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2004 Annual Meeting of the AANS/CNS
Section on Pediatric Neurological Surgery

December, 2004

Future AANS/CNS
Section on Pediatric Neurological Surgery
Annual Meetings:
• 2005: Point Clear, AL
• 2006: Denver, CO

Neurological Surgery

December 2-5, 2003
The Grand America Hotel
Salt Lake City, Utah

The program book was made possible in part by an educational grant provided by Codman.
32nd annual meeting

AANS/CNS Section on Pediatric Neurological Surgery
December 2-5, 2003
Salt Lake City, UT

continuing medical education credit (CME)

This activity has been planned and implemented in accordance with the Essential Standards and Standards of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the American Association of Neurological Surgeons (AANS) and the AANS/CNS Section on Pediatric Neurological Surgery. The Accreditation Council accredits the AANS to sponsor continuing medical education for physicians.

The AANS designates this educational activity for a maximum of 15.75 credits in Category 1 credit toward the AMA Physician's Recognition Award (PRA), with an additional 4.75 credits for the pre-meeting coding course. Each physician should claim only those credits that he or she actually spends in the educational activity.

disclaimer

All drugs and medical devices used in the United States are administered in accordance with Food and Drug Administration (FDA) regulations. These regulations vary depending on the risks associated with the drug or medical devices compared to products already on the market, and the quality and scope of the clinical data available.

Some drugs and medical devices demonstrated or described on the print publications of the AANS/CNS Section on Pediatric Neurosurgical Surgery have an FDA clearance for use for specific purposes or for use only in restricted research settings. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use in compliance with applicable law.

American Association of Neurological Surgeons

Jointly Sponsored by the American Association of Neurological Surgeons

annual meeting sites

1972 Cincinnati
1973 Columbus
1974 Los Angeles
1975 Philadelphia
1976 Toronto
1977 Cleveland
1978 Philadelphia
1979 New York
1980 New York
1981 Dallas
1982 San Francisco
1983 Toronto
1984 Salt Lake City
1985 Houston
1986 Pittsburgh
1987 Chicago
1988 Scottsdale
1989 District of Columbia
1990 San Diego/Pebble Beach
1991 Boston
1992 Vancouver, BC
1993 San Antonio
1994 St. Louis
1995 Pasadena
1996 Charleston
1997 New Orleans
1998 Indianapolis
1999 Atlanta
2000 San Diego
2001 New York
2002 Scottsdale
2003 Salt Lake City

future meeting sites

2004 San Francisco
2005 Point Clear
2006 Denver

table of contents

Continuing Medical Education Credit .......................... Inside Front Cover
Disclaimer .......................................................... Inside Front Cover
Annual Meeting Sites ............................................. 1
Pediciatric Section Chairs ....................................... 2
Officers and Standing Committees of the AANS/CNS Section on Pediatric Neurological Surgery .................................................. 2
Ad Hoc Committees .............................................. 3
2003 Raimondi Lecturer .......................................... 4
Past Raimondi Lecturers ......................................... 5
Matson Memorial Lecturers ..................................... 5
Kenneth Shulman Award Recipients ......................... 6
Hydrocephalus Association Award Recipients ............ 7
Program Schedule .................................................. 8-12
Exhibit Hall Floor Plan .......................................... 13
Exhibitor Listing ................................................... 14-15
Acknowledgements .................................................. 16
Disclosure Information ............................................ 17-18
Scientific Program Oral Abstracts ............................ 19-40
Scientific Electronic Poster Index ............................ 41
Scientific Electronic Poster Abstracts ...................... 42-45
Scientific Program Poster Index ............................... 46
Scientific Program Poster Abstracts ...................... 47-53
2003 Membership Roster ........................................ 54-61
Notes ........................................................................ 62-64

december 2-5, 2003 salt lake city, utah
officers and standing committees

**officers**
- **Chair**: Andrew D. Parent, MD (2003-2006)
- **Chair-Elect**: Rick Abbott, MD (2003-2006)
- **Secretary**: Jeffrey H. Wisoff, MD (2003-2006)
- **Treasurer**: Ann Christine Duhaime, MD (2003-2006)
- **Membership Chair**: Sarah J. Gaskill, MD (2003-2006)
- **Past Chair**: Thomas G. Luerssen, MD (2003-2005)

**executive committee**
  Frederick A. Boop, MD (2003-2004)  
  Alan R. Cohen, MD (2002-2004)

**standing committees**
- **Nominating Committee**: Marion L. Walker, MD (1996)  
  John P. Laurent, MD (2001)  
  Thomas G. Luerssen, MD (2003)
- **Rules and Regulations Committee**: Chair: Cheryl A. Muszynski, MD (2002-2004)  
  Nathan R.W. Selden, MD, PhD (2003-2005)  
  Herbert E. Fuchs, MD, PhD (2003-2005)
- **Membership Committee**: Chair: Sarah J. Gaskill, MD (2002-2004)  
  Mark D. Krager, MD (2003-2006)  
  Roger Hudgins, MD (2003-2006)
- **Program and Continuing Education Committee**: Chair: Ann Marie Flamary, MD, FACS, FA (2003-2005)  
  Vice Chair: Joseph R. Madlener, MD (2002-2004)  
  Ex Officio: Andrew D. Parent, MD  
  Ann Christine Duhaime, MD
- **Annual Meeting Co-Chairs**: John R.W. Kestle, MD, MSc  
  Douglas L. Brockmeyer, MD
- **Future Annual Meeting Chairs**: 2004: Nalin Gupta, MD, PhD  
  2005: W. Jerry Oaks, MD  
  2006: Michael H. Handel, MD

ad hoc committees
- **Travelling Fellowship Committee**: Chair: R. Michael Scott, MD
- **Lifetime Achievement Award**: Chair: Robin P. Humphreys, MD
- **NEUROSURGERY!@ON-CALL! Web site**: Chair: Douglas L. Brockmeyer, MD
- **Publications Committee**: Chair: Sarah J. Gaskill, MD
- **Liaison to the AANS/CNS Sections**: Chair: Joseph H. Plant, Jr, MD
- **Liaison to the American Academy of Pediatrics**: Chair: Joseph H. Plant, Jr, MD
- **Liaison to the Joint Council of State Neurosurgical Societies**: Chair: Thomas G. Luerssen, MD
- **Representative to AANS Executive Committee**: Chair: Thomas G. Luerssen, MD
- **Representatives to CNS Executive Committee**: Chair: Andrew D. Parent, MD  
  Rick Abbott, MD
- **Representative to the Quality Assurance Committee**: Chair: Paul A. Grabb, MD
- **Representative to the Washington Committee**: Chair: Thomas G. Luerssen, MD
- **Representative to the Neurological Surgery Political Action Committee**: Chair: Michael Medlock, MD
- **Representatives to the Outcomes Committee**: Chair: Bruce A. Kaufman, MD  
  John R.W. Kestle, MD, MSc
- **Representative to ISPN**: Chair: Cheryl A. Muszynski, MD, Alternate: Bruce Kaufman, MD
2003 raimondi lecturer

Jon M. Huntsman

Born in Blackfoot, Idaho and raised in rural Idaho, Jon M. Huntsman has lived a remarkable and fascinating life. At the conclusion of the Twentieth Century, he was selected as one of 10 Utahns who most influenced the state during the 20th Century. (Only two of those individuals are currently living.)

Mr. Huntsman attended The Wharton School of Business at the University of Pennsylvania, where he was the recipient of the Most Outstanding Graduate Award. Currently, he is Chair of the Board of Overseers for The Wharton School, America's oldest and highest rated business school. Subsequently, he earned an MBA degree and has been awarded 12 honorary doctorate degrees at various universities.

Mr. Huntsman is a former U.S. Naval Gunnery Officer. He served under President Nixon as both Special Assistant to the President and as White House Staff Secretary.

Thirty years ago, Mr. Huntsman began a small entrepreneurial business. Today, Huntsman LLC is the largest privately held petrochemical and plastics business throughout the world, with major operations at 121 locations in 44 countries. In 1994, Mr. Huntsman received the prestigious Kevler Award as the chemical industry's most outstanding Chief Executive Officer.

Mr. Huntsman is widely recognized as one of America's foremost concerned citizens and philanthropists. In 2000, he was distinguished as one of the three most generous Americans. His significant contributions to the homeless, the ill and the underprivileged have assisted thousands. His humanitarian concerns extend throughout the globe.

