by her son. CT Angiogram revealed 2.4mm anterior communicating artery (AComm) aneurysm. The patient underwent successful coil with EVD placement. Systolic blood pressure (SBP) was kept less than 180 mm Hg. The patient underwent repeat angiography for vasospasm on post bleed day (PBD) 6 and developed cerebral salt wasting her during hospital stay, but remained neurologically intact; fetal heart rates were monitored closely and remained reassuring, and she was eventually discharged on PBD 21.

Conclusions: Early transfer to appropriate facility with neuro critical care, high risk obstetrics, and neurosurgery teams available is crucial for management of SAH in pregnancy. In our case, treatment without immediate delivery was feasible with post coil SBP less than 180 mmHg to maintain adequate CPP and ensure fetal safety. Prognosis for both fetus and patient can be favoring with early discovery and prompt management of complications.
Abstract

Background:
Kissing carotid phenomenon refers to bilateral retropharyngeal displacement of the internal carotid arteries (ICA) and can present a surgical challenge secondary to the anomalous critical anatomy. We describe a case of this phenomenon in the context of transcervical spinal surgery and provide our step-by-step technique in order to assist future surgeons.

Case presentation:
An 82-year-old female presented to our institution with progressive clinical myelopathy. On physical exam, she had pronounced right hemiparesis below the C4 myotome along with decreased light touch sensation. She was hyperreflexic and exhibited positive Hoffman’s sign in the bilateral upper extremities. Cervical spine imaging demonstrated a large disc herniation at C3-C4 eccentric to the right of the canal resulting in severe spinal canal stenosis and myelomalacia. Vascular imaging overlying the prevertebral fascia at the midline in the retropharyngeal space suggested the presence of anomalous ICAs bilaterally. Secondary to the complex vascular anomaly centered at the intended discectomy level, the otolaryngology-head and neck service was consulted to assist in the exposure for a tranccervical approach for anterior cervical discectomy and fusion of C3-C4. The procedure required meticulous dissection and was successful without complications.

Conclusion:
The kissing carotid phenomenon is a rare presentation of extreme medial displacement of bilateral ICAs. There have been limited reports of this anatomic variant in Spinal Surgery literature. We implore spinal surgeons to be cognizant of this variant and outline a schema to assist in judicious surgical treatment.
Conservative management of Cervical Spinal Cord Injury Without Radiological Evidence of Trauma (SCIWORET): Single Institution Study in Nigeria

Joseph A. Adedigba, B.A.¹, Adetunji A. Oremakinde, MD, MSc, FWACS², Adefolahan O. Malomo, MD, MHSc, FWACS³,⁴, Temitayo M. Shokunbi, MD, MSc, FRCSC, FWACS³,⁴, Brendan Huang, B.S.¹, *Augustine A. Adeolu, MD, FWACS³,⁴

¹Tulane University School of Medicine, New Orleans, LA, USA 70112
²Institute of Medical Science, University of Toronto, Toronto, ON, Canada,
³Department of Neurological Surgery, University College Hospital, Ibadan, Nigeria
⁴University of Ibadan, Ibadan, Nigeria

Abstract

Introduction

Cervical spinal cord injury without radiological evidence of trauma (SCIWORET) in patients with pre-existing canal stenosis from degenerative disease is not well discussed within neurosurgical literature. The aim of this study is to evaluate the outcome of non-operative management of this condition at the Department of Neurological Surgery, University College Hospital, Ibadan, Nigeria.

Methods

Data was collected prospectively from 2007 to 2012. All patients were treated non-operatively with cervical collar immobilization. Parameters assessed included Frankel grading on presentation and discharge, occurrence of Deep Vein Thrombosis (DVT), Urinary Tract Infection (UTI), Sphincteric Dysfunction (SD), and Pressure Sore (PS), and Magnetic Resonance Imaging (MRI) Signal Cord Changes (MSCC). These parameters were analyzed with level of significance set at P value less than 0.05.

Results

28 patients were included. Among patients who presented with Frankel A, 100% stayed the same on discharge. Patients presenting with Frankel grade B, 85.71% improved to a higher grade while 14.29 % stayed the same. 90.91% of patients with Frankel C improved to a higher grade while 9.09% stayed at Frankel grade C. 85.71% of patients with Frankel grade D stayed the same on discharge while 14.29% improved to Frankel grade E. All patients had satisfactory spinal stabilization post-treatment. Chi Square analysis showed a statistically significant correlation between the Frankel grade at presentation and the neurological outcome on discharge (P = 0.00004) and UTI (P = 0.02870).

Conclusion

No patients deteriorated neurologically, and all had satisfactory spinal stabilization following non-operative treatment. We suggest that non-operative care is a safe option of management and that surgical stability procedures may not be necessary. This study also demonstrated that Frankel grading at presentation may be associated with outcome parameters such as neurological outcome on discharge and occurrence of UTI.
Abstract

Background
Vein of Galen malformations (VOGM) are rare and divided into two categories, mural and choroidal, depending on the respective feeding vessels. At presentation, VOGM is known to cause additional complications in the neonate including hydrocephalus, congestive heart failure, and seizures. Traditional treatment options include coil and microparticle embolization. Microvascular plugs (MVPs), used traditionally for arterial occlusion, have recently been introduced as a VOGM treatment option. In this case presentation, we present the second known case using a MVP to assist with venous occlusion for a VOGM.

Case Presentation
A 39-week old male born via an urgent Cesarean section presented with a right atrial dilation and a cerebral vascular malformation. MRI-angiography and venography demonstrated a 4.3 x 3.6 x 4.1 centimeter aneurysmal VOGM with primary supply via a dilated right superior cerebellar artery (SCA) and primary drainage via a dilated median prosencephalic vein. Post-partum day-7, the patient showed signs and symptoms of worsening heart failure. Treatment was deemed necessary. The left vertebral artery was catheterized and multiple runs revealed a mural type VOGM with direct AV fistula from the supplying right SCA. The right SCA was measured at approximately 3.8 mm in diameter. A 3-5mm MVP was chosen for primary embolization. Post-MVP deployment, angiographic runs showed decreased flow through the fistula. Three coils were then deployed, followed by Onyx 34 in order to completely obliterate the fistula. Final angiographic runs revealed fistula obliteration and patent basilar, posterior cerebral, left superior cerebellar, and left posterior inferior cerebellar arteries. Follow-up cranial ultrasound showed smaller ventricular size, and repeat echocardiography showed stable hemodynamics without evidence of heart failure.

Conclusion
This is the second case documented in the literature demonstrating the utility of the microvascular plug for assistance in embolization of a VOGM. The utility of this device is limited by vessel diameter and appropriate landing zone requirements. Further investigation is needed to assess feasibility, short and long term outcomes, and related complications.
Josh Hanna, MD (Tulane-Ochsner)

Pseudoaneurysm in a 58-year-old male Nocardia Meningitis: Case Report and Literature Review

Joshua Hanna MD, Erin McCormack MD, Kennedy Carpenter B.Sc., Derek Neupert MD, Aimee Aysenne MD, John Nerva MD

Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA
Tulane University School of Medicine, New Orleans, LA

Abstract

Introduction
Intracranial pseudoaneurysm secondary to Nocardia meningitis is a rare but dangerous disease manifestation. Nocardia is an angio-invasive pathogen that generally affects the immunocompromised. Abscesses are the most common systemic presentation with primary central nervous system (CNS) nocardiosis being rarer. Currently there are only four known cases of intracranial aneurysms associated with nocardia; we describe the fifth case.

Methods
A 58-year-old male with dialysis-dependent kidney disease and nocardia cerebritis on active antimicrobial treatment presented with altered mentation. The patient had recently presented for a recurring acute tentorial subdural hematoma, now with progressive hydrocephalus on serial scans. The patient underwent bedside ventriculostomy placement complicated by tract hemorrhage and intraoperative contralateral ventriculostomy placement under neuro-navigation also complicated by tract hemorrhage. CTA demonstrated a PICA pseudoaneurysm, confirmed by an angiogram that underwent subsequent coiling. The patient developed spontaneous intraventricular hemorrhage during his post-operative course and was transitioned to comfort care per family.

Discussion
Primary CNS nocardiosis is an exceedingly rare form of a generally systemic disease, and it most commonly manifests as cerebritis or abscess. There are very few recorded cases of intracerebral vascular pathology however, patients with known CNS nocardiosis are at increased risk due to the angio-invasive nature of pathogenesis. Patients with immunocompromise or other heightened susceptibility to disease are routinely placed on prophylactic antimicrobial therapy, however any evidence of intracranial or systemic bleeding should be thoroughly investigated and aggressively treated.

Conclusion
Current literature reports only four cases of intracerebral aneurysm associated with nocardia infection and should be considered an exceedingly rare but lethal differential. Early diagnosis and treatment are critical to optimizing prognosis with special emphasis placed on disease prevention in susceptible populations.
Non-Functional Pituitary Macroadenoma Presenting with Severe Headache, Retroclival Hematoma, and Subarachnoid Hemorrhage: A Case Presentation and Literature Review

Glynn RM, Stewart JJ, Lockwood J, Mathkour M, Umansky D, Biro E

Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA

Abstract

Introduction

Subarachnoid hemorrhage (SAH) is a life-threatening emergency classically presenting with thunderclap headache, commonly diagnosed by computed tomography (CT) or angiography. Pituitary apoplexy is another known cause of severe headache, which may lead to blindness and/or endocrine abnormalities. Rarely, these two conditions may be linked in which case management guidelines are not fully established. We present one such case here.

Case Presentation

A 62-year-old male with no medical history presented with the worst headache of his life after mowing his lawn. He was initially discharged from an outside hospital, but, after radiologists reviewed his CT head, he was sent for an outpatient MRI, which revealed trace suprasellar blood with suspected underlying pituitary mass. The patient was referred for Neurosurgery consult and Neuro ICU admission.

Results

CT angiogram revealed pre-pontine and right sylvian fissure hyperdensities consistent with acute SAH. An iso-attenuating sellar and supra-sellar mass was also demonstrated. Cerebral angiogram was negative for aneurysm or vascular malformation. A contrasted MRI brain revealed a pituitary macroadenoma, however, on ophthalmologic exam, he had no visual field loss and his pituitary panel was normal. After three days he remained asymptomatic and headache was alleviated. He was eventually discharged with close neurosurgical follow up and readmitted as an outpatient for resection of non-functional macroadenoma.

Discussion

Pituitary adenoma is rarely coincident with thunderclap headache or SAH. However, apoplexy has been associated with severe headache and may mimic a SAH but is treated as a surgical emergency. This case demonstrates a pituitary adenoma with certain features of apoplexy and SAH which was initially managed conservatively, but was later treated surgically with a successful outcome.
Christopher Carr, MD (Tulane-Ochsner)
The Global Burden of Epilepsy: Disparities and Increasing Demand for Neurosurgical Care

Tyler Scullen, MD (Tulane-Ochsner)
Utilization of stereoelectroencephalography beyond epilepsy: a systematic review

Matthew Hefner, MD (LSUHSC-S)
Focal epilepsy caused by single cerebral cavernous malformation (CCM) is associated with regional and global resting state functional connectivity (FC) disruption

Lora Kahn, MD (Ochsner)
Revision of Responsive Neurostimulation Devices for Neuromodulation of Epilepsy

Brendan Huang (Tulane)
The Global Burden of Central Nervous System Infections: Disparities in Neurosurgical Care

Elizabeth Wild, MD (LSUHSC-S)
Iatrogenic Neurologic Deficits Following Neurosurgical Intervention at an Academic Medical Center

Jared Brougham, MD (LSUHSC-S)
National Neurosurgery Residency Stipend Analysis 2019-2020

Devon LeFever, MD (LSUHSC-S)
The Medical Review Panel in Louisiana Neurosurgery and Beyond
The Global Burden of Epilepsy: Disparities and Increasing Demand for Neurosurgical Care

Alex Yacob, BS\textsuperscript{1}; Christopher Carr, MD, MPH\textsuperscript{2}; Alice Walton, BS\textsuperscript{1}; Adhira Divagaran, BS\textsuperscript{1}; Mansour Mathkour, MD, MSc\textsuperscript{2}; Tyler Scullen, MD\textsuperscript{2}; Aaron S Dumont, MD, MBA\textsuperscript{3}

\textsuperscript{1}Tulane University School of Medicine, New Orleans, LA
\textsuperscript{2}Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, Tulane University Medical Center
\textsuperscript{3}Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA

Abstract

Background

Epilepsy is a disease of recurrent seizures and carries a high degree of morbidity and mortality if not effectively controlled. The Global Burden of Disease (GBD) is the largest comprehensive investigation of global health disease burden ever conducted. We hypothesized that low- and middle-income nations would show a greater burden of epilepsy along with disparities in access to neurosurgical care.