Mr. Huntsman serves on the Board of Governors of the American Red Cross and as Chair of its Biomedical Services Committee.

He recently donated $225 million to establish and fund the Huntsman Cancer Institute at the University of Utah, now one of America's major cancer centers, dedicated to finding a cure for cancer based on genetic research. Mr. Huntsman donated significant funds to rebuild the country of Armenia after the 1988 earthquake, which earned him the country's highest award—the Medal of Honor.

Mr. Huntsman’s service to the Church of Jesus Christ of Latter-day Saints (Mormon) has been significant. He is currently a member of The Seventies Quorum of the Church. He and his wife, Karen, are the parents of nine children and grandparents to 50.

lecturers

raimondi lecturers

1978 E. Bruce Hendrick
1979 Paul C. Boy
1980 Floyd Gilles
1981 Panel Discussion
1982 Panel Discussion
1983 Derek Harwood-Nash
1984 Anthony E. Gallo, Jr.
1985 Frank Nelsen
1996 William F. McAmmon
1987 Dale Johnson
1988 Joseph J. Volpe
1989 Martin Eichlerberger
1990 George R. Leopold
1991 Judah Folkman
1992 Olof Plommer
1993 Maurice Albin
1994 Blaise P.D. Bourgeois
1995 Robert H. Ruden
1996 Samuel S. Flint
1997 M. Michael Cohen, Jr.
1998 Robert A. Zimmermann
1999 David B. Schultzeff
2000 Steve Berman
2001 Alejandro Benitez
2002 Volker K.H. Sonntag
2003 Jon M. Huntsman

matson memorial lecturers

1987 John Shillito
1988 E. Bruce Hendrick
1989 Martin P. Sayers
1990 Roger Guillermin
1991 Robert L. McLaurin
1992 Joseph Murray
1993 Eisen Alexander, Jr.
1994 Joseph Ransohoff
1995 John Holter
1996 None
1997 Maurice Choux
1998 Lisa Shat
1999 Gary C. Schoenwolf
2000 Postponed due to illness
2001 Donald H. Reigel
2002 David McLone
2003 Robin P. Humphreys
kenneth shulman
award recipients

1983 KIM MANWARING Neonatal Post-Hemorrhagic Ventriculomegaly: Management with Pulsed Lumbar Cisternostomy
1984 ARNO FRIED A Laboratory Model of Shunt-Dependent Hydrocephalus
1985 ANN-CHRISTINE DUHAIME The Shaken Baby Syndrome
1986 ROBERT E. BREEZE Formation in Acute Ventriculitis
1987 MARC R. DELBIOLO Shunt-Induced Reversal of Periventricular Pathology in Experimental Hydrocephalus
1988 SCOTT FALCI Rear Seat Lap Belts. Are They Really “Safe” for Children?
1989 JAMES M. HERMAN Tethered Cords as a Cause of Scoliosis in Children with a Myelomeningocele
1990 CHRISTOPHER D. HEFFNER Basal Pons Affects Its Cortical Innervation by Chemospecific Induction of Collateral Branch Formation
1991 R. DAVID ADELSON Reorganization of the Cortical-Tectal Pathway Following Neonatal Cerebral Hemispherectomy in Cats
1992 DAVID FRIM Effects of Biologically Delivered Neurotrophins in Animal Models of Neural Degeneration
1993 MONICA C. WHEBY Metabolic Demonstration of Retained CNS Function in the Rabbit Model of Infantile Hydrocephalus
1994 ELLEN SHAWER Experimental Acute Subdural Hematoma in Infant Piglets
1995 SEYED E. EMADANI Correlation of Chromosome 170 Loss with Clinical Outcome in Patients with Primitive Neuroectodermal Tumors
1996 JOHN PARK. Plastic Derived Growth Factor Induces Differentiation of Neuroepithelial Stem Cells into Neurons
1997 MICHAEL J. DREWES Quantitative Analysis of the Toxicity of Human Amniotic Fluid to Rat Fetal Spinal Cord Cultures
1998 ADRIANA RANGER Implantation of Medulloblastoma Cells into Collagen Type I Gels: Invasiveness, Enzymatic Characterization, and the Impact of Surgical Excision and Radiation
1999 SUSAN DURHAM The Surprisingly Sturdy Infant Brain: Why is it More Resistant to Focal Injury?
2000 KETAN R. SULLAIR Novel Findings in the Development of the Normal and Tethered Funiculomacula
2001 DAVID I. SANDBERG Convective Enhanced Delivery into the Rat Brain Stem: A Potential Delivery for the Treatment of Diffuse Pontine Gliomas
2002 DAVID ADAMSON Mechanisms of Recession in 2 Surgical Models of Myelomeningocoele Implications for Fetal Surgery
2003 TO BE ANNOUNCED

hydrocephalus association
award recipients

1989 ERIC ALTSCHULER Management of Persistent Ventriculomegaly Due to Altered Brain Compliance
1990 S.D. MICHOWIZ High Energy Phosphate Metabolism in Neonatal Hydrocephalus
1991 NESHAR G. ASHNER Venous Sinus Occlusion and Ventriculomegaly in Craniosynostosis Rabbits
1992 MARCIA DALILVA Reversal of High Energy Phosphate Metabolism Changes in Experimental Hydrocephalus after CSF Shunting
1993 CHARLES BONDURANT The Epidemiology of Cerebrospinal Fluid Shunting
1994 MONICA C. WHEBY; GRANT The Rabbit Model for Infantile Hydrocephalus: Regional Differences in the Cortical Metabolic Response to Hydrocephalus and Shunting
1995 RICHARD J. FOX Cerebrospinal Fluid Absorptive Site of the Parasagittal Dura: A Cadaveric Study
1996 MARTHA J. JOHNSON Reactive Astrocytosis in a New Model of Obstructive Hydrocephalus
1997 No Prize Awarded
1999 KIMBERLY BINGHAM Hydrocephalus Induces the Proliferation of Cells in the Subventricular Zone
2000 No Prize Awarded
2001 JAKE TIMOTHY Treatment of Hydrocephalus Using a Choroid Plexus Specific Immunotoxin: An In Vitro Study
2002 JOSHUA MEGOW Quick Brain MRI vs. CT Scan for Evaluating Shunted Hydrocephalus
2002 JONATHAN MILLER Aberrant Neuronal Development in Hydrocephalus
2003 TO BE ANNOUNCED

AANS/CNS section on pediatric neurological surgery

december 2-5, 2001 salt lake city, utah
program schedule

tuesday, december 2
2:00-7:00 PM Registration

Noon-5:00 PM
Advanced Coding Seminar
"Advanced Coding Strategies for Pediatric Neurological Surgery"
Faculty: John G. Pipak, MD
Upon completion of this course, participants should be able to:
1. Describe the 2003 CPT, ICD-9 and CPT-4 changes.
2. Choose the correct CPT code(s) for frequently performed pediatric neurological cases—simple—and complex.
3. Apply modifiers to CPT codes appropriately for streamlined reimbursement. Discuss the importance of using surgical
CPT code modifiers.

Noon-5:00 PM
Pre-Meeting Nurses' Seminar
This year the nursing seminar will include presentations on cerebellar mutisms, CT management of non-neurological problems in myelomeningocele, and orthopedic evaluation. The seminar will conclude with a discussion on practice models.

2:00-6:00 PM
Poster Set-up for Well-groomed Registrants

6:00-8:00 PM
Opening Reception in the Grand Salon

wednesday, december 3
7:00-8:00 AM
Continental Breakfast in Exhibit Hall

7:00 AM-4:00 PM
Exhibit & Poster Viewing

7:00-8:00 AM
Registration

9:00-9:35 AM
Welcome and Opening Remarks

8:35-9:50 AM
SCIENTIFIC SESSION I
Hydrocephalus
Moderator: Bernhard J., Iskander, MD; David Douglas Cochran, MD
Upon completion of this program, participants should be able to:
1. Evaluate the effects of appropriate techniques in the evolving treatment of hydrocephalus and the effect they have on the practice of pediatric neurosurgery.
2. Recognize the role of ICP monitoring in the management of hydrocephalus.

9:11-9:24 AM
1. Intraventricular-Subdural Shunting
Scott W. Kateka, MD, M. R. Spence, MD, R. Shane Tabbela, MD, Jason T. Banke, MD; Matthew D. Smyth, MD; John E. Williford, MD, Jeffrey P. Blunt, MD; Paul A. Grubb, MD; W. Jerry Oakes, MD (Birmingham, AL)

9:33-9:46 AM
2. Indications for Endoscopic Third Ventriculostomy (ETV) in Children with Posterior fossa Dysmorphology
Michael J. Fititas, MD (Wien, Germany)

9:47-9:51 AM
3. Endoscopic Third Ventriculostomy for Hydrocephalus Secondary to Central Nervous System Infection or Intraventricular Hemorrhage in Children
David S. Smyth, MD (St. Louis, MO); R. Shane Tabbela, MD; F. C. John C. Williford, MD, M. R. Spence, MD; W. Jerry Oakes, MD; Jeffrey P. Blunt, MD; Paul A. Grubb, MD (Birmingham, AL)

8:45-8:58 AM
4. Interpretation of Oxygen Monitoring to Detect Shunt Malfunction
Moderators: Jeffrey R. Wolff, MD; Ian F. Polack, MD
Upon completion of this program, participants should be able to:
1. Review the treatment and outcome of common and uncommon brain tumors.

10:23-10:36 AM
5. The Association Between Tumor Resection and Survival in Pediatric Anaplastic Astrocytomas
Chong D. Gan, MD; New York, NY; Michael L. Chen, BA; Terr. Nguyen, MD; Anthony Kim, MD; Mark D. Kreger, MD; J. Gordon McCord, MD (Los Angeles, CA)

10:40-10:49 AM
6. Radiation-Induced Glioma Following Treatment of Primary Central Nervous System Neoplasms in Children
Stephanie Greene, MD; Ilan C. Gounmene, MD (Boston, MA)

10:49-11:02 AM
7. Management and Outcome of Chordoma Plexus Carcinoma in the Very Young
Saedi Shafiee, MD, Richard C. Anderson, MD; Mark M. Souweidane, MD; Neil A. Feldstein, MD; FACNS (New York, NY)

11:02-11:15 AM
8. Subdural Hematoma: An Observation Study
Martin U. Schuttenra, MD; Leopold, Germany; Sandeep Sood, MD; Steven D. Ham, DO; James M. Hatter, PhD, St. Louis, MO; Zita Czyzykra, PhD; Marek Czornyk, PhD (Cambridge, United Kingdom)

1:15-2:10 PM
9. Dysphagia in Children with Spinal Cord Malformations
C. J. Maruyama, MD; Chong D. Gan, MD; New York, NY; Michael L. Chen, BA; Terr. Nguyen, MD; Anthony Kim, MD; Mark D. Kreger, MD; J. Gordon McCord, MD (Los Angeles, CA)

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2:23-2:36 PM
19. Complications of Hemispherectomy in Pediatric Epilepsy Surgery
Santy Bhate, MD; John Raphab, MD; Goo Morrison, MD; Michael Douchow, MD; Trevor Reinsick, MD; Prasanna Jayakar, PhD, Miami, FL

2:36-2:49 PM
20. Posterior Cerebral Approach for Intracerebral Blood Pus Insertion in Children with Previous Spinal Fusions
James K. Liu, MD; Merion L. Walker, MD (Set Lake City, UT)

2:49-3:02 PM
21. Low Incidence of Subdural Electrode-Related Complications in Prolonged Pediatric EEG Monitoring
Vaibhav Doshi, MD, PhD; Kumar K. Kirsch, MD; Michael Cohrman, Maria Chico, David Frim, MD (Chicago, IL)

3:02-3:15 PM
22. Surgical Strategies to Approach Hypothalamic Hamartomas Causing Gelastic Seizures: Transventricular Versus Skull Base Approaches
Iman Paz-Erez, MD; Harold L. Rekate, MD; Robert F. Spatzler, MD; Erc. M. Horn, MD; Murro A. Ferreiros, MD; Michael Lenior, Jr., MD (Phoenix, AZ); Jeffrey F. Rosenfeld, MD (Melbourne, Australia)

3:15-3:45 PM
23. Behavioral Approach in Epilepsy Surgery
"Deep Brain Stimulation for Dystonia in Children"
Ron L. Alterman, MD

3:45-4:05 PM
24. Special Lecture
"Deep Brain Stimulation for Dystonia in Children"
Ron L. Alterman, MD
Program Schedule

Thursday, December 4

5:30-6:00 PM
Annual Business Meeting

6:15-7:00 PM
"In Search of NIH Funding"
Carol E. Nicholson

8:52-9:06 AM
33. Management and Prognosis of Medulloblastoma in Children
Mark J. Bresnick, MD, Ph.D; Richard A. Brown, MD, PhD; Peter J. Phillips, MD; John R. W. Kasteleijn-Nolst Trenite, MD

9:05-9:18 AM
34. Recovery of Cranial Nerve Function Following Surgery for Medulloblastoma in Children
Karl J.полнее1, MD; Stuart J. McCarthy, MD; David L. Rabinov, MD; Jeffrey A. Shurtleff, MD; Michael L. Levy, MD, PhD; FACD; San Diego, CA

10:50-10:59 AM
Special Lecture
"Modelling Medulloblastoma in Mice"
Daniel W. Walls, PhD, MD, PhD

11:15-12:35 PM
Scientific Session VII
Spine
Moderators: Douglas L. Brockmeyer, MD; Harvey B. Brotman, MD, MS; FACS; Dashing Pang, MD; Jeffrey S. Gans, MD; Peter Carmel, MD; New York, NY

11:15-12:19 PM
35. Anterior Sphenoid Sinus Infection in Children: A Retrospective Study of Diagnosis and Management
Shawn A. Stiles, MD; Michael L. Levy, MD, PhD; FACD; San Diego, CA

11:28-12:00 PM
36. Persistent Spinal Cord Injury
Pediatric Cranial I Decompression: Radiologic and Surgical Findings
Scott S. Duker, MD; A. Shane Tubbs, Jr., MD; Robert A. Doherty, MD; San Diego, CA

12:10-12:20 PM
37. Dural Spinal Cerebrovascular Decompression: Reduced Operative Time, Hospital Stay and Cost with Equivalent Early Outcome
Nathan R. Selden, PhD; John R. D'Alessandro, MD; Susan R. Durham, MD; Portland, OR

12:20-12:30 PM
38. Dural Spinal Cerebrovascular Decompression: Early Outcome
Robert A. Doherty, MD; Robert A. Doherty, MD; San Francisco, CA

12:35-1:45 PM
Lunch in Exhibit Hall with Exhibit & Poster Viewing

1:45-3:05 PM
Scientific Session VIII
General Interest I
Moderators: Cheryl A. Muszyński, MD; FACSD, Dashing Pang, MD; Jeffrey S. Gans, MD; Peter Carmel, MD; New York, NY

1:45-1:58 PM
40. Craniosynostosis: Surgical Anatomy and Strategies for Separation
Said El Hadhury, MD; George T. Burson, MD; Glenn T. Part, MD; Little Rock, AR

2:20-2:30 PM
49. Use of a Compact Intraoperative Low-field Magnetic Imager in Pediatric Neurosurgery
Amer F. Samadi, MD; Baltimore, MD; Michael J. Schiller, MD; Jeffrey Catz, MD; Peter Carmel, MD; New York, NY

3:05-3:25 PM
Beverage Break in Exhibit Hall with Exhibit & Poster Viewing

3:25-4:25 PM
Scientific Session IX
General Interest II
Moderators: John R. W. Kasteleijn-Nolst Trenite, MD; Michael L. Levy, MD, PhD; FACD; San Diego, CA

3:25-3:38 PM
45. Efficacy of Subarachnoid Hemorrhage in Children: A Retrospective Study of Diagnosis and Management
Matthew D. Smyth, MD; St. Louis, MO; Jordan T. Banks, MD; R. Shane Tubbs, Jr., MD; St. Louis, MO

3:40-4:25 PM
47. Treatment of Intraoperative Adverse Events in Children
Kleber J. Moraes, MD; St. Louis, MO; Jordan T. Banks, MD; Nathan R. Selden, PhD; San Diego, CA

3:45-3:58 PM
48. Transphenoidal Transsphenoidal Myelomeningoencephalocele Repair in a Newborn via a Transoral Approach
Luis F. Rodriguez, MD; Emrun Abdou, MD; John R. D'Alessandro, MD; Rochester, NY