Methods

Using 2017 GBD data, we abstracted death by cause and prevalence of years lived with disability (YLD) for epilepsy for every nation. We compared this to additional characteristics of nations including GDP per capita, quality of healthcare system, region, and access to epilepsy and neurosurgical care.

Results

14 of the 20 (70\%) nations with the highest deaths were in the lowest quartile for GDP per capita, 3 (15\%) were in the second quartile, 2 (10\%) were in the third, and 1 (5\%) was in the highest quartile. 12 of the 20 (60\%) nations with the highest YLD were in the lowest GDP quartile, 4 (20\%) were in the second, 4 (20\%) were in the third, and 0 (0\%) were in the fourth. Both deaths and YLD decreased as a function of the quality of a nation’s health care system. African nations had a disproportionately high burden of epilepsy and were also those with the least developed neurosurgical infrastructure and the fewest neurosurgeons per capita.

Discussion

Epilepsy causes large disease burdens in low- and middle-income nations. At the same time, indications for neurosurgical treatment of epilepsy are expanding. This trend is exacerbating existing disparities in poorer nations where availability and affordability of anti-epileptic drugs may also be poor. The neurosurgical community can address global disparities by focusing on sustainable interventions such as surgeon exchange programs and development of multidisciplinary infrastructure for epilepsy treatment in low and middle-income nations.
Utilization of stereoelectroencephalography beyond epilepsy: a systematic review

Tyler Scullen, MD\textsuperscript{1,2}, Nikhil Teja, MD\textsuperscript{3}, Seo Ho Song, PhD\textsuperscript{4}, Josh Hanna MD\textsuperscript{1,2}, Andrew Jannsen MD\textsuperscript{1,2}, Chris Carr, MD\textsuperscript{1,2}, Mansour Mathkour, MD\textsuperscript{1,2}, Darrin J. Lee, MD PhD\textsuperscript{5}, Robert F. Dallapiazza, MD, PhD\textsuperscript{1}

\textsuperscript{1}Tulane University School of Medicine, Tulane University, New Orleans, LA 70130
\textsuperscript{2}Department of Neurological Surgery, Ochsner Medical Center, Jefferson, LA 70121
\textsuperscript{3}Department of Psychiatry, Dartmouth-Hitchcock Medical Center, Hanover, NH 03755
\textsuperscript{4}Geisel School of Medicine, Dartmouth University, Hanover, NH 03755
\textsuperscript{5}Department of Neurosurgery, Keck School of Medicine, University of Southern California

Abstract

Introduction

Stereoelectroencephalography (sEEG) is an increasingly popular surgical technique used clinically to study neural circuits involved in medication refractory epilepsy, and it is concomitantly used to scientifically investigate behavioral neural circuitry. The purpose of this systematic review is to summarize prior and current clinical investigations using sEEG for indications other than epilepsy.

Methods

Using PRISMA guidelines, the United States National Library of Medicine at the National Institutes of Health PubMed database was queried for investigational or therapeutic applications of sEEG in human subjects. Abstracts were analyzed for inclusion or exclusion independently by two authors.

Results

The study search resulted in 752 publications, and after applying exclusion criteria eight studies were selected for in-depth review. Among these eight studies, 122 patients were included with indications ranging from schizophrenia to Parkinson’s disease. All studies included were single-institution, case series representing level IV scientific evidence.

Conclusions and Relevance

sEEG is an important method in epilepsy surgery that could be applied to neurological and psychiatric diseases outside of epilepsy. Information from these studies could provide additional pathophysiologial information and lead to further development and refinement of neuromodulation therapies for these conditions.
Focal epilepsy caused by single cerebral cavernous malformation (CCM) is associated with regional and global resting state functional connectivity (FC) disruption

Jason D’Cruz, MD, Matthew Hefner, MD, Christina Ledbetter, PhD, Hai Sun MD, PhD
Department of Neurosurgery, LSUHSC Shreveport

Abstract

Epilepsy, including the type with focal onset, is increasingly viewed as a disorder of the brain network. Here we employed the functional connectivity (FC) metrics estimated from the resting state functional MRI (rsfMRI) to investigate the changes of brain network associated with focal epilepsy caused by single cerebral cavernous malformation (CCM). Eight CCM subjects and 21 age and gender matched controls were enrolled in the study. Seven of 8 CCM subjects underwent surgical resection of the CCM and became seizure free and 4 of the surgical subjects underwent a repeat rsfMRI study. We showed that there was both regional and global disruption of the FC values among the CCM subjects including decreased in homotopic FC (HFC) and global FC (GFC) in the regions of interest (ROIs) where the CCMs were located. There was also the disruption of the default mode network (DMN) especially the FC between the middle prefrontal cortex (MPFC) and the right lateral parietal cortex (LPR) among these individuals. We observed the trend of alleviation of these disruptions after the individual has become seizure free from the surgical resection of the CCM. Using a voxel-based approach, we found the disruption of the HFC and GFC in the brain tissue immediately adjacent to the CCM and the severity of the disruption appeared inversely proportional to the distance of the brain tissue to the lesion. Our findings confirm the disruption of normal brain networks from focal epilepsy, a process that may be reversible with successful surgical treatments rendering patients seizure free. Some voxel-based metrics may help identify the epileptogenic zone and guide the surgical resection.
Revision of Responsive Neurostimulation Devices for Neuromodulation of Epilepsy

Lora Kahn, MD; Cornelia Drees, MD; Steven Ojemann, MD; Aviva Abosch, MD, PhD; Cuong Bui, MD

1Ochsner Clinic Foundation Department of Neurosurgery
2University of Colorado Department of Neurology
3University of Colorado Department of Neurological Surgery

Abstract

Introduction
While resective surgery for the treatment of intractable focal-onset epilepsy has historical precedent for seizure freedom, neuromodulation affords the opportunity to provide operative therapy to patients with epilepsy who would otherwise not meet criteria. The Food and Drug Administration approved the responsive neurostimulator (RNS) in 2013 to provide closed-loop neuromodulation for intractable focal-onset epilepsy in adults with one or two seizure foci who are not resective candidates. As RNS is a novel technology, publications regarding repositioning of lead placement have been limited. Here, we present our experience with revision of the RNS system.

Materials and Methods
Between August 2015 and December 2019, 27 RNS devices were implanted in 26 discrete patients.

Results
Seven patients underwent revision of their RNS systems. One patient required explantation and revision due to infection with Propionibacterium acnes, and a second had wound breakdown over a lead. The third patient had delayed traumatic subdural and intraparenchymal hematoma, and the fourth elected to have an additional electrode placed. The final patients underwent right temporal lobectomy based on closed-loop data with preservation and repositioning of the right temporal strip electrode in one case, preservation of a hippocampal depth electrode in another, and placement of a new subdural strip in the third. Follow-up periods have been insufficient to draw meaningful conclusions about seizure outcomes after revision surgery. We also present a prospective patient who will likely have a laser amygdalohippocampectomy pending the results of her RNS monitoring.

Discussion
Revisions of intracranial neuromodulation devices pose novel technical challenges to the neurosurgeon. As evinced by our experience, among others, latent infection may require device explantation. One patient was successfully reimplanted after a course of intravenous antibiotics, and another’s electrode was salvaged by placement of a protective bactiseal catheter. The third patient’s delayed traumatic hematoma six months after placement necessitated explantation to evacuate the hematoma. The remaining patients’ lead additions, preservation, and repositioning warrant further discussion of technical considerations not described elsewhere in the literature. Other potential causes for revision cited in the literature include lead damage upon exiting the skull and initial stereotaxy error.

Conclusions
RNS is a promising technique for patients with refractory focal epilepsy who do not meet criteria for resective surgery. As this technology is increasingly implanted, understanding the potential causes for and technical considerations involved in revising the leads, and moreover, the role in definitive treatment, is increasingly relevant.
The Global Burden of Central Nervous System Infections: Disparities in Neurosurgical Care

Brendan Huang, BS¹; Christopher Carr, MD, MPH²; Jake Foote, BS¹; Andrew Olinger, BS¹; Mansour Mathkour, MD, MSc²; Aaron S Dumont, MD³

¹Tulane University School of Medicine, New Orleans, LA
²Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA
³Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA

Abstract

Background

Central nervous system (CNS) infections have high morbidity and mortality if not promptly and effectively treated. The Global Burden of Disease (GBD) database is the largest comprehensive investigation of global health disease burden ever conducted. We hypothesized that low- and middle-income nations would show a greater burden of CNS infection along with disparities in access to neurosurgical care.

Methods

Using 2017 GBD data, we abstracted death by cause and years lived with disability (YLD) for meningitis and encephalitis for every nation. Data for intracranial abscess was unavailable. We compared this to additional characteristics of nations including GDP per capita, quality of healthcare system, region, and access to neurosurgical care.

Results

Among 20 nations with the highest burden of deaths due to CNS infection, 19 (95%) were in the lowest per capita GDP quartile, and another 19 (95%) were in sub-Saharan Africa. Among 20 nations with the highest YLD burden, 16 (80%) were in the lowest GDP quartile, and all were in sub-Saharan Africa. 6 of the 10 (60%) poorest nations on earth were among the top 20 nations in terms of death. 5 of the 10 (50%) poorest nations were among the top 20 in YLD. These nations were also among those with the least developed neurosurgical infrastructure and the fewest neurosurgeons per capita.

Discussion

CNS infection causes disproportionately large disease burdens in low- and middle-income nations which suffer from endemic tropical diseases and inadequate primary prevention and antibiosis. Optimal treatment of CNS infection often requires neurosurgical care including biopsy, decompression and washout of abscesses, and insertion of drains for intracranial pressure management or monitoring response to treatment. Citizens of poor countries lack access to this level of care and suffer greater death and disability and may benefit from interventions such as development of sustainable infrastructure for treatment.
Iatrogenic Neurologic Deficits Following Neurosurgical Intervention at an Academic Medical Center

Abstract

Iatrogenic injury giving rise to new neurologic deficits is a known risk of any neurosurgical intervention, however the incidence and natural history of these iatrogenic deficits have not been well characterized in the neurosurgical literature. The authors retrospectively reviewed the outcomes of 719 consecutive surgeries performed by a single attending surgeon at an academic medical center from January 1, 2015 to December 31, 2016 with a mean follow up time of 11.25 months. Surgeries were 47% spinal and 53% cranial. Iatrogenic neurologic deficits were observed in 11% of surgeries, including 7% of spinal surgeries and 15% of cranial surgeries. Of patients with iatrogenic neurologic deficits 38% experienced complete resolution, 30% experienced partial improvement, and 32% experienced no improvement at last documented follow up. While there are significant limitations to this study because of its retrospective design, these findings may help to guide counselling of patients about risk of iatrogenic injury prior to surgical intervention and expected recovery when iatrogenic deficits have occurred.
Abstract

Introduction

Neurological surgery residency is a seven-year training program that follows a four-year undergraduate education followed by a four-year medical school education. This extended training period in the face of rising educational costs puts the neurosurgery resident in a uniquely challenging financial situation.

Objectives

The primary goal of this study is to describe the current financial landscape of United States neurosurgery residents across all training levels.

Methods

Stipend data for the current academic year was obtained by accessing individual institution websites and with communication with graduate medical education. This data was then analyzed using statistical methods to determine various comparative financial figures.

Results

This study included 106 allopathic neurological surgery residencies that information was readily available. Across the post graduate levels (PGY) the average salary was; PGY1 $57712.07, PGY2 $59968.36, PGY3 $62567.44, PGY4 $64829.17, PGY5 $67443.39, PGY6 $69914.96, PGY7 $72464.15. Assuming a 60-hour work week and working 47 weeks a year, the hourly salary of a resident per PGY level was; PGY1 $20.47/hr, PGY2 $21.27/hr, PGY3 $22.19/hr, PGY4 $22.99/hr, PGY5 $23.92/hr, PGY6 $24.79/hr, PGY7 $25.70/hr.

Conclusions

Modern financial realities of the graduate medical education compensation scheme have been illustrated in this study. These findings taken in light with the increasing debt burden gives a basic understanding of the modern challenges facing the United States’ resident work force. Further studies into economic differences in regions, non-salary benefits, and other economic forces are required to help further inform any future advocacy for residents.
Devon LeFever, MD (LSUHSC-S)
The Medical Review Panel in Louisiana Neurosurgery and Beyond

Devon LeFever, MD

1Louisiana State University Health Science Center- Shreveport, Department of Neurosurgery

Abstract

For the past several decades, medical malpractice claims in the state of Louisiana have been screened by a pretrial medical review panel (MRP). Composed of 3 physicians and 1 attorney, these panels are a method of filtering nonmeritorious lawsuits while expediting creditable claims. Currently, 14 jurisdictions in the United States require medical liability/malpractice cases be heard by an MRP or screening panel prior to trial. In this article, we review the MRP process in Louisiana and compare it to those in other states. Data are presented for the past 10 yr of malpractice claims in Louisiana with an emphasis on the neurosurgery specialty. Finally, the benefits and challenges of pretrial screening panels are discussed.
Moderators: Peter Amenta, MD; Daniel Barrow, MD; Jason Cormier, MD

Racheal Peterson, MD (LSUHSC-S)
Evaluating the Safety of Ligating the Anterior Superior Sagittal Sinus

Cassidy Werner (Tulane)
A Review of the Cost-effectiveness of Population-based Screening for Unruptured Intracranial Aneurysms

Mansour Mathkour (Tulane-Ochsner)
Hybrid Open and Endovascular Approach for Occipital Arteriovenous Fistula, Borden III Cognard IV, with Complete Obliteration

Tyler Scullen, MD (Tulane-Ochsner)
Mechanical thrombectomy for a right hemispheric stroke syndrome due to an acute left A1-A2 junction thromboembolic occlusion

Garrett Whipple, MD (LSUHSC-S)
Middle Meningeal Artery Embolization: a brief history and institutional experience

Tyler Scullen, MD (Tulane-Ochsner)
Stroke Patients with a TOAST Category of Cardioembolic who Receive Pre-Operative tPA have Increased Odds of Total Recanalization Following Mechanical Thrombectomy

Tyler Zeoli (Tulane)
Acute Ischemic Stroke Due to Free Floating Thrombus of the Carotid Artery: A Case Series and Review of the Literature

Nimer Adeeb, MD (LSUHSC-S)
Repeat Flow Diversion for Previously Failed Flow Diversion in a Multicenter Cohort

Tyler Scullen, MD (Tulane-Ochsner)
Arteriovenous Fistula of the Filum Terminale: A case report and review of the literature

James Barry, MD (LSUHSC-S)
Neuroform Atlas Stenting in Cases of Refractory Intracranial Stenosis
Abstract

Background

It is a common belief within neurosurgery that ligation of the anterior third of the superior sagittal sinus (SSS) is safe. This principle can be traced back to Cushing’s Meningiomas text, wherein he states that ligation of the sinus anterior to the Rolandic vein has little comorbidity and allows for aggressive resection of tumors involving the sinus. There are few publications in modern literature examining the outcomes following ligation of the sinus. The goal of this study is to outline the complications seen following SSS ligation.

Methods

A retrospective review was performed utilizing our institutions Electronic Medical Records system. Patients who underwent bifrontal craniotomy between 2010-2019 were screened to identify those with operative ligation of the sinus. A total of 38 patient records were reviewed for the presence of postoperative infarct, edema, or new neurological deficit.

Results

Of the 40 bifrontal craniotomies performed among 38 patients, 15 included ligation of the SSS. This group was comprised of 11 parafalcine meningiomas, 3 olfactory groove meningiomas, and 2 other anterior skull base lesions. Ten of these patients had imaging demonstrating preoperative occlusion of the sinus. After ligation, 2 patients developed worsening of preoperative deficits and 4 developed new deficits. Four patients had new anterior cerebral artery infarcts and 5 demonstrated worsening edema on postoperative MRI. Tumor recurrence occurred in one patient.

Literature Review

Conclusion

Our evaluation identified patients with poor neurological outcomes following ligation of the anterior superior sagittal sinus, particularly venous infarct and edema. While this has typically been regarded as a safe surgical technique, this does not hold true in all cases. Review of the literature shows morbidity relating to venous edema ranging from 0 to 54% and mortality ranging from 0 to 22% for bifrontal craniotomy with sinus ligation. The incidence of venous infarct following SSS ligation may be related to disruption of collateral veins associated with the tumor in an already-compromised venous system. Recent anatomical studies suggest that there are varying degrees of vascularity in the frontal lobes ranging from minimal to dominant drainage into the SSS, making certain individuals more sensitive to disruption of the sinus. Anterior SSS ligation is not a universally safe maneuver and should be considered carefully before it is performed.
A Review of the Cost-effectiveness of Population-based Screening for Unruptured Intracranial Aneurysms

Cassidy Werner MSc¹; Christopher Carr MD, MPH²; Mansour Mathkour MD, MSc²; Tyler Scullen, MD²; Aaron S. Dumont, MD, MBA³

¹ Tulane University School of Medicine, New Orleans, LA
² Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA
³ Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA

Abstract

Background

Unruptured intracranial aneurysms (UIA) carry a prevalence of 3%-12%. Rupture results in aneurysmal subarachnoid hemorrhage (aSAH), with a 30-day mortality of 30-45%. Continuing efforts investigate developing population-based screening programs. In this report, we review the literature concerning the cost-effectiveness of such screening.

Methods

We conducted a review of the literature using the PubMed database for articles pertaining to cost-effectiveness of population-based screening for UIA. We reviewed published costs of associated imaging modalities and standardized treatments.

Results

We conducted a PubMed search for articles concerning the cost-effectiveness of population-based screening in the general population and high-risk populations. The latter studies involved patients with histories of multiple first-degree relatives with aneurysm history, hypertension, smoking, female sex, and/or associated congenital disorders such as polycystic kidney disease, Ehlers-Danlos IV, or a bicuspid aortic valve. Studies involving high-risk populations included randomized controlled trials and class 1 evidence supporting screening programs. Cost-effectiveness of UIA screening in the general population has not been analyzed by randomized controlled trials, and reports consist of single center series with variable conclusions.

Discussion

US hospitals are now required to make list prices of their charges accessible for the public. Furthermore, minimally-invasive endovascular treatment of UIA continues to gain popularity and associated economies of scale. In light of these changes, along with insufficient analysis in the primary literature, it is reasonable to reexamine the cost-effectiveness of population-based screening for UIA rupture.
Hybrid Open and Endovascular Approach for Occipital Arteriovenous Fistula, Borden III Cognard IV, with Complete Obliteration

Mansour Mathkour, MD, MSc; Jayson Lavie, MD; Tyler Scullen, MD; Cassidy Werner, MSc; Christopher Carr, MD, MPH; Paul Gulotta, MD; Gabriel Vidal, MD; James Milburn MD; CJ Bui, MD; Edison Valle, MD
Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA
Tulane University School of Medicine, New Orleans, LA

Abstract

Background

Dural arteriovenous fistulas (DAVFs) are abnormal shunting connections between the meningeal arteries and dural/cortical venous vasculature. Lesions with cortical venous reflux carry a high risk of hemorrhage and may be treated effectively through endovascular embolization. We present a case of DAVF with cortical venous reflux not amenable to conventional access for endovascular embolization, treated with direct surgical access to the occipital artery (OA) and liquid embolic embolization.

Case presentation

A 67-year-old man with a history of seizure disorder presented with a seizure one month after stopping his antiepileptics. Neurological examination was unremarkable aside from diminished hearing in the right ear. Cranial imaging demonstrated prominent cortical veins overlying the right temporal convexity, suspicious for dAVF. Digital subtraction angiography (DSA) confirmed fistula with supply from the right OA and middle meningeal arteries (MMA) and shunting to the transverse sinus with multiple dilated cortical veins, compatible with a Borden 3, Cognard 4 lesion. The patient was found to have a type 3 aortic arch with an extremely tortuous right common carotid artery (CCA). Due to a failure of transfemoral and transradial approaches, the patient underwent surgical cutdown for direct access to the right OA for embolization. Using ultrasound guidance, the right OA was localized and surgically exposed. An ONYX compatible microcatheter was used to access the nidus of the fistula and under direct fluoroscopy the fistula was embolized. A post-embolization angiogram from the right OA demonstrated no residual filling of the fistula. The postoperative course was unremarkable, and follow up angiogram at 6-months showed complete obliteration.

Conclusion

A variety of hybrid open and endovascular approaches for DAVF embolization usually not in the context of surgical cutdown. In this case, we report a hybrid surgical and endovascular approach for Borden III dAVF that was inaccessible to standard endovascular approaches and embolized via trans-occipital access. Direct cannulation of feeding vessels to DAVF represent a treatment option in patients who are not candidates for conventional endovascular or open approaches.
Tyler Scullen, MD (Tulane-Ochsner)

Mechanical thrombectomy for a right hemispheric stroke syndrome due to an acute left A1-A2 junction thromboembolic occlusion

Tyler Scullen, MD\textsuperscript{1,2}, Josh Hanna\textsuperscript{1,2}, MD, Ryan Glynn, MD\textsuperscript{1,2}, Joseph Lockwood, MD\textsuperscript{1,2}, Mansour Mathkour, MD, MSc\textsuperscript{1,2}, Peter S. Amenta, MD\textsuperscript{1}

\textsuperscript{1}Department of Neurological Surgery, Tulane University, New Orleans, LA 70130
\textsuperscript{2}Department of Neurological Surgery, Ochsner Medical Center, Jefferson, LA 70121

Abstract

Introduction
Mechanical thrombectomy (MT) for large vessel occlusions (LVO) has had a dramatic impact on the management of acute ischemic stroke (AIS). Extended use of MT beyond American Heart Association (AHA) guidelines has seen successful in carefully selected cases.

Case Description
A 71-year-old male presented as a wake-up stroke with mild left hemiparesis. The patient suddenly deteriorated and was found to have a chronic occlusion of the communicating segment of the right internal carotid artery. Angiography of the left ICA demonstrated acute occlusion of the left A1-2 junction which was recanalized with emergent MT. Twenty-four hour imaging displayed no evidence of infarct and the patient rapidly improved over the course of the hospitalization. The patient was discharged on post-operative day 7 with a National Institutes of Health Stroke Scale of zero.