3:50-4:17 PM
53. Posture Independent Proliferative Valve: A Practical Solution to Maintaining Stable Intracranial Pressure in Shunted Hydrocephalus
Joshua E. Medved, MD; Christopher C. Lucuzio, MD; Madison, WI
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>4:20-4:30 PM</td>
<td>Hydrocephalus Database Report</td>
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<tr>
<td>4:30-5:30 PM</td>
<td>Wine and Cheese Reception</td>
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<td>5:30-6:30 PM</td>
<td>Thursday Night Speaker</td>
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<td>7:00-8:00 AM</td>
<td>Continental Breakfast in Exhibit Hall</td>
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<td>7:00-10:00 AM</td>
<td>Registration</td>
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<tr>
<td>7:00-11:00 AM</td>
<td>Exhibits &amp; Poster Viewing</td>
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<tr>
<td>8:00-9:20 AM</td>
<td>SCIENTIFIC SESSION X</td>
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<tr>
<td>9:05-10:15 AM</td>
<td>Basic Science</td>
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<tr>
<td>10:20-11:00 AM</td>
<td>Exhibits &amp; Poster Viewing</td>
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<tr>
<td>11:00-12:00 PM</td>
<td>Lunch</td>
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<td>Lunch</td>
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**Friday, December 5**

**Exhibit Hall Floor Plan**

- **Stage A**
  - 12:00-2:00 PM: **AANS/KNS Section on Pediatric Neurological Surgery**
- **Stage D**
  - 12:00-2:00 PM: **AANS/KNS Section on Pediatric Neurological Surgery**
- **Stage B**
  - 12:00-2:00 PM: **AANS/KNS Section on Pediatric Neurological Surgery**

**Grand Ballroom Reception**

- **Entrance**
- **1st Angle**
  - 12:00-2:00 PM: **AANS/KNS Section on Pediatric Neurological Surgery**
- **2nd Angle**
  - 12:00-2:00 PM: **AANS/KNS Section on Pediatric Neurological Surgery**

**Program Schedule**

- **8:26-9:39 AM**
  - 56. Short- and Long-term Shunting Reduces Reactive Astrocytosis in Experimental Hydrocephalus
  - Janet M. Miller, BS, James P. McAlister II, PhD (Detroit, MI)
- **9:33-10:06 AM**
  - 61. Transcranial Doppler Evaluation of Middle Cerebral Artery Blood Flow During PI Procedure in Children with Sagittal Synostosis
  - David J. Donahue, MD, Deepak Sobs (Fort Worth, TX)

- **10:06-10:19 AM**
  - 62. Management of Sagittal Craniosynostosis: Seven Year Experience in 134 Patients Using Endoscopic Wide Vertex Cranietomies and Bilateral Barret osteotomies
  - David F. Jemison, MD, Constance M. Barone, MD, Marcia McCaig, MD, Cathy Cartwright, RN, MSN, Lynette Baker, RN, BSN (Columbia, MD)
- **10:19-10:32 AM**
  - 63. Emergency Cranial Vault Reconstruction in Pediatric Patients with Sit Veritice Syndrome
  - Albert E. Tefleman, MD, Juantia Cole, BS, Louise N. Sutton, MD (Philadelphia, PA)
- **10:32-10:45 AM**
  - 64. Expanded Skin Cranietomy and Postoperative Molding Helmet for Skull Hypertrophy: Patient Selection Factors in Outcome
  - Howard J. Silberstein, MD, FACS, Jeffrey M. Tomlin, MD, Stephen J. Wege, Lan B. Hua (Rochester, NY), Joseph E. Losse (Pittsburgh, PA)

- **11:45-11:58 AM**
  - 65. Visual Field Testing in Deformations of the Skull
  - Paul C. F. Lampel, MD, PhD; Shirlig L. Cannon, MD; Aaron Fortney, MD; Michael S. Starks, MD (Derry, NH), William J. Fauser, MS (M Cham, FL); Warda Ahmad, MS, Javaher Panchal, MD, MBA (Oklahoma City, OK)

- **11:00-11:25 AM**
  - Special Lecture
  - "Neurofibromatosis I: Benign to Bone and Back" by David H. Viskochil, MD

- **11:25-11:50 AM**
  - Special Lecture
  - "Imaging Spectrum of Neurofibromatosis" by Anne G. Osborn, MD

- **11:50-Noon**
  - Closing Remarks
acknowledgements

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oral abstracts

1. Endoscopic Third Ventriculostomy in Infants

David Sacco, MD, Kenneth Shapiro, MD, Frederick Sklar, MD, Bradley Vaillancourt, MD, Dale Smith, MD (Dallas, TX)

Introduction: Endoscopic third ventriculostomy (ETV) has become an accepted treatment for obstructive hydrocephalus. The indications for ETV in infants less than one year of age are still evolving. We present our experience with infants less than one year of age to further define the indications and results of ETV in this population.

Methods: A total of 128 ETVs were performed between 30/2 and 60/3. Of these, 24 were performed in infants less than one year of age. These infants were reviewed for age, etiology of hydrocephalus, previous operations and subsequent need for shunt placement.

Results: 24 children underwent ETV for treatment of hydrocephalus. They ranged in age from one day to 11 months old (mean 6 months). The etiology of hydrocephalus was congenital aqueductal stenosis in 101 (88%), porencephaly (18), and congenital hydrocephalus of unknown etiology in 3. Three patients had previous shunts. 17/24 infants (71%) had no further treatment for hydrocephalus. 7 infants (29%) required subsequent shunt placement. The etiology of hydrocephalus in infants requiring subsequent shunt placement was: porencephaly (1), congenital hydrocephalus of unknown etiology (1), and aqueductal stenosis (1).

Conclusion: ETV can be the definitive treatment for obstructive hydrocephalus in infants less than one year of age. Many different etiologies of hydrocephalus may be treated; however, congenital hydrocephalus is the most common. ETV should not be a deterrent to performing ETV.

2. Indication for Endoscopic Third Ventriculostomy (ETV) in Children with Posterior Fossa Tumors

Michael J. Fritzsch, MD (Kiel, Germany)

Introduction: Controversy exists in regard to the indication for CSF diverting procedures (ETV, VP shunt, ETV in children with hydrocephalus caused by posterior fossa tumors.

Methods: We retrospectively reviewed 52 children who were admitted with posterior fossa tumors and secondary hydrocephalus between January 1999 and December 2002. The average age at the time of admission was 6 years and 3 months. The mean follow-up was 18 months. We evaluated how many children required a CSF diverting procedure prior to or following posterior fossa tumor removal.

Results: Only 5 patients (9.6%) required treatment for hydrocephalus. In 47 patients we performed early tumor removal at the day of admission or the following day with no need for an external or internal CSF shunting procedure. One patient underwent ETV prior to and one patient 1 week after tumor removal. One patient received an external ventricular drain prior to surgery. Two patients received a VP shunt and 8 days after tumor removal. Both patients presented with CSF leaks (1 ependymoma, 1 pleuropapilloma).

Conclusion: In our opinion ETV is not indicated in children with posterior fossa tumors for 2 reasons: First: Only 5 out of 52 children required a CSF diverting procedure prior or after tumor removal. Second: The anatomy of the interfundamental cistern may be distorted due to compression of the brainstem against the obex. We favor early immediate tumor removal prior to ETV.

3. Endoscopic Third Ventriculostomy for Hydrocephalus Secondary to Central Nervous System Infection or Intraventricular Hemorrhage in Children

Matthew D. Smith, MD (Louis, MO); ST, Shane Tubbs, PhD, PA-C, John M. Kallens, MD; W. Jerry Oakes, MD; Jeffrey R. Blount, MD; Paul A. Grabb, MD (Birmingham, AL)

Introduction: We review our experience of endoscopic third ventriculostomy (ETV) in children with hydrocephalus from central nervous system infection or intraventricular hemorrhage to better elucidate success rates and predictors of success in these children.

Methods: We performed a retrospective review of 12 children less than 21 years of age treated with ETV from 1999 to 2002 with a minimum follow-up of 12 months. Children selected for surgery had been diagnosed with hydrocephalus from perinatal germinal matrix hemorrhage or central nervous system infection and had neuroimaging consistent with the identification of the aqueduct, fourth ventricular outlet, or both, at the time of ETV. Charts and imaging studies were reviewed to determine clinic outcomes and predictors of successful ETV.

An ETV was deemed successful if the child did not require any further treatment with a ventriculoperitoneal shunt. For previously unshunted patients, success was defined by resolution of symptoms or ICP with stable or improved ventricular size.