Conclusion
We describe a patient presenting with false localizing symptoms consistent with a right hemispheric ischemic stroke resulting from acute occlusion of the left A1-2 junction treated successfully with MT. This case demonstrates the importance of a high index of suspicion when evaluating atypical stroke presentations and the effectiveness of MT in the treatment of more distal smaller caliber vessels.
Garrett Whipple, MD (LSUHSC-S)

Middle Meningeal Artery Embolization: a brief history and institutional experience

Garrett Whipple, MD

LSUHSC-Shreveport

Abstract

Chronic subdural hematomas (cSDH) are a common and sometimes challenging pathology neurosurgeons encounter. Characterized by slow repetitive cycles of inflammation and micro-hemorrhage, this entity is often identified in the elderly and typically larger in size. With varying treatment modalities ranging from non-invasive medications to evacuations in the OR, the appropriate treatment option for cSDH is sometimes controversial. One treatment method that utilizes advances in endovascular intervention is middle meningeal artery (MMA) embolization. As the endovascular community has increased its breadth of interventions, MMA embolization has become an adjunct/alternative to the current management strategies for cSDH. While the effect of MMA embolization does have a delay in terms of resolution of the cSDH, this treatment option does allow for a less invasive approach. In this paper we set out to detail the rise of MMA embolization in the treatment of cSDH as well as our institutional experience and outcomes.
Stroke Patients with a TOAST Category of Cardioembolic who Receive Pre-Operative tPA have Increased Odds of Total Recanalization Following Mechanical Thrombectomy

Sam Shamsnia MD¹, Tyler Scullen MD¹, Josh Hanna MD¹, Ryan Glynn MD¹, Joseph Lockwood MD¹, Mansour Mathkour MD¹, Peter Amenta MD¹
¹Tulane University, Department of Neurosurgery, New Orleans, LA

Abstract

Introduction
Contemporary treatment of acute ischemic stroke (AIS) has undergone revolutionary paradigm shifts with the advent and advancement of endovascular intervention. Prior to and continuing into the endovascular era, intravenous tissue plasminogen activator (tPA) has been a gold standard non-invasive treatment modality for indicated patients. In this study we investigated outcomes based on treatment patterns of patients treated with endovascular therapy with or without prior administration of tPA.

Methods
We conducted a retrospective review of all patients treated at our comprehensive stroke center from June 2014 through September 2018 with endovascular recanalization for AIS. Cases were reviewed as a whole and as subgroups based on trial of ORG 10172 in acute stroke treatment (TOAST) categorization and tPA administration. Primary outcomes of interest were inpatient mortality and thrombolysis in cerebral infarction (TICI) grade.

Results
A total of 236 patients were included in our analysis, 49% of whom received tPA. Overall mortality rate was 13% with no significant differences between tPA and non-tPA cases or between TOAST categorizations. There was no overall significant difference in TICI grade between patients when all TOAST subgroups were considered together. Subgroup analysis, however, showed a statistically significant difference in TICI grade in patients with a TOAST classification other than cardioembolic (CE). Such patients had significantly increased odds of subtotal recanalization (OR 2.22, 95%CI 1.15-4.3, p=0.0174) if they received tPA. The inverse was accordingly seen in CE patients. This difference was not associated with mortality rate.

Conclusion
Endovascular intervention is now that mainstay treatment for appropriate candidates with AIS. tPA remains a standard adjunct. We demonstrate in our single center retrospective review that patients with a TOAST categorization of cardioembolic may have increased recanalization rates associated with pre-operative tPA administration. Additional studies will be conducted to further investigate.
Acute Ischemic Stroke Due to Free Floating Thrombus of the Carotid Artery: A Case Series and Review of the Literature

Tyler Zeoli BA\textsuperscript{a}; J. Franklin Berry MD MS\textsuperscript{a,b}; Erin McCormack MD \textsuperscript{a,b}; Brian Helbig MS\textsuperscript{a}; Mansour Mathkour MD MSc\textsuperscript{a,b}; Aaron Dumont MD\textsuperscript{a,b}; Edison Valle MD\textsuperscript{b}

Tulane Medical Center, Department of Neurosurgery, New Orleans, LA
Ochsner Clinic Foundation, Department of Neurosurgery, New Orleans, LA

Abstract

Background

Free-floating thrombus (FFT) of the carotid artery remains a rare and underrepresented cause of ischemic stroke in the adult population. FFT is characterized by a partially attached intraluminal thrombus with circumferential blood flow at its distal end. The exact etiology is poorly understood, and current research has failed to elucidate a standardized definition and treatment algorithm. Current management options include medical therapy, surgery, and innovative endovascular techniques. Here, we present three cases of FFT and review current literature regarding pathophysiology and treatment methods.

Case Presentation

Three cases of FFT were identified at our institution. All cases presented with symptoms of ischemic stroke, and an FFT was identified via CT angiography with demonstration on digital subtraction angiography in two patients. Two of the FFT involved the internal carotid artery and received tPA. The other case presented with an FFT within the common carotid artery and failed to meet criteria for tPA administration. One thrombus had a concomitant ICA dissection. During angiography, one patient was treated with thrombectomy alone, while the others underwent stent placement due to underlying carotid stenosis. Following treatment, two patients developed malignant intracranial hypertension and underwent subsequent decompressive hemicraniectomy and were sent to either a long term care facility or rehab. One patient had full symptom resolution and was discharged home.

Conclusion

The clinical approach for managing FFT remains poorly described. A more concrete understanding of the pathophysiology and morphology of this underrepresented pathology can facilitate further advancements in treatment options. Early diagnosis and treatment of FFT is necessary to reduce the risk of morbidity and mortality from downstream ischemic injury. While there are currently no clear evidence based recommendations regarding the treatment of FFT, a variety of medical and surgical options exist, and it is apparent that endovascular procedures should be considered as safe and feasible options.
Repeat Flow Diversion for Previously Failed Flow Diversion in a Multicenter Cohort

Nimer Adeeb, MD

LSUHSC-Shreveport

Abstract

Introduction
Aneurysmal persistence after flow-diversion (FD) occurs in 15-30% of aneurysms which might necessitate further treatment. Multiple options for retreatment exist, commonly including the deployment of another flow-diverting device (FDD) in a telescoping fashion within the existing FDD. There is no current data to evaluate this strategy.

Methods
A retrospective review of patients undergoing FD retreatment from 15 centers was performed, including patients if the repeat FD occurred for the same aneurysm at least 6 months after initial treatment, with 6 months of follow-up after retreatment. The primary outcome was aneurysmal occlusion with secondary outcomes of safety and complications. A multivariable logistic regression model was constructed to identify potential predictors of persistence/occlusion after retreatment.

Results
A total of 95 patients (median age 57, 81% females) harboring 95 aneurysms underwent 198 treatment procedures. 87.4% of aneurysms were unruptured; 74.7% were saccular and 79% were located in the internal carotid artery (median maximal diameter 9-mm), with 87 patients treated twice and 8 patients were treated thrice. Median elapsed time between first and second treatment, and between retreatment and last available follow-up was 12.2 and 12.8 months, respectively. Last imaging follow-up was performed at a median of 30.6 months after initial treatment, showing complete occlusion in 46.2%, and near-complete occlusion (90-99%) in 20.4% of aneurysms; no difference in ischemic complications following initial treatment and retreatment (4.2% vs 4.2; p>.99). On multivariable logistic regression, fusiform morphology was associated with higher odds of non-occlusion after retreatment (OR 7.2; p=0.003), while family history of aneurysms and positive smoking history were associated with higher odds of complete occlusion (p=0.019 and p=0.026; respectively).

Conclusion
Repeat flow diversion for persistent aneurysms is associated with a reasonable chance of success and an acceptable safety profile.
Arteriovenous Fistula of the Filum Terminale: A case report and review of the literature

Tyler Scullen, MD\textsuperscript{1,2}, Mansour Mathkour, MD\textsuperscript{1,2}, Peter S Amenta, MD\textsuperscript{1}, Robert Dallapiazza, MD, PhD\textsuperscript{1}

Tulane University School of Medicine, Tulane University, New Orleans, LA 70130
Department of Neurological Surgery, Ochsner Medical Center, Jefferson, LA 70121

Abstract

Background

Fistulas of the filum terminale are rare lesions that result from a fistulous connection between the artery and vein of the filum terminale. These lesions often present as progressive thoracic myelopathy secondary to venous hypertension that is transmitted to the coronal venous plexus of the spinal cord. Frequently, filum fistulas are associated with lumbar stenosis, and likely form as a result of chronic inflammation and compression. Unfortunately, due to the relative rarity of filum fistulas and the commonality of lumbar stenosis, filum fistulas may be overlooked or misdiagnosed.

Case Description

We present a 62-year-old male with severe lumbar stenosis who presented with progressive thoracic myelopathy. Work-up including spinal angiography identified a low flow arteriovenous fistula within the filum terminale that was successfully treated with microsurgical obliteration. The patient tolerated the procedure well with good functional recovery within one month.

Conclusion

As was the case with this patient, these lesions demonstrate a high association with lumbar stenosis and tethered or tight cord syndrome. We review the clinical presentation, imaging findings, surgical management, and possible mechanisms of development for these rarely encountered fistulas.
James Barry, MD (LSUHSC-S)

Neuroform Atlas Stenting in Cases of Refractory Intracranial Stenosis

Hugo Cuellar MD PhD¹, James Barry MD¹, Rimal Hanif MD¹

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

Abstract

Endovascular management of intracranial stenosis is a controversial subject in neurointervention. Previously the SAMPRIS trial provided level 1 evidence showing superiority of medical management but more recent studies have shown improved outcomes in select patients. Herein we describe a novel technique for stenting of intracranial stenosis using a single system with Coyote angioplasty balloon and the Atlas stent. Additionally we provide preliminary data from a series of 22 patients treated using this technique.
**Moderators: Christopher Maulucci, MD; Anthony Sin, MD; Gabe Tender, MD**

**Derrick Umansky, MD (Tulane-Ochsner)**
Venous Drainage of the Lumbar Vertebral Bodies: An Anatomical Study with Application to Kyphoplasty, Vertebroplasty and Pedicle Screw Complications

**Adam Beighley (Tulane)**
A Review of Patient Reported Outcomes in Spine Surgery

**Casey Spinelli (LSUHSC-NO)**
Intraoperative Hip Flexion Facilitates Insertion of Larger Interbody Spacers During Transforaminal Lumbar Interbody Fusion Procedures

**Pervez Khan, MD (Tulane-Ochsner)**
Relationship of the Obturator Nerve and Psoas Major: Anatomical Study with Application to Avoiding Iatrogenic Injury

**Mansour Mathkour, MD (Tulane-Ochsner)**
The Necessity of Dependency “functional health status” as a Constituent of the Modified 5-item Frailty Index in Spine Patients: Does It Make a Difference and Predict Outcomes?

**David Cavanaugh, MD (Spine Institute of Louisiana)**
Radiographic and Clinical Adjacent Segment Pathology Following Cervical Total Disc Replacement or Anterior Cervical Discectomy and Fusion Through 7-Year Follow-Up
Derrick Umansky, MD (Tulane-Ochsner)

Venous Drainage of the Lumbar Vertebral Bodies: An Anatomical Study with Application to Kyphoplasty, Vertebroplasty and Pedicle Screw Complications

Umansky, Derrick; Iwanga, Joe; Bui, Cuong; Dumont, Aaron; Tubbs, Shane

Tulane University School of Medicine, Tulane University, New Orleans, LA 70130
Department of Neurological Surgery, Ochsner Medical Center, Jefferson, LA 70121

Abstract

Background

Bone cement augmentation with polymethylmethacrylate (PMMA) is a reliable method for stabilizing osteoporotic compression fractures and for improving fixation of pedicle screws. However, cement extrusion into the vertebral venous system (VVS) can result in pulmonary cement embolism. The goal of this anatomical study was to identify the relationship between the internal/external vertebral plexus and the neighboring abdominal caval system.

Methods

Thirty-two lumbar vertebral levels were used in this study. Anterior abdominal dissection was performed to access the lumbar vertebral bodies through the peritoneal cavity and a 16-gauge needle was placed into the center of each lumbar vertebral body at its anterior aspect. Fluoroscopy was used to confirm if the needle was correctly placed. Next, latex and/or continuous air injections were performed into each lumbar vertebral level (L1-L5). Observations confirmed if the latex or air traveled into the IVC. Additionally, the spinal canal was opened to see if any latex was found to enter inside the vertebral canal in cadavers injected with the latex.

Results

Latex or air was found to flow into the inferior vena cava at all the lumbar vertebral levels. The latex/air was not observed in the spinal canal in any specimen.

Conclusions

An exact knowledge of the lumbar vertebral venous anatomy is essential when procedures are involved which could affect the VVS. Its complexity and anatomical variability necessitate such an understanding to better prevent/understand possible complications associated with PMMA extrusion.
A Review of Patient Reported Outcome Measures in Spine Surgery

Adam Beighley, BS\(^1\); Allen Zhang, BS\(^1\); Brendan Huang, BS\(^1\); Christopher Carr, MD, MPH\(^2\); Mansour Mathkour, MD, MSc\(^2\); Derrick Umansky, MD\(^2\); Robert Dallapiazza, MD, PhD\(^3\); Christopher Maulucci, MD\(^3\)

Tulane University School of Medicine, New Orleans, LA
Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, Tulane University Medical Center
Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA

Abstract

Background

Steadily increasing expenditure in the US national health system has led to shifts towards a value-based model which focuses on quality of care and cost-effectiveness. Operations involving the spine rank among some of the most common and expensive procedures performed in operating rooms nationwide. Patient Reported Outcome Measures (PROMs) are a useful tool for reporting levels of outcome and analyzing patient recovery but are both under-utilized and non-standardized in spine surgery. We sought to perform an extensive literature review concerning the use of major PROMs within the field.

Methods

We conducted a review of the literature using the PubMed database, focusing on the most commonly utilized PROMs for cervical and lumbar spine disease and spinal deformity. The benefits and drawbacks of these PROMs were then summarized and compared.

Results

Spine-specific PROMs were based on the class of disease. The most frequently utilized PROMs were the Neck Disability Index (NDI) and the modified Japanese Association scale (mJOA); the Oswestry Disability Index (ODI) and the Roland-Morris Disability Questionnaire (RMDQ); and the Scoliosis Research Society 22-item questionnaire (SRS-22) for cervical spine disease, lumbar spine disease, and spinal deformity, respectively.

Conclusions

We found limited though effective use of PROMs targeting specific classes of disease within spine surgery. We further advocate for increased use of PROMs in spine surgery, in both the research and clinical settings. These will help physicians assess subjective outcomes in standard ways, more uniquely tailor treatment to individual patients, and engage patients in their own medical care.
Intraoperative Hip Flexion Facilitates Insertion of Larger Interbody Spacers During Transforaminal Lumbar Interbody Fusion Procedures

Casey Spinelli2, Jessica Shields MD1, Jared Robichaux MD1, Clifford Crutcher MD1, Gabriel Tender MD1

1Louisiana State University, Department of Neurosurgery, New Orleans, LA, USA
2Louisiana State University School of Medicine, New Orleans, LA, USA

Abstract

Introduction

Placement of adequate size interbody spacers during transforaminal lumbar interbody fusion procedures is important for lordosis preservation or restoration. However, this can be challenging, particularly at L5-S1. In 2017, we started placing the patient in hip flexion, using the operating table controls, until the interbody spacer was inserted, after which the neutral position was restored.

Methods

Between Jan 2017 and Dec 2018, 46 patients underwent L5-S1 and/or L4-L5 TLIF at our institution, using the table flexing technique. Between Jan 2015 and Dec 2016, 49 patients underwent the same procedure without changing the table position. We conducted a retrospective chart review where the two groups were compared for preoperative disc height, relative spacer size, and perioperative complications. Disc height was calculated using measurement techniques described in Mirab et al3. Spacer size was noted from the chart as well as correlated on postoperative imaging.

Results

In the first group, the average preoperative disc height was 8.4 mm (range: 6.0 -12.3 mm) and the average spacer height was 11.4 mm (range: 9-14 mm). In the second group, the average preoperative disc height was 8.2 mm (range: 5 - 11 mm) and the average spacer height was 10.6 mm (range: 7-15 mm). There was one patient with postoperative radiculopathy due to spacer retropulsion, in the second group, requiring revision.

Conclusions

During TLIF procedures, placing the patient in hip flexion allows for larger spacer insertion and may prevent spacer backout postoperatively. Anesthesia should be notified to restore the table neutral position after spacer insertion and before locking the screw/rod construct, in order to avoid fusing the patient in a kyphotic position.
Pervez Khan, MD (Tulane-Ochsner)

Relationship of the Obturator Nerve and Psoas Major: Anatomical Study with Application to Avoiding Iatrogenic Injuries

Joe Iwanaga, DDS, PhD¹,², Tyler Warner³, Tyler A. Scullen, MD⁴, Alex von Glinski, MD⁵, Basem Ishak, MD⁶, CJ Bui, MD⁷, Aaron S. Dumont, MD¹, R. Shane Tubbs, PhD¹,³,⁸,⁹, Pervez A. Khan MD

Department of Neurosurgery, Tulane Center for Clinical Neurosciences, Tulane University School of Medicine, New Orleans, LA, USA
Division of Gross and Clinical Anatomy, Department of Anatomy, Kurume University School of Medicine, Kurume, Fukuoka, Japan
Department of Anatomical Sciences, St. George’s University, St. George’s, Grenada
Tulane University & Ochsner Clinic Neurosurgery Program, Tulane University School of Medicine, New Orleans LA
Department of Trauma Surgery, BG University Hospital Bergmannsheil, Ruhr University, Bochum, Germany
Department of Neurosurgery, Heidelberg University Hospital, Heidelberg, Germany
Department of Neurosurgery, Ochsner Health System, New Orleans, LA
Department of Structural & Cellular Biology, Tulane University School of Medicine, New Orleans, LA, USA
Department of Neurosurgery and Ochsner Neuroscience Institute, Ochsner Health System, New Orleans, LA

Abstract

The proximal course of the obturator nerve as related to the psoas major has been described differently among various authors. As this relationship is important for better understanding clinical presentations and during surgical approaches, the present study aimed to elucidate this anatomy via cadaveric dissection. Twenty obturator nerves from ten Caucasian cadaveric specimens underwent dissection and observations were made of the relationship between the nerve and psoas major muscle. On all sides, the obturator nerve descended posterior to the psoas major and never through it. These results might be important to clinicians who interpret radiology of this region, treat patients with presumed obturator compression syndromes, or to surgeons who operate near the intracavitary part of the obturator nerve.
The Necessity of Dependency “functional health status” as a Constituent of the Modified 5-item Frailty Index in Spine Patients: Does It Make a Difference and Predict Outcomes?

Mansour Mathkour, MD, MSc; Cassidy Werner, MSc; Jon Mark Lane, MD; Tyler Scullen MD; Christopher Carr, MD, MPH; CJ Bui, MD; James Kalyvas, MD

Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA
Tulane University School of Medicine, New Orleans, LA

Abstract

Introduction

Outcome prediction scores are increasingly relevant in assessing patient perioperative risk prior to surgical intervention. The modified 5-item frailty index (mFI-5) is a comorbidity-based risk assessment tool that has been shown to correlate with outcomes for many surgical fields including neurosurgery. The five variables are congestive heart failure (CHF), diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), hypertension, and functional health status or dependency at the time of surgery. As there is no standardized method for assessing functional status of spinal patients, we assessed the necessity of this variable as a constituent of the mFI-5.

Methods

Frailty scores were retrospectively calculated for 6011 patients that underwent spinal surgery between June 2012 and May 2018 at our institution using a four-variable mFI that omitted functional health status. Adverse outcomes included mortality, readmission, revision, and system-specific complications. Linear regression analysis was used to determine correlations.

Results

Higher four-variable frailty scores significantly correlated with a greater number of total adverse outcomes ($r^2 = 0.8964$, $p = .01461$). In addition, higher four-variable frailty scores significantly correlated with increased hospital readmission at 1 month ($r^2 = .8912$, $p = .01577$), at 3 months ($r^2 = .8761$, $p = .0193$), and at 12 months ($r^2 = .9518$, $p = .00456$). Significant correlations were also seen with postoperative complications including increased rates of wound dehiscence at 3 months ($r^2 = 0.8053$, $p = .03883$) and pneumonia at 3 months ($r^2 = .87$, $p = .020745$).

Conclusions

Our data show that the mFI-5 without functional health status is a strong predictor of adverse outcomes in patients undergoing spinal surgery. Further future research needed to expand on these findings, we will conduct subgroup analysis to determine the relative strength of the four individual variables to each specific spine pathology. We plan to study additional functionality indicators that are applicable to all spinal surgery patients, which currently undergoing validation, and can be used in place of functional health status.
Abstract

Introduction
Cervical disc arthroplasty (CDA) is an alternative to anterior cervical discectomy and fusion (ACDF) hypothesized to protect adjacent segments. For CDA and ACDF, the true incidence and relationship between radiographic and clinical adjacent segment pathology (RASP & CASP) following cervical spine surgery remains heavily debated.

Methods
Prospectively collected data through 7-years from an FDA IDE trial comparing CDA to ACDF was retrospectively analyzed. Independent radiologists (MMI) evaluated RASP using the Kellgren-Lawrence Scale. CASP was defined as surgical intervention at either adjacent level. Patient demographics included; age, race, gender, height, weight, and BMI. CASP to RASP correlation was analyzed using matched retrospective cohort analysis. Multivariate Cox models were used to determine if time to CASP was associated with patient demographics.

Results
CASP occurred in 24 ACDF patients, 12 one-level and 12 two-level, and 17 CDA patients, 7 one-level and 10 two-level. Kaplan-Meier estimates confirmed significantly higher probability of CASP for ACDF patients at one (p=0.002) and two-level (p=0.008).

The incidence of grade 3/4 RASP in one-level was 27% CDA and 47% ACDF (p<0.0001) and for two-level was 14% CDA and 49% ACDF (p<0.0001).

Patients with grade 3/4 RASP did not show statistically significant increased probability of CASP, regardless of treatment, using case control analysis. Patients identified with CASP did not experience elevated RASP rates compared to patients without CASP.

Multivariate Cox modeling of all patients identified increased CASP risk in younger patients (p<0.0013) and treatment with ACDF (p<0.001). No other demographic covariates were associated with CASP.

Conclusions
Rates of RASP and CASP were lower in CDA patients compared to ACDF. No correlation was found between CASP and RASP, but treatment with ACDF and younger age were found to be risk factors of CASP. The mechanism of CASP development remains unclear and should be studied further in large, high quality datasets.
Moderators: Christopher Maulucci, MD; Anthony Sin, MD; Gabe Tender, MD

Cassidy Werner (Tulane)
Reperfusion “White Cord” Syndrome in Cervical Spondylotic Myelopathy: Does Mean Arterial Pressure Goal Make a Difference?