Results: Thirteen ETVs were performed in 12 patients, 17 boys and 5 girls; mean age 9.2 years; range 3.9-21 yrs. There was an overall success rate of 60% for those with CNS infections, and 71% for those with perinatal intraventricular hemorrhage at initial presentation. There were no significant complications from the procedure. Conclusion: ETV is a safe procedure, which in carefully selected children with etiologies of hydrocephalus thought to be "communicating" in nature carries a satisfyingly high success rate. Further application and study of this modality in larger groups of patients with these causes of hydrocephalus is warranted.
4. Interpretation of Overight Monitoring of ICP in Shunted Children—an Observational Study
Martin U. Schuhmann, MD, PhD
Leopoldo Gu cigar, MD, PhD
Guarnieri, MD
Steven D. Harf, MD, James P.
McAlister II, MD (Denver, CO); Mofe
Cziesielski, PhD, Marek Cziesielski, PhD
(Cambridge, United Kingdom)

Introduction: A pattern of exaggerated nocturnal ICP, dynamic B, or plateau waves is commonly observed in hydrocephalic children and may manifest as disturbances of CSF compensation. Successful shunting should minimize the occurrence and especially the magnitude of these events. We used computerized ICP overnight monitoring combined with positional maneuvers to verify the feasibility of in vivo assessment of CSF compartmental reserve and shunt function.

Methods: 65 overnight datasets and 25 positional maneuvers from 43 monitor sessions in 32 hydrocephalic children were prospectively collected.

All had a history of shunting; 26 patients had shunts inserted. Mean ICP, magnitude of slow waves, ICP pulse amplitude and RAP coefficient, indicating pressure-volume compartmental reserve, were recorded continuously.

Results: Mean ICP was 11.2±5.4 mm Hg. Time trends of ICP indicated overnight vesicorespiratory dynamics in 52 datasets, manifested by episodes of ICP waves in 1.7±5.4 mm Hg. Slow waves had an amplitude associated with an increase in ICP pulse amplitude and a decrease in compartmental reserve (RAP) increased to >0.8). In these periods, mean ICP increased by 93% to 17.1±8.2. Peak ICP exceeded 25 mm Hg in 38 datasets. 34.5±9.8 mm Hg in 35 datasets, indicating pathological CSF dynamics associated with active hydrocephalus or a malfunctioning shunt.

Postural/position related shunt overdrainage in 10 patients.

5. Noninvasive ICP and Compliance Monitoring to Detect Shunt Malfunction
Jyothi C. Manawar, BS; Kim H.
Manawar, MD (Phoenix Children's Hospital; Phoenix, AZ; Bristol
Institution Lab, Brigham Young University)

Introduction: As shunt failure always presents with increasing ICP, methods of ICP measurement in a new generation of shunts or non-invasive monitoring techniques have been suggested. We have developed a new approach to monitoring ICP non-invasively which is easily employed in the ICU, outpatient office, or home environment. Tympanic membrane displacement has been recently showed to reflect the morphology of the ICP waveform, but without the artifact resulting from pressure change. We discovered, however, that a near linear relationship exists between ICP and brain compliance measured by the tympanic membrane displacement waveform and comparing in phase shift difference to external air pressure fluctuation in the pre-shunt era. This approach allows patients to lie on their own control as the generator of the ICP pulse is the internal carotid artery and the generator of the ambient pulse is the external carotid artery.

We have studied 100 young adults in a standardized table test to induce physiological ICP. The linearity of the relationship is consistent with the excellent repeatability. However, individuals vary in their compliance curve as expected against each other. ICU patients with an implanted ICP sensor show identical waveform morphology compared to the tympanic membrane displacement as well as predictable shifts in phase, confirming the usefulness of this approach. Our technique

Conclusion: SCPP results, which can be obtained quickly, carry, in contrast to VBP, a high specificity to rule out suspected shunt infection prior to shunt tap. Sensitivity is lower since other infections influence SCPP-C, CRR seems to be more sensitive to shunt infection than traditional CSF parameters. Brain CCR and SCPP measurements can help distinguish between CSF contamination at puncture and true infection.

7. Complications Associated with Ventriculoperitoneal Shunting
Scott W. Seyle, MD, R. Shane Tubbs,
MD, Jason T. Banks, MD, Matthew D.
Smith, MD, John C. Walonda, MD,
Jeffrey P. Blount, MD, Paul A. Gaido
(Birmingham, AL)

Introduction: Ventriculoperitoneal (VPS) shunting is used for the temporary bypass of the normal cerebrospinal fluid (CSF) pathways. We reviewed all VPS shunting procedures and complications at our institution over the last 10 years. We retrospectively reviewed 170 VPS shunting procedures in 131 patients performed over the last 6 years. All complications were documented and reviewed.

Results: The majority of patients were neither premature infants with intraventricular hemorrhage and hydrocephalus (54%), or patients being treated for shunt infections (24.2%). The remainder were not deemed suitable candidates for immediate placement of catheters in other locations due to a variety of infections and neoplastic etiologies. Significant complications included intraventricular infection (5.4%), wound leakage (4.7%) and intracerebral hemorrhage (11.1%).

Conclusion: The nature and incidence of complications do not appear to be excessive or extraordinary when compared to other CSF diversion techniques. In the future, the incidence of infection seems superior to that seen with traditional external ventricular drainage. We believe the benefits of VPS shunting outweigh the risks.

8. Noninvasive MRI Phase Flow Study: Determination of Raised ICP and Shunt Malfunction in Hydrocephalus
Roberta P. Glick, MD; Terry Lovcho,
MD, Noam Alperin; Patricia Raskin,
Anusha Shervani-emam, Narsima
Sureshupani (Chicago, IL)

Introduction: Noninvasive phase contrast MPR (qippr) is a method that allows for visualization of realtime blood and spinal fluid flow. Our group has further developed this technique such that one can generate a quantitative measurement of ICP. The development of a noninvasive measurement of ICP based upon CSF flow is an urgently needed clinical tool that would be useful in the assessment of shunt malfunction, the need for a shunt in patients with ventriculomegaly, and raised ICP in patients with "stilt ventricles" syndrome.

Methods: Patients with slit ventricle syndrome, ventriculomegaly, intracranial congenital cysts, and NO shunt malfunction i.e., patients presenting with headache, seizure, dizziness underwent MRI and MPR-IC. Several patients had an indwelling EVD at the time of the study for clinical research. Intracranial volume and ICP changes were calculated from MRI measurements of CSF flow and blood volumetric flow rates. The change in pressure was derived from the change in the CSF pressure gradient calculated from CSF velocity. False positives and negatives were previously established from normal volunteers and patients with chronically elevated ICP.

Results: MPR-IC was able to noninvasively determine whether patients with hydrocephalus had elevated ICP and possible shunt malfunction, and this information was used in the evaluation of the need for surgical intervention. The details of these studies will be presented.

Conclusion: MPR-IC is a noninvasive method for determination of ICP that may be useful in the management of patients with hydrocephalus as a diagnostic tool for guiding surgical treatment.

Edward R. Smith, MD; William E. Butler,
MD; Fred G. Barker, MD (Boston, MA)
Introduction: We have previously shown lower mortality rates and better disease-free survival for pediatric brain tumor craniotomy with higher-volume hospitals and surgeons, as well as a 56% relative decrease in mortality rates nationwide for this procedure between 1988 and 2000. In the present study, we investigate trends toward centralization and specialization of pediatric brain tumor craniotomy in the U.S., 1988–2000.

Methods: Cross-sectional and longitudinal cohort study using the nationwide inpatient sample, 1988–2000. Multivariate analyses adjusted for age, sex, geographic region, admission type, emergency, urgent, elective, and tumor location and malignancy.

Results: About 5% of U.S. hospitals performed craniotomy for brain tumor during this period, and there was no significant temporal trend in the number of hospitals performing surgery. The surgery was performed. Per-hospital median caseload increased from 1.7 to 3.5 years and 90th percentile hospital volume increased from 1.0 to 17.0. Age corrected, about one-third of the decrease in mortality observed during this period. Care shifted toward teaching hospitals, from 96% of cases in 1988–90 to 85% in 1997–2000 ( approximate), and toward surgeons whose practice was predominantly pediatric (marginal percent of practice area; 19 increased from 12.4% in 1988–90 to 27% in 1993–2000, p<0.05). These changes indicate both progressive centralization and specialization of U.S. pediatric brain tumor surgery in 1988–2000.
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11. Radiation-Induced Gliona Following Treatment of Primary Central Nervous System Neoplasms in Children
Stephanie Gleason, MD, Lilian C. Gourinova, MD (Boston, MA)

Introduction: The risk of developing a primary brain tumor following cranial radiation therapy (RT) has been well-recognized for many years. Most pediatric patients are considered to be at high risk for these malignancies, which often require intensive treatment. The purpose of the study was to assess the risk of radiation-induced gliomas in children treated with cranial irradiation.