John Wilson, MD (LSUHSC-NO)
The Safety Profile of Bone Marrow Aspirate Harvest for Concentration and Application in Cervical Spine Surgery and a Technical Note

Mansour Mathkour, MD (Tulane-Ochsner)
Successful Correction of Sagittal Imbalance by Single-segment Minimally Invasive Anterior Column Release with Anterior-to-the-Psoas Interbody Fusion Using Hyperlordotic Expandable Cage and Posterior Instrumentation: Case Series

Andrew Janssen, MD (Tulane-Ochsner)
Does the L5 Spinal Nerve Move Anatomical Evaluation with Implications for Postoperative L5 Nerve Palsy

Clifford Crutcher II, MD (LSUHSC-NO)
Does the Use of Bone Marrow Aspirate Concentrate Affect Fusion Rates In Myelopathic Smokers Undergoing Anterior Cervical Discectomy and Fusion

J. Frank Berry, MD (Tulane-Ochsner)
Management of Recurrent Chondrosarcoma: Complex Tumor Management at a Multidisciplinary Comprehensive Skull Base Center

Jessica Shields, MD, PhD (LSUHSC-NO)
Use of transcranial magnetic stimulation to track functional improvement following surgical decompression in patients with cervical myelopathy
Cassidy Werner, MSc; Mansour Mathkour, MD, MSc; Jonathan Riffle, DO; Tyler Scullen, MD; Christopher Carr, MD, MPH; Robert F. Dallapiazza, MD, Ph.D.; Aaron Dumont, MD; Christopher Maulucci, MD

Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, New Orleans, LA
Tulane University School of Medicine, New Orleans, LA

Abstract

Introduction

White Cord Syndrome or reperfusion injury of chronically ischemic areas of the spinal cord refers to a rare syndrome characterized by unexplained new neurological deficits following an anterior or posterior decompressive cervical procedure with corresponding imaging findings. The radiographic hallmark is the presence of hyperintense T2 intramedullary signal change following a decompressive procedure without other pathologic changes. We present a case of such syndrome following posterior cervical decompression.

Case Presentation

A 79-year-old male presented to our facility with three weeks of progressive myelopathy. Magnetic resonance imaging (MRI) of the cervical spine demonstrated severe spondylotic canal stenosis with myelomalacia. The patient underwent posterior cervical decompression and fusion complicated by decreased transcranial motor evoked potentials at the end of the case, and he awoke with worsened right hemiparesis. MRI of the brain was negative for ischemic insult and MRI of the cervical spine showed worsening T2 signal changes. The patient’s weakness improved with hyperperfusion goals, systemic glucocorticoids, and physical therapy. He was eventually discharged to an acute rehabilitation facility. A review of the literature identified only five previously reported cases of white cord syndrome.

Conclusion

The pathophysiology of white cord syndrome is thought to be due to a reperfusion type injury of chronically ischemic areas of the spinal cord. All but one published cases to date have improved following MAP goals, steroid administration therapy, and acute rehabilitation. Spine surgeons should be aware of this potentially devastating complication and how to properly manage these patients’ postoperative care.
The Safety Profile of Bone Marrow Aspirate Harvest for Concentration and Application in Cervical Spine Surgery and a Technical Note.

John Wilson, Clifford Crutcher
Department of Neurosurgery, LSU Health Sciences Center, New Orleans, LA

Abstract

Background
Anterior cervical discectomy and fusion is one of the most common neurosurgical procedures performed each year. Symptom resolution and successful arthrodesis surgery are the fundamental goals of spinal fusion surgery. Iliac crest bone has been used in the past and remains is the graft gold standard. While there are many allograft options available, each possesses varying degrees of efficacy. The authors routinely harvest bone marrow aspirate (BMA) from the anterior iliac crest for addition to allograft to improve the efficacy of the surgeons preferred allograft combination. Here the authors present our initial safety profile.

Methods
A multi-surgeon single institution retrospective analysis was performed on all cervical myelopathic patients undergoing decompression and fusion from January 2013- April 2017. All adult patients with myelopathy who have BMA harvested were included.

Results
A total 299 patients underwent surgery for cervical myelopathy. One hundred and one patients met the inclusion criteria. The mean age was 50.7 +/- 8.4. Nearly half of the patients were Caucasian (49.5 %) males (55.4%). The average BMI was 31.4 +/- 7.8. The average Nurick grade was 2.1+/1.2. There were 85 anterior only, 14 posterior only, and 2 combined approach surgeries. There were no reported complications or patient complaints regards the bone marrow aspirate harvest.

Conclusion
Harvesting bone marrow aspirate from the anterior iliac crest for spine surgery appears safe. Further research regarding BMA efficacy in spinal surgery will be of benefit.
Mansour Mathkour, MD (Tulane-Ochsner)

Successful Correction of Severe Sagittal Imbalance by Single-segment Minimally Invasive Anterior Column Release with Anterior-to-the-Psoas Interbody Fusion Using Hyperlordotic Expandable Cage and Posterior Instrumentation: Case Series

Velina S. Chavarro, AM1; Mansour Mathkour2, MD,MSc2; Daniel Denis, MD, MSc1,2

1University of Queensland, Faculty of Medicine, Brisbane QLD Australia
2Ochsner Health System, Department of Neurological Surgery, New Orleans, LA

Abstract

Background

Adult sagittal plane imbalance is a structural spinal deformity associated with debilitating low back and leg pain and decreased quality of life. Traditionally, restoration of sagittal plane imbalance requires extensive long-segment spinal fusion and instrumentation. Minimally invasive anterior column release (ACR) is a new surgical technique which aims to improve global lumbar lordosis. ACR with placement of a hyperlordotic expandable cage during anterior-to-the-psoas (ATP) interbody fusion can restore severe sagittal plane imbalance caused by single-level spondylolisthesis.

Method

A retrospective chart review of all patients with significant positive sagittal imbalance due to single-level spondylolisthesis in the setting of lumbosacral radiculopathy treated with ACR and hyperlordotic interbody spacer. Patient demographic data, perioperative and postoperative data were collected. Patient reported functional outcomes including Oswestry Disability Index (ODI) and Numeric Pain Score (NRS) at baseline and follow up visits were obtained and collected. Baseline and postoperative radiographical parameters of sagittal balance including lumbar lordosis (LL), Sagittal vertical axis (SVA) and pelvic incidence-lumbar lordosis mismatch (PI-LL) were documented and collected. We used paired t-test and a two-sample t-test. Study outcomes were compared using univariate analyses, 1-sample paired t-tests, and 2-sample t-tests to determine means, standard errors, and p-values for statistical significance.

Results

A total of 3 consecutive cases, 2 females and 1 male, were treated between April-November 2019. All underwent single-level ATP interbody fusion with ACR using expandable fully expanded 30-degree hyperlordotic cages. Mean age at surgery was 62.2 years (range 58-66, SD ± 4.1 year) and mean body mass index (BMI) was 44 (range 40-48). Two patients had L4-L5 degenerative spondylolisthesis and one had L3-4 spondylolisthesis caused by adjacent segmental degeneration. Average post-operative length of stay was 3 days (range 2-4 days, SD 1day) and EBL 266cc (range 200-300, SD 57cc). All patients experienced significant improvements in sagittal balance parameters determined by augmentation reductions in LL (32.6 ±15 vs 56.6±12, p 0.015); reductions in SVA (180±31 vs 61.3±18, p 0.0046) and PI-LL (preop 26±22° vs postop 17±21°, p 0.0495). NRS and ODI measurements at follow-up improved significantly in all patients.

Conclusion

Single level lumbar spondylolisthesis can present with severe sagittal plane imbalance. Significant restoration of sagittal plane balance combined with a short LOS and significant improvement in clinical parameters suggest that ACR with the use of a hyperlordotic interbody spacer is a promising approach with the potential of achieving similar results than posterior long segment fusion but with decreased morbidity. Future studies of its efficacy are warranted.
Andrew Janssen, MD (Tulane-Ochsner)

Does the L5 Spinal Nerve Move Anatomical Evaluation with Implications for Postoperative L5 Nerve Palsy

Andrew Janssen, Basem Ishak, Shogo Kikuta, Tyler Scullen, Joe Iwanaga, Daniel J. Denis, James Kalyvas, Christopher M. Maulucci, Aaron S. Dumont, R. Shane Tubbs

Abstract

Objective

While palsy of the L5 nerve root due to stretch injury is a known complication in patients who have undergone reduction of high-grade spondylolisthesis the underlying pathophysiology remains unclear. The goal of this cadaveric study was to quantify movement of the L5 nerve root during flexion/extension of the thigh and spine.

Methods

Ten fresh-frozen human cadavers sides were dissected to expose the lumbar vertebral bodies and the L5 nerve roots. Movement of the L5 nerve root was tested during flexion and extension of the thigh and spine. Four steps were undertaken to characterize these movements: (1) removal of the bilateral psoas muscles, (2) removal of the lumbar vertebral bodies including the transforaminal ligaments from L3 to L5, (3) opening and removing the dura mater laterally to visualize the rootlets, and (4) removal of remaining soft tissue surrounding the L5 nerve root. Two metal bars were inserted into the sacral body at the level of S1 as fixed landmarks. The tips of these bars were connected to make a line for the ruler that was used to measure movement of the L5 nerve roots. Movement was regarded as measurable when there was an L5 nerve excursion of at least 1 mm.

Results

The mean age at death was 86.6 years (range 68-89 years). None of the four steps revealed any measurable movement after flexion/extension of the thigh and spine on either side (< 1 mm). Flexion of the thigh and spine revealed lax L5 nerve roots. Extension of the thigh and spine showed taut ones.

Conclusion

Significant movement or displacement of the L5 nerve root could not be quantified in this study. No mechanical cause for L5 nerve palsy could be identified so the etiology of the condition remains unclear. Further anatomical studies are needed to confirm our findings.
Does the Use of Bone Marrow Aspirate Concentrate Affect Fusion Rates In Myelopathic Smokers Undergoing Anterior Cervical Discectomy and Fusion

Clifford Crutcher

Abstract

Introduction

Anterior discectomy and fusion is a common treatment option for patients presenting with cervical myelopathy. The literature has shown that smoking can affect the rate of pseudarthrosis in the cervical spine. Recently, we have started to routinely harvest and utilize bone marrow aspirate concentrate (BMAC) for our myelopathic patients who are unable to quit smoking. Here we present our initial results.

Methods

A multi-surgeon single institution retrospective analysis was performed of all myelopathic patients undergoing decompression and fusion from January 2013- October 2016. Patients with at least 1-year follow-up CT or X-ray were included. Non-smokers, patients undergoing anterior corpectomy, and patients undergoing combined anterior and posterior fusions were excluded.

Results

A total of 266 patients were reviewed. Thirty-two patients met our inclusion criteria. The mean age was 49.4 +/-7.8 years and 43.8% were females. 50% of patients were Caucasian. Bone marrow aspirate was harvested in 50% of patients. The non-BMAC group had an 87.5% (14/16) fusion rate. The BMAC group demonstrated a 100% (16/16) fusion rate P<0.05.

Conclusions

The utilization of bone marrow aspirate concentrate may improve fusion rates among smokers undergoing anterior cervical discectomy and fusion. A larger study with subgroup analysis of the single level and the multilevel fusions would be a useful addition to the literature.
Abstract

Chondrosarcomas are rare tumors, accounting for less than 0.15% of intracranial neoplasms. These tumors, which arise from the cranial synchondroses of the skull base, frequently reach a large size and involve critical neurovascular structures prior to presentation. Management consists of maximum surgical resection of the soft tissue and bony components, while preserving neurologic function. Complex skull base approaches, including the middle fossa and transmastoid approaches, are often required to adequately address the tumor burden. Adjuvant therapy consists of proton beam therapy for unresectable tumor. As a result, treatment is often best managed at a comprehensive skull base center with access to skull base neurosurgery, neurotology/otolaryngology, and radiation oncology. We present a 52-year-old female with an extensive recurrent chondrosarcoma of the left middle fossa, cavernous sinus, petrous apex, jugular foramen, and neck that had not been imaged for approximately two decades. She presented with acute onset of a left frozen globe secondary to tumor invading the cavernous sinus. She underwent a left-sided combined pterional and middle fossa craniotomy with resection of the tumor and exenteration of the left cavernous sinus. Tumor was also resected from the posterior fossa via Kawase's rhomboid and drilling of the clivus. Tumor resection resulted in a communication between the sphenoid sinus and middle fossa, which was treated by rhinology with a fascia lata graft and nasoseptal flap. A second stage neck dissection combined with a transmastoid approach to the jugular foramen addressed the tumor extending into the jugular foramen and neck. Tumor found to be adherent to the lower cranial nerves was not resected and the patient was referred for proton beam therapy by radiation oncology. The patient developed no new neurologic deficits and has not experienced any disease progression for eighteen months. We believe this case demonstrates the value of a multidisciplinary comprehensive skull base program when managing complex skull base pathology.
Use of transcranial magnetic stimulation to track functional improvement following surgical decompression in patients with cervical myelopathy.