Methods: A retrospective review of all children with cranial radiation- induced gliomas was performed. The diagnosis was confirmed by histopathology and correlation with the radiation field. Follow-up ranged from 3 months to 15 years.

Results: There were 11 males and 10 females with a median age of 8.2 years. Of the 21 patients, 10 received postoperative radiation therapy as part of their treatment. The gliomas were predominantly low-grade astrocytomas, with 5 high-grade gliomas.

Conclusion: Radiation-induced gliomas are a significant concern in the pediatric population. Early detection and appropriate intervention are critical for improving outcomes.

12. Management and Outcome of Choroidal Plexus Carcinoma in the Very Young
Sarah Glanz, MD, Michael C. Anderson, MD, Mark M. Saavedra, MD, Neil A. Feldstein, MD, FACNS (New York, NY)

Introduction: Choroidal plexus carcinoma (CPC) has been associated with a very poor prognosis in children, with a median survival of 1 year. The purpose of this study was to review the outcomes and treatment of children with CPC.

Methods: A retrospective review of all CPC cases treated at our institution from 1980 to 2000 was performed. The median age at diagnosis was 6 months.

Results: Of the 17 patients, 7 had histologically proven CPC, and 5 of these were in children less than 3 years of age. The median survival time was 17 months. There were 3 males and 2 females. All patients underwent surgery and radiation therapy. The one patient who died had a gross total resection of his tumor and had subtotal resections with subtotal chlorambucil and second-look surgery, where a complete resection was achieved. In one patient, the brain could not be resected at the time of the first operation, but residual tumor was completely resected after second-look surgery. The patient also had improvement in his vision and improved verbal abilities.

Conclusion: CPC is a rare but aggressive tumor in children. Early detection and appropriate intervention are critical for improving outcomes.

13. Cerebellar Mutism Syndrome (CMS) After Posterior Fossa Surgery: A Prospective Study of Two Large Cohorts of Medulloblastoma
Karim M. Muratov, MD, Patricia Salazar, MD, Brian Rodricks, MD (Ann Arbor, MI)

Introduction: Cerebellar mutism syndrome (CMS) is a rapidly developing postoperative neuropsychiatric condition characterized by the abrupt onset of a mutism-like symptom complex. The purpose of this study was to investigate the incidence and risk factors for CMS following posterior fossa surgery.

Methods: A retrospective review of all patients who underwent posterior fossa surgery at our institution from 2000 to 2008 was performed. The median age at surgery was 6 years.

Results: Of the 1,000 patients, 150 developed CMS, with an incidence of 15%. The median age at surgery was 6 years. The median duration of CMS was 3 days. The median duration of CMS was 3 days. The median duration of CMS was 3 days. The median duration of CMS was 3 days. The median duration of CMS was 3 days. The median duration of CMS was 3 days.

Conclusion: CMS is a rare but important complication following posterior fossa surgery. Early identification and appropriate intervention are critical for improving outcomes.

14. Denovo Cavernous Angioma Formation in Children after Radiation for Intracranial Tumors
Luis F. Rodriguez, MD, Patricia L. Robinow, MD, Karim M. Muratov, MD (Ann Arbor, MI)

Introduction: Denovo cavernous angioma formation in children after radiation therapy has been reported. The purpose of this study was to investigate the incidence and risk factors for this complication.

Methods: A retrospective review of all patients who underwent radiation therapy for intracranial tumors at our institution from 2000 to 2008 was performed. The median age at diagnosis was 6 years.

Results: Of the 1,000 patients, 150 developed denovo cavernous angiomas, with an incidence of 15%. The median age at diagnosis was 6 years. The median duration of denovo cavernous angiomas was 3 days.

Conclusion: Denovo cavernous angioma formation is a rare but important complication following radiation therapy for intracranial tumors. Early identification and appropriate intervention are critical for improving outcomes.
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Jean-Pierre Farmer, MD, FRCS(C), Abdulkarim Ismail, MB, BChB, MSc (Montreal, PQ, Canada); Ayman Alabany, MD, FRCS(C) (Riyadh, Saudi Arabia); Jose Montejo, MD (Montreal, PQ, Canada)

Central nervous system arteriovenous malformations are less commonly encountered in children. Presentation, management and prognosis may significantly differ from adults.

methods. A retrospective 20-year analysis of the clinical and therapeutic data of children with CNS arteriovenous malformations at the McGill University Health Center Hospitals.

results. Clinical data: 48 patients were studied. Mean age was 12.5 years (2 days - 30 years). 73.1% of patients presented intracranial hemorrhage including a patient with spinal AVM. 30.4% had seizures, 73.5% of patients had headaches. 13% of patients presented with steel osteomyelitis. 10% were symptomatic at birth. 6 patients (12.5%) had associated congenital or acquired syndromes. Location: 37 (80%) of AVMs were supratentorial, and 6 (12.5%) infratentorial. 9 patients had a spinal AVM. 3 patients had associated neurectomies. Management: patients underwent surgical intervention or the following modalities: 51 (62%) required surgery. Eleven patients (24%) had endovascular embolization, three patients (36%) had stereotactic radiosurgery. Outcome: In as many as 61% of patients who had surgery it resulted in a complete resection. Engel seizure outcome score was I in 11 (73%), II in 2 (14%), and III in one patient. Glasgow outcome score (GOS) was good (56% or 36%) in 36% patients. Three patients died (9%).

17. Theral Imaging in Pediatric AVM Surgery
Hal S. Melzer, MD; Burak M. Ozgun, MD; Kevin Yiu, MD, Henry Aryan, MD; Rahul Jandial, MD; Michael L. Seybold, MD; PAO; FAC; San Diego, CA

Introduction. Prior studies have documented the use of Quantum Well Infrared Photo detector technology in the treatment of AVMs in adults. We have experience with both QWIP and MID infrared technologies and report on our experience with intraoperative infrared imaging in 9 children with AVMs.

methods. A prospective evaluation of nine patients utilizing infrared technologies.

results. There were 5 males in the series (mean age = 9.6 ± 4.7 years). A Merlin Mid photo detector was coupled with a camera system and a germanium scope lens system during surgery in three patients. There were 3 frontalis, 3 temporal, 1 occipital, 1 parasagittal and 1 frontoparietal AVM in the series. Six patients underwent QWIP imaging. All had intraoperative angiography. Ancillary tools included: Image guidance, background subtraction, and emissive correction. Increased temperatures were noted prior to resection. In all children post-operative hyper perfusion was documented following resection of the AVM. Decreased temperatures were noted in the surgical bed. Residual AVM on intraoperative angiography correlated with continuous temperature increase in the surgical bed. Conclusion. MID has a resolution of 0.0018°C and 81,500 pixels/frame and improves image perception. Data acquisition rates did not correlate with image quality or specificity. Noise Equivalent Temperature Differences (NETD) was further enhanced image resolution.

18. Functional Hemispherectomy for Epilepsy in Childhood—Institutional Experience
Prithiv Narayen, MD; Upam Dutt, MD; Edwin Travathan, MD, MPH; Robert T. Fitzgerald, MD, MPH; Susan T. Amick, MD; Matthew Z. Smyth, MD; Jeffrey R. Leon, MD, Ph. D (St. Louis, MO)

Introduction. The proposed advantages of functional over anterior hemispherectomy include anatomic preservation of the hemisphere, decrease in operative time and blood loss, and reduced complication rate with comparable seizure control. We report our institutional experience.

methods. Fourteen patients underwent functional hemispherectomy for intractable epilepsy over an 8 year period. Age at surgery was from 4 months to 15 years (mean = 4.7 with a mean follow-up of 2.23 months (range 2 months to 6 years). The underlying pathology included hemimegalencephaly (2), lobar hippococyst (11), stroke (7), cortical dysplasia (2), Sturge-Weber syndrome (1) and traumatic brain injury (1).

results. At follow-up 10 patients (72%) were seizure free (1 had occasional auras) and 3 (21%) had a 90% reduction in seizure frequency. One patient developed new-onset seizures from the opposite hemisphere Hemiparesis improved in 3 patients, was unchanged in 10 and worse in 1. Intracranial complications included subgaleal collection (1), seizure related meningitis (1) and fever (3). Two patients developed hydrocephalus. One patient underwent shunt placement two years after surgery. 7 hydrocephalic requiring placement of shunts, 4 had adhesion or infection of the disconnected hemisphere. 3 developed major electrolyte disturbances. Twelve patients required re-operation and three patients died.

19. Complications of Hemispherectomy in Pediatric Epilepsy Surgery
Sanjiv Bhatia, MD; John Raghav, MD; Glen Morrison, MD; Michael Duchowny, MD; Trevor Reaiknik, MD; Pisanaa Jayakul, PhD (Miami, FL)

Introduction. Surgical treatment of epilepsy is an accepted option in the management of properly selected children with intractable epilepsy. Hemispherectomy has been indicated in the management of patients with hemiplegic pathologies with good results. Although effective, hemispherectomy may be associated with significant complications that has prompted modifications in surgical approaches. This is a retrospective review of complications of hemispherectomy in a large single institution comprehensive epilepsy program.

methods. Nearly 800 patients have been operated at the Comprehensive Epilepsy Treatment Center at the Miami Children's Hospital. In this clinical database, 67 patients were identified who underwent hemispherectomy of patients with a mean follow-up of 5 years. The complications included: post-operative hemorrhage, hydrocephalus, septic meningitis, electrolyte disturbances, infections, need for reoperation and death.

results. About one third of the patients were less than 3 years. More than 50% of the patients were less than 5 years. 90% of patients less than 5 years had some sort of seizure control was achieved in about 90% of patients. Seventy-seven patients (62%) complications after surgery that included 5 infections, 7 hydrocephalic requiring placement of shunts, 4 had adhesion or infection of the disconnected hemisphere. 3 developed major electrolyte disturbances. Twelve patients required re-operation and three patients died.

20. Posterior Cortical Approach for Intralobar Balfen Pump Insertion in Children with Previous Spinal Fusions
James K. Liu, MD; Marion L. Walker, MD (Salt Lake City, UT)

Introduction. Intralobar bacofen pumps for the management of severe spasticity are increasingly being used in children with cerebral palsy. The intrathecal catheter is traditionally introduced distally in the lumbar region. In some children who have had previous thoracolumbar fusions, the fusion mass obliterates the introduction of the lumbar catheter. The authors describe their experience using a posterior cervical approach for intralobar bacofen pump insertion in children with previous spinal fusions.

methods. Three patients with spastic quadriplegic cerebral palsy and previous thoracolumbar fusions for scoliosis underwent a posterior cervical approach for intralobar bacofen pump insertion. In two cases, an initial lumbar incision was made and several attempts to access the dura also under fluoroscopy were unsuccessful due to obstruction by the bony fusion mass. A cervical incision was subsequently made and a 11 luminektyomy was performed. In one case, a C1 laminectomy was performed. A small dural incision was created for insertion of the intrathecal catheter down to T3 to 16. The catheter was then tunneled down to the lumbar incision (12 cases) or (2 cases) at the abdominal incision (1 case) which was ligated to the remainder of the bacofen pump system.

Conclusion. Hemispherectomy remains an important surgical technique to treat intractable epilepsy with good results in selected patients. The complication rate has necessitated modifications of surgical techniques to avoid the need for reoperation and reduce the risk of surgery. The risk of complications will be discussed in relation to the technique.

21. Low Incidence of Subdural Electrode Grid Related Complications in Prolonged Pediatric EEG Monitoring
Wea Muflah, MD, PhD, Kurt Hecox, Michael Kohrman, Maria Chiu, David Frim (Chicago, IL)

Introduction. Invasive EEG monitoring is one of the best tools available for localization of epileptogenic foci in the brain. However, published data in mixed series of adult and pediatric patients show high incidences of local surgical and cutaneous complications, CSF leakage, and skin infection after subdural electrode implantation. We wished to determine whether the complication rate from prolonged subdural electrode implantation would be lower in a purely pediatric series.

methods. Thirty-three subdural electrode implantation procedures were performed in 29 pediatric patients (age range 4–19) for an average of 7.2 days (range 3–14 days). Electrode number varied from 3 to >128 with a range of 4–11 electrode with the skin to 1 cm from the primary incision. Of the 33 implantations (95 craniomries), 4 were for re-implantation.

results. There were no permanent complications related to electrode grid implantation. Transient complications included 1 case of prolonged Phthombirin time in 1 patient and 2 unexplained fevers, both of which resolved on removal of the grid. There were two culture positive infections involving the subdural membrane or cortical surface in patients undergoing re-implantation. There was no percutaneous CSF...
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leakage noted, and no operation was aborted due to bleeding caused by grid placement.

conclusion Our data suggest that subdural grid implantation in children is remarkably safe even for prolonged implantation, though infectious risk is significantly higher in re-operation (p<0.001). This observation may contribute to lowering the threshold for two-stage invasive monitoring approaches in children as opposed to adults with epilepsy.

Imran Fei-Er Fan, MD, Harold L. Rakela, MD, Robert F. Spetzler, MD, Eric M. Horn, MD, Mauro A. T. Fanarola, MD, G. Michael Lennox, Jr., MD (Phoenix, AZ); Jeffrey V. Rosenfeld, MB (Melbourne, Australia)

Introduction Hypothalamic hamartomas may be associated with gelastic seizures. Surgical resection is the most effective treatment for this condition. These lesions can either be approached using several different surgical approaches. This study reviews the decision making for choosing an approach to these rare lesions.

methods The charts and diagnostic films of 10 pediatric patients younger than 17 years (age 3–16 years) who were surgically treated for hypothalamic hamartomas causing refractory gelastic seizures were reviewed retrospectively. In three cases, an endoscopic approach was used. In six cases, an interhemispheric interhemispheric approach was used. Endoscopic resection through the foramen of Monro was performed in one case.

results Radiographic complete resection was obtained in seven cases. Two lesions were resected subtotally, and one lesion was resected partially. One lesion accessed through the orbitozygomatic approach required a second orbitozygomatic approach for complete resection. The remainder required one surgical approach for treatment. Postoperatively, seizures were eliminated in eight patients. Seizure frequency declined significantly in two patients who underwent the orbitozygomatic approach. There was no permanent morbidity or mortality from surgery.

conclusion Most hypothalamic hamartomas causing refractory gelastic seizures are best approached from above through an interhemispheric interhemispheric approach to the third ventricle. Endoscopic resection is optional if the lesion is small. The orbitozygomatic approach is suitable for hamartomas located laterally in the hypothalamus that do not bulge into the third ventricle and with a narrow base attachment to the hypothalamus. The best seizure control has been associated with the interhemispheric interhemispheric approach.

Mark S. Dass, MD, Hershey, PA; Kim Smith, RN; Kathy deGuehney, RN; Wentai Li, MD (Philadelphia, PA)

Introduction The Upstate New York SBS Education Program began in December 1998 to educate both parents (mothers and fathers, fathers/father figures) of all infants born in the 8 counties of Western New York, before hospital discharge, about the dangers of violent infant shaking, and thereby reduce the regional incidence of absence head injury.

methods Parents were asked to view written and video materials about SBS before leaving the hospital and voluntarily sign commitment statements (CS) affirming their receipt and understanding of the materials. Commitment statements were returned and tracked by the investigators. The annual incidence of absence head trauma during the program was compared with historical control incidence rates from WNY during the 6 preceding years and with insurance figures from Pennsylvania where the program was not in existence.

results CS were received from 63% of the live births in the region. Ninety-six percent of CS were signed by mothers, and 76% by fathers/father figures. The annual incidence of absence head injuries declined 48% from 39.7 cases per 100,000 births per year during the control period to 20.6 cases per year (p<0.05); no comparable decline was seen in Pennsylvania.

conclusion A hospital based parental education program can be very effective in reducing the incidence of absence head injuries.

Rebecca M. Bennett, CRNP, Robert Granville, BS, Hel S. Melzner, MD, Michael L. Levy, MD, PhD, FAC (San Diego, CA)

Introduction The incidence of concussive injury in children and adolescents remains a concern despite modifications in athletes, rules and playing techniques over the years. A more significant problem is the inability of those present at the competitions to adequately assess the athlete and make determinations regarding removal from competition and return to play.

method Based upon over a decade of experience on the playing field at the high school and NCAA levels, we developed an instrument to allow for the rapid and reproducible evaluation of potentially concussed athletes. The index was derived from the Concussion Grading System of Cants, the (Colomb) Medical Society, the AAN and MGG University. It was found to be easily understood by medical personnel and trainers alike.

results A four variable index was devised utilizing Confusion, Headache, Sudden LOC, and Decreased Memory. Based upon these four parameters return to play guidelines were determined as long term follow-up of the athlete. When coupled with the Standard Sideline Assessment of Concussion, the tool became even more useful.

conclusion We describe a novel tool to assess athletes for concussive injury on the sideline. It is simple enough to be utilized by physicians, nurses and trainers and allows for the determination of Return to Play and Follow-up status for the athlete.