Jessica Shields, Erin Fannin, Kevin Morrow, Jason Wilson

Department of Neurosurgery, LSU Health Sciences Center, New Orleans, LA, USA

Abstract

Introduction

The goal of this study was to investigate the use of cortical stimulation to study corticospinal recovery following surgical decompression in a cohort of patients with cervical myelopathy (CM). Recruitment curves provide a measure of corticospinal function.

Methods

Transcranial magnetic stimulation induced motor evoked potentials were measured in 12 myelopathy patients before and at 2 weeks, 3 months, and 6 months post operatively. The slope of the motor recruitment curve was calculated both as a pooled group and as a change score for individual patients to correlate with functional improvement. 2 patients were studied for cortical mapping of motor cortex responses to study cortical plasticity with recovery.

Results

The mean JOA score significantly improved at 3 months post operatively. There were no changes in resting motor threshold throughout the post-operative period. 10 patients showed significant improvement in recruitment curve slope, which was greatest at the 2 week post-op interval but remained significant at the other time periods. One patient did not show improvement in recruitment curve function or JOA score. During recovery, 2 patients showed widening of their cortical arm representation which may suggest cortical plasticity during recovery.

Conclusions

These results suggest that surgical decompression improves corticospinal function in CM patients and that this can be monitored via non-invasive physiologic monitoring.
Moderators: Jorge Alvernia, MD; David Cavanaugh, MD; Aaron Dumont, MD

Robert Ross, MD (Tulane-Ochsner)
Anatomy and Surgical Relationships of the Falciform Ligament

Mitchell Kilgore (Tulane)
A Review of Lumbar and External Ventricular Drainage in the Management of Meningitis

Cassidy Werner (Tulane)
Feasibility and Effectiveness of Minimally Invasive Craniotomy and Cesium-131 Brachytherapy for Treatment of Brain Oligometastases: Preliminary Report

Kevin Morrow, MD (LSUHSC-NO)
Evaluation of MRI Safety for Civilian Gunshot Wounds with Retained Bullet

Joseph Lockwood, MD (Tulane-Ochsner)
The Inferior Intercavernous Sinus: An Anatomical Study with Application to Trans-sphenoidal Approaches to the Pituitary Gland

Tyler Scullen, MD (Tulane-Ochsner)
Chordae Willisii within the Transverse Sinus: A Morphological Study

Adam Podet, MD (LSUHSC-NO)
Hearing preservation and facial function after hearing preservation surgery for acoustic neuromas

Erin McCormack, MD (Tulane-Ochsner)
Space-occupying lesions of the retropharyngeal space: An anatomical study with application to post-operative retropharyngeal hematomas

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Robert Ross, MD, MPH (Tulane-Ochsner)

Anatomy and Surgical Relationships of the Falciform Ligament

Robert C. Ross
Tulane/Ochsner Department of Neurosurgery

Abstract

Objective

The current study aims to increase awareness of the falciform ligament and its anatomical and surgical relationships, for the benefit of the neurosurgeon.

Methods

Twenty-four sides from twelve Caucasian cadaveric heads (all fresh-frozen) were used in this study. The length and thickness of the falciform ligament were recorded. The relationship of the falciform ligament to the optic nerve was also observed and documented. Finally, the force needed to avulse the falciform ligament was recorded.

Results

In all specimens, the ligament was identified as a continuation of the outer dural layer, forming a roof at the entrance of the optic canal. The mean medial-to-lateral length, anteroposterior length, and thickness of the falciform ligament were 7.97 mm, 2.12 mm, and 0.26 mm, respectively. The mean distance from the medial attachment of the ligament to the midline was 5.54 mm. For the undersurface of the falciform ligament, the optic nerve occupied the middle third in 50.0%, the lateral third in 44.4%, and the medial third in 5.6% of sides. The mean optic nerve diameter at the entrance of the optic canal was 4.20 mm. The mean failure force was 2.47 N.

Conclusions

The anatomical measurements and relationships provided in this description of the falciform ligament serve as a tool for surgery selection and planning, as well as an aid to improving microsurgical techniques, with the final goal being better patient outcomes.
A Review of Lumbar and External Ventricular Drainage in the Management of Meningitis

Mitchell D Kilgore, BS¹; Christopher Carr, MD, MPH²; Roxanne Daban, BS¹; Mansour Mathkour MD, MSc²; Aaron S. Dumont, MD, MBA³

¹Tulane University School of Medicine, New Orleans, LA
²Tulane University-Ochsner Clinic Foundation Program, Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA
³Department of Neurosurgery, Tulane University Medical Center, New Orleans, LA

Abstract

Background

Meningitis is a neurological condition characterized by meningeal inflammation arising from numerous etiologies. The high mortality and morbidity seen in meningitis are predominantly due to brainstem compression and brain herniation secondary to associated intracranial pressure (ICP) elevation and communicating hydrocephalus. Aggressive neurosurgical interventions including the placement of lumbar and external ventricular drains (LD/EVD) for cerebrospinal fluid (CSF) diversion have been used in treating meningitis. Nevertheless, no consensus has been made as to how these interventions should be utilized.

Methods

A review of PubMed was conducted to assess current literature on the mechanisms, outcomes, and risks associated with LD/EVD in the setting of meningitis, including the advantages and disadvantages of each treatment modality.

Results

Animal and clinical studies of adjuvant mechanical CSF sterilization in bacterial meningitis demonstrate significantly reduced CSF bacteria and leukocyte concentrations as well as reductions in ICP and morbidity and mortality when compared to pharmaceutical controls. Nevertheless, ventricular and lumbar CSF analysis in patients with an array of unobstructed central nervous system infections showed significant rostrocaudal differences in CSF protein, albumin, and immunoglobulin composition. LD and EVD each were noted to carry unique periprocedural risks. LD/EVD in the context of elevated ICP unrelated to meningitis is associated with secondary nosocomial infection, although this risk is significantly higher for LD.

Discussion

Adjuvant LD/EVD in meningitis is associated with reduced morbidity and mortality. This may be due to sustained reductions in ICP and elimination of pathogenic material. A threefold higher risk of secondary nosocomial infection burdens LD compared to EVD. Nevertheless, future investigations are needed to better elucidate which procedure is ultimately preferable. Both modalities may be suitable adjuvant therapies in meningitis patients that do not respond to pharmaceutical management as well as for CSF diversion on a case-by-case basis.
Cassidy Werner (Tulane)

Feasibility and Effectiveness of Minimally Invasive Craniotomy and Cesium-131 Brachytherapy for Treatment of Brain Oligometastases: Preliminary Report

Mansour Mathkour, MD, MSc; Cassidy Werner, MSc; Clayton Smith, MD; Marcus Ware, MD, PhD

Ochsner Health System, Department of Neurological Surgery, New Orleans, LA
Ochsner Health System, Department of Radiation Oncology, New Orleans, LA

Abstract

Objective
To test the hypothesis that minimally invasive craniotomy (MIC) and stereotactic brachytherapy (SBT) is safe and effective for patients with intracranial oligometastases.

Methods
While our outcome analysis will eventually include multiple functional scales at follow-up points, this preliminary report focuses on dosimetry and tumor volume data in correlation to clinical outcomes and local progression. We assessed patient demographics, primary tumor and metastasis locations, number of implanted Cesium-131 brachytherapy seeds and associated volumes receiving 100% of the prescribed dose (V100), pre- and post-operative DICOM-measured tumor volumes, and local progression. Linear regression analysis was used to determine correlations between dosimetry and tumor volume.

Results
We report preliminary results from the first 7 patients included in our trial. Two of the patients died of causes not directly related to their brain metastasis or surgery and both had lung cancer. Four patients (57%) were male. Mean age at time of surgery was 61.3 ± 10.1 years. Primary tumor locations included lung (42.9%), breast (28.6%), endometrium (14.3%), and kidney (14.3%). Brain metastasis locations included cerebellum (57.1%), frontal lobe (14.3%), parietal lobe (14.3%), and occipital lobe (14.3%). All patients were treated with a combination of minimally invasive craniotomy (MIC) for gross total resection and Cesium-131 brachytherapy seed implantation. Mean number of implanted seeds was 15 ± 4.6. Mean preoperative tumor volume was 14.4 ± 7.3 cm3, postoperative tumor volume was 5.72 ± 1.76 cm3, and mean pre-/post-operative ratio was .491 ± .322. Mean V100 coverage was 87.4% ± 15.7%. For all patients, follow-up imaging showed no local progression. Based on primary data, we did not appreciate any significant correlation between dosimetry and tumor volume.

Conclusion
Based on our preliminary analysis, MIC and Cesium-131 brachytherapy is effective and safe for use in patients. Our final outcome analysis will eventually include multiple functional scales at follow-up points that assess functional status, cognitive function, quality of life, and cost-effectiveness. We will assess tumor characteristics such as freedom from local progression, growth kinetics, change to the size and shape of the resection cavity over time, and median and overall survival.
Evaluation of MRI Safety for Civilian Gunshot Wounds with Retained Bullet

Kevin Morrow, MD

LSU Health Sciences Center, Department of Neurosurgery, New Orleans, LA

Abstract

Introduction

There is concern for ballistic movement and radiofrequency induced heating causing damage to surrounding structures. The goal of this study was to examine the safety of undergoing an MRI in victims with retained civilian bullets in the New Orleans trauma population.

Methods

The prospectively maintained trauma database was queried for gun-shot wounds from 2016-2019. Charts from patients with retained bullets who subsequently underwent MRI were reviewed.

Results

1,977 patients were evaluated for gun-shot wounds from January 2016 to May 2019. 63 (3.2%) had retained bullets who subsequently underwent an MRI. A total of 67 MRIs was completed on these 63 patients. 5 (7.5%) were performed on a 1.0 Tesla, 41 (61.2%) on a 1.5T, and 21 (31.3%) on 3.0T. 35 (55.5%) of the MRIs were performed within one month of the gun-shot injury. Of these 35 MRIs completed within the first month, 23 were ordered or requested by the neurosurgery team. 36 (53.7%) of the MRIs images involved or were around the retained bullet. 28 (44.4%) out of the 63 patients had a large bullet slug retained, 23 (36.5%) with multiple fragments, 11 (17.5%) with a combination of slug and fragments, and 3 (4.8%) with a pellet. 2 patients had retained intracranial bullets that underwent MRI brain. 5 patients had retained intraspinal bullets that underwent MRI spine. Following completion of MRIs, 17 (27%) patients had follow up CTs that included imaging of the retained bullets. 11 of these 17 were performed within 1 month of the MRI, with no images showing any bullet migration. 13 (20.6%) patients did not have CT following the MRI but did have post-MRIs X-rays involving the retained bullet. Once again, there was no obvious bullet migration. There was no reported complication as the result of MRI.