Ann Christine Dufourmelle, MD; Andrew Saykin, PhD, Brene McDonald, PhD, Gregory Holmes, MD, Brent Harris, MD, Carter Dodge, MD, Paul Tomeshok, SA (London, NY)

Introduction The scaled cortical impact model has provided insights into age-dependent differences in the recovery of the immature brain to mechanical trauma. We have now begun to study repair and recovery processes after injury in the geriatric brain, which may be relevant to the development of age-appropriate treatment strategies.

methods Pigs at 5 days (infants), 1 month (toddlers), and 4 months (adolescents) underwent cortical impact scaled for the growth of the brain to the homologous cortex. Subjects were injected with bromodeoxyuridine after injury, and brains were double-labeled for immature neuronal and glial markers. Subjects underwent magnetic functional resonance imaging (fMRI) of the somatosensory cortex before and at 4 and 6 months after injury to track the recovery of cortical function.

results In the youngest group, new cells in the subventricular zone on the injured side appear after injury, and these have characteristics of neuronal precursors. While there are a paucity of functional outcomes measures in this species, fMRI enables tracking of cortical recovery over time as a function of age at injury, as cortical functions relate to adjacent regions.

conclusion Treatments for brain injury during immaturity need to take into account inherent repair processes which may be advantageous. This model system allows for investigation of these processes in the development of new treatments.

Rahul Jindal, MD, Hanny Ariam, MD; Kevin Yu, MD; Burkit M. Dogar, MD; Hel S. Melzner, MD, Michael L. Levy, MD, PhD, FAC (San Diego, CA)

Introduction We performed a thorough historical, physiological, and biomechanical analysis to review head injury in children and adolescents in sport as it relates to helmet evolution.

methods Obtain data from thorough review of the literature.

results The reported incidence of concussion among high school football players dropped from 19% in 1983 to 4% in 1993. During the 1997 CFL season, players with a previous LOC in football were 6.15 times as likely to experience a concussion as players without a previous LOC (p=0.05). Players with a previous concussion in football were 5.10 times as likely to experience a concussion as players without a previous concussion (p=0.0001).

With the implementation of NOCSAE standards, fatalities decreased by 74%, and serious head injuries decreased from 4.25/100,000 to 0.06/100,000.

conclusion Helmet-use in conjunction with more stringent head injury guidelines and rules have had a tremendous impact in decreasing head injury severity in sport. The role of a neurosurgeon is critical in further head injury prevention and guidelines in sport.

27. Utility of Serial Computed Tomography Scans in Pediatric Head Trauma.
Kenneth C. Liu, MD; Nathan R. Selden, MD, PhD, Susan R. Durrant, MD (Portland, OR)

Introduction In pediatric head trauma, serial CT scans are often obtained to document progression of intracranial injuries. Often these offer little additional clinical information and expose the young patient to unnecessary radiation exposure. The goal of this study is to determine the utility of serial CT scanning and to determine what types of intracranial injury may warrant additional scanning.

methods All pediatric patients (1–18y) with known or suspected head trauma who underwent CT scan on admission between January 1, 2001 and December 31, 2002 were included for study. Patients whom required urgent neurosurgical operative intervention were excluded. All patients received a second CT scan within 24 hours of admission. The first and second CT scans were compared for any intracranial changes.

results 182 patients (111 male, 71 female) were studied. The mean age was 10.5 years (range 2–18y). In 147 patients (80%), and whenever possible, a pretraumatic baseline computed tomography was obtained. On repeat imaging (19.2%) showed progression of known intracranial injury. The injuries were divided into 4 distinct categories: 50% parenchymal contusion (96%), diffuse axonal injury (50%), subdural hematoma (4%), central edema (4%), intracerebral hemorrhage (20%) and subarachnoid hemorrhage (7%). Five patients underwent neurosurgical intervention after the second CT, however, in only one patient was the decision for surgery based solely on radiographic findings. 10 of the 35 patients who had a negative initial CT, repeat imaging did not demonstrate interval development of intracranial injury.

conclusion Serial CT scans in pediatric head trauma are unlikely to add useful clinical information and expose pediatric patients to unnecessarily radiation.
28. Skiing and Snowboarding Head Injury: Why are Head Injuries More Common in Snowboarders?
Mark A. Hunt, MD, Nathan R. Seiden, MD, PhD, Susan R. Durham, MD, Portland, OR
Introduction. Skiing and snowboarding are popular winter sports that include high speeds, jumps and drops, and potentially hazardous terrain and conditions. Head injury is a common outcome of any sport with this combination of elements. To date, limited information is available regarding the relative incidence of head injury among skiing and snowboarding. We retrospectively analyzed the epidemiologic data from several large registries.

Methods. We performed a literature search using Medline and identified 32 articles relevant to skiing/snowboarding and head injury since 1966. Seven articles contained both head injury and participation data. We combined and reanalyzed these results.

Results. Head injury occurs with an incidence of 0.4/100,000 skier-days and 1.0/44,000 snowboarder-days. The incidence of death from head injury is 0.07/1,000,000 skier-days and 0.087/1,000,000 snowboarder-days. The average age for head injured skiers was 27, while for head injured snowboarders it was 22. Males accounted for the majority of head injuries with 65% of head injured skiers and 75% of head injured snowboarders.

Conclusion. We do not have any fact-based reason for the greater than three-fold increased rate of head injury and ten percent increased rate of death from head injury for snowboarders, but surmise that it relates to several reason mechanistic, age, sex, risk-taking behavior, and/or underestimation of the number of winter sports. Over 54 million skier/snowboarder-days in the United States in 2001-2002, the potential number of head injuries supports the routine use of helmets, particularly in snowboarders.

Michael D. Taylor, MD, PhD, Frederick A. Blob, MD, Robert A. Sanford, MD, Aamer Gass, MD, Maimon Koupeli, MD, Tom E. Marchant, MD, Larry E. Kun, MD (Memphis, TN)
Introduction. Pineoblastoma is an uncommon, malignant tumor of the pineal gland. Because of its rarity, limited progress has been made in the characterization and treatment of this tumor.

Method: A retrospective chart review of all children with pineal region neoplasms was conducted, and children with pineoblastoma were identified. The results 14/35 pineal region neoplasms identified were pineoblastomas. No cases of pineocytoma were identified. The male/female ratio was 8.6 and the median age 4.4 years (range 0.6-28.1 years). 6/14 patients were <3 years of age. Children under the age of 3 years had a worse outcome (4/6 died of disease [DOD], as opposed to 4/8 older children). The median number of operations was 2 (range 1-4), with 1 patient who underwent resection, as opposed to biopsy alone who had a trend towards better outcome (bio 3/4 DOD, resec 5/10 DOD). Children >3 years of age were treated with radiation therapy and chemotherapy. 4/8 patients received craniospinal irradiation under the age of 3 did not receive radiation therapy, but did receive chemotherapy. Of those 4 children, 3 died and one has stable disease. Children received Gamma Knife radiotherapy; all three live with no evidence of disease. No child presenting with a metastasis survived.

Conclusion. pineoblastoma remains a devastating disease with a >50% mortality rate in younger children, and in children presenting with metastases. A trend towards better survival in the group of children who received a resection, compared to those who were only biopsied, suggests that cytoreductive surgery may be value in patients with pineoblastoma.

30. The Diagnostic Value of Preoperative Radiologic and Serologic Testing in Pineal Region Tumors in Children
Mark D. Krueger, MD, J. Gordon McCrumb, MD (Los Angeles, CA)
Introduction. The management of pineal region tumors is contingent upon accurate diagnosis. Pure germinomas, the most common childhood tumors in this location, are effectively treated with chemotherapy and/or radiation. However, the management of nongerminomatous germ cell tumors, pineoblastoma, pineal primitive neuroectodermal tumors (pNET), and pineocytoma is more controversial, although surgical resection plays a critical role.

Method: To ascertain the ability of preoperative diagnostic testing to determine therapy, we retrospectively reviewed the records of 50 consecutive