Conclusion

MRIs with retained civilian non-ferromagnetic ballistics should be considered safe regardless of magnet strength, location of injury, or time between injury and MRI. There was no migration or complications related to MRI when imaging tissue surrounding the ballistic. There was no complication for MRI imaging intracranial or intraspinal ballistics.
Joseph Lockwood, MD (Tulane-Ochsner)

The Inferior Intercavernous Sinus: An Anatomical Study with Application to Trans-sphenoidal Approaches to the Pituitary Gland

Lauren Wahl¹, Joseph D. Lockwood², Kerri Keet³, Brandon Michael Henry⁴,⁵, Jerzy Gielecki⁶,⁷, Joe Iwanaga², CJ Bui⁸, Aaron S. Dumont², R. Shane Tubbs²,⁹,¹⁰

Department of Cell and Developmental Biology, University of Colorado, Boulder CO, USA
Department of Neurosurgery, Tulane University School of Medicine, New Orleans, LA, USA
Division of Clinical Anatomy, Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
Cardiac Intensive Care Unit, The Heart Institute, Cincinnati Children’s Hospital Medical Center, Cincinnati, Ohio, USA
International Evidence-Based Anatomy Working Group, Krakow, Poland
Department of Radiology, Collegium Medicum, School of Medicine, University of Warmia and Mazury, Olsztyn, Poland
Department of Anatomy, University of Warmia and Mazury, Olsztyn, Poland
Department of Neurosurgery, Ochsner Medical Center, New Orleans, LA, USA
Department of Anatomical Sciences, St. George’s University, St. George’s, Grenada, West Indies
Department of Structural & Cellular Biology, Tulane University School of Medicine, New Orleans, LA, USA

Abstract

The inferior intercavernous sinus is located below the pituitary gland in the sella turcica. Its presence has been controversial among anatomists because it is not always found on radiological imaging or during cadaveric dissections; however, it is becoming a better-known structure in the neurosurgical and radiological fields, specifically with respect to transsphenoidal surgery. Therefore, the present study was performed to better elucidate this structure at the skull base. Fifty adult, latex injected cadavers underwent dissection. The presence or absence of the inferior cavernous sinus was evaluated and when present, measurements of its width and length were made. Its connections with other intradural venous sinuses were also documented.

An inferior intercavernous sinus was identified in 26% of specimens. In all specimens, it communicated with the left and right cavernous sinus. The average width and length were 3 mm and 9.5 mm, respectively. In the sagittal plane, the inferior intercavernous sinus was positioned anteriorly in 31%, at the nadir of the sella turcica in 38%, and slightly posterior to the nadir of the sella turcica in 31%. In two specimens (15.4%), the sinus was plexiform in its shape. In one specimen a diploic vein connected the basilar venous plexus to the inferior intercavernous sinus on its deep surface. An improved understanding of the variable anatomy of the inferior intercavernous sinus is important in pathological, surgical, and radiological cases.
Chordae Willisii within the Transverse Sinus: A Morphological Study

Joe Iwanaga, DDS, PhD¹,², Evan Courville³, Mahindra Kumar Anand⁴, Pervez A. Khan, MD¹, Oded Goren, MD⁵, Markus Lammle, MD⁶, CJ Bui, MD⁷, Aaron S. Dumont, MD¹, R. Shane Tubbs, PhD¹,⁸-¹₀

Department of Neurosurgery, Tulane University School of Medicine, New Orleans, LA, USA
Department of Structural & Cellular Biology, Tulane University School of Medicine, New Orleans, LA, USA

Abstract

Objective

Some have suggested that trabeculae within the transverse sinuses (chordae Willisii) might restrict flow and potentially contribute to thrombus organization. Additionally, these structures might be encountered with endovascular procedures within the transverse sinus and are now readily seen on imaging. Therefore, as anatomical studies of these structures are scant, the current study aimed to better elucidate these structures within the transverse sinus via a morphological study in cadavers.

Methods

Thirty, fresh-frozen, cadaveric transverse sinuses were dissected and their detailed morphology recorded. Classification schemes were applied based on the anatomy and orientation of each chordae.

Results

Chordae were found on 70% of sides and were statistically more likely to be found on right sides (86.6%) (p<0.01). Three types and three classes of chordae were identified. There was a statistically significant difference between sides regarding type of chordae (p=0.02).

Conclusions

To date a comprehensive anatomical evaluation of the intraluminal chordae of the transverse sinuses has been lacking. Knowledge of these bands is also essential to those performing endovascular procedures of the dural venous sinuses and for those interpreting imaging of these structures.
Chordae Willisii within the Transverse Sinus: A Morphological Study

Adam Podet, Jessica Shields, Kevin Morrow, Isaac Erbele, Moises Arriaga, Frank Culicchia

Department of Neurosurgery, LSU Health Sciences Center, New Orleans, LA

Abstract

Introduction

Hearing preservation surgery for acoustic neuromas is done via the retrosigmoid or middle fossa approaches. Rates of long-term hearing preservation and facial nerve function are important for patient counseling and decision making regarding surgical approach.

Methods

Retrospective chart review of RS and MF performed at 2 centers (WJMC, OLOL) from 2015-2019. A total of 38 cases were performed, 5 patients were excluded due to inadequate follow up. Data followed included tumor size, degree of resection, hearing class, facial nerve dysfunction (measured by house-brackmann [HB] score).

Results

Average short and long term follow up was 3.7 and 17 months, respectively. Post operatively, 14 (42%) patients had a decline in hearing at long term follow up. Facial nerve dysfunction occurred in 7 (21%) of patients (5 RS, 2 MCF). Of the 5 patients who had a HB6 in the initial follow up, 4 (80%) showed improvement to HB 3-4. The average overall size of the tumors was 1.3mm (± .74). The average size of tumors which showed facial nerve decline was 1.65mm (± 1.05) and hearing decline was 1.45cm (± 0.78).

Conclusions

Despite hearing preservation surgery, 42% of patients showed a decline in hearing function, which is in accordance with previously published rates. Of the patients who showed post-operative facial nerve dysfunction, the majority showed significant improvement. The patients who showed long term decline of hearing and facial nerve dysfunction post operatively had larger tumors than those who did not.
Space-occupying lesions of the retropharyngeal space: An anatomical study with application to post-operative retropharyngeal hematomas

Erin McCormack

Department of Neurosurgery, Tulane University New Orleans, LA
Department of Neurosurgery, Ochsner Clinic Foundation, New Orleans, LA

Abstract

Introduction
The retropharyngeal space’s (RPS) clinical relevance is apparent in the field of anterior cervical spine surgery (ACSS) with respect to postoperative hematoma, which can cause life-threatening airway obstruction. To establish treatment guidelines, a better understanding of the pathomechanism and knowledge of the amount of postoperative bleeding required to cause a clinically significant compression or deviation of the trachea or the esophagus are mandatory.

Materials and Methods
Five fresh-frozen Caucasian cadavers (four male, one female, mean age at death 83 years) were dissected in the supine position. A digital manometer and a 20 Fr. Foley catheter were inserted into the retropharyngeal space via an anterolateral approach. While inflating the Foley catheter the esophagus/trachea’s position was documented using fluoroscopy and the pressure was measured. We defined the volume that compromised the esophagus as that required to shift the esophagus/trachea >1 cm from its origin with respect to the C5 spinous process on fluoroscopy. Further volume required to change the cervical silhouette was recorded.

Results
The esophagus visibly moved at a mean of 12.5 mL (mean pressure 0.03 PSI). The trachea deviated at a mean volume of 20.0 mL (mean pressure of 0.08 PSI). The visible clinical changes were apparent at a mean of 39.36 mL.

Conclusion
Even a small amount of volume in the RPS can cause the esophagus and trachea to deviate significantly. The esophagus is the structure in the retropharyngeal space to be most influenced by mass effects, while the visual changes in the anterior cervical spine’s silhouette and tracheal compression appear later.
Anatomical study of the pterygospinous and pterygoalar ligaments and their relationship to the mandibular nerve (V3): Neurosurgical implications for treating trigeminal neuralgia

Joe Iwanaga, PhD¹,², CJ Bui, MD³, Aaron S. Dumont¹, MD, R. Shane Tubbs, PA-C, PhD¹,⁴,⁵

Department of Neurosurgery, Tulane Center for Clinical Neurosciences, Tulane University School of Medicine, New Orleans, LA, USA
Division of Gross and Clinical Anatomy, Department of Anatomy, Kurume University School of Medicine, Kurume, Fukuoka, Japan
Department of Neurosurgery, Ochsner Health System, New Orleans, LA
Department of Structural & Cellular Biology, Tulane University School of Medicine, New Orleans, LA, USA

Abstract

Introduction

Ossification of the pterygospinous and pterygoalar ligaments has been well documented as forming pterygospinous and pterygoalar bony bars. However, the actual ligaments have been rarely shown in the existing literature. Therefore, the goal of this study was to reveal the detailed anatomy of these structures and their relationship with the branches of the mandibular nerve (V3) adjacent to the foramen ovale.

Methods

Thirty fresh frozen cadaveric sides were dissected. The branches of the V3 and any ligaments or bony bridges between the lateral plate of the pterygoid process and spine of the sphenoid were documented. The pterygospinous ligament/bar was defined as a ligament/bar between the lateral plate of the pterygoid process and inferior surface of the greater wing that runs medial to the main trunk of the V3. The pterygoalar ligament/bar was defined as a ligament/bar between the lateral plate of the pterygoid process and inferior surface of the greater wing that runs more lateral to the pterygospinous ligament/bar.

Results

This ligament/bar was classified into two different types: Type I, running between the buccal nerve and main trunk, and type II, running medial to the inferior alveolar nerve and lateral to the lingual nerve. Twenty-seven sides (90%) had at least one pterygoalar ligament/bar or pterygospinous ligament/bar. A pterygospinous ligament/bar was found on fifteen sides (50.0%). A pterygoalar ligament/bar was found on 16 sides (53.3%), with type I ligament/bars on eleven sides and type II ligament/bars on five sides.

Conclusions

These findings might be of use to neurosurgeons treating trigeminal neuralgia, especially with transfacial approaches to the foramen ovale. The classification developed in this study is simple to understand and can be easily applied to future studies.
New superficial surgical landmark for the sigmoid sinus: application to retrosigmoid approaches to the posterior cranial fossa

Joe Iwanaga, DDS, PhD¹, Pervez A. Khan MD¹, John D. Nerva, MD¹, Peter S. Amenta, MD¹, CJ Bui, MD², Aaron S. Dumont¹, MD, R. Shane Tubbs, PhD, PA-C¹,³

Abstract

Introduction
Many external anatomical landmarks have been used for approximating deeper, intracranial structures. Herein, we evaluate the attachment of the longissimus capitis on the mastoid process as a landmark for the underlying sigmoid sinus.

Materials and Methods
Adult cadavers underwent dissection of the posterior occiput with special attention to the attachment of the longissimus capitis muscle. Once the periphery of the muscle’s tendon of attachment was determined, a burr hole was made in this area and evaluated internally for its relationship to the sigmoid sinus.

Results
From an intracranial view, burr holes on all sides were over the sigmoid sinus and just slightly lateral to the center of the sinus. The distance from the midline to the medial border of the insertion of the longissimus capitis had a mean of $63.0 \pm 7.2$ mm. The width of the tendon of insertion of the longissimus capitis on the mastoid process had a mean of $17.6 \pm 5.7$ mm. The length of the tendon insertion of the longissimus capitis had a mean of $14.7 \pm 4.7$ mm. The distance from the inferior border of the insertion of the longissimus capitis to the tip of the mastoid process had a mean of $6.2 \pm 4.5$ mm.

Conclusions
To our knowledge, use of the attachment site of the longissimus capitis on the mastoid process as an external landmark for the underlying sigmoid sinus has not previously been reported. Based on our cadaveric findings, the sigmoid sinus is centered under the attachment of the longissimus capitis regardless of the width of its tendon. Burr holes should be placed medial to this attachment site in order to avoid the sigmoid sinus. Surgical use and validation of these anatomical findings are now needed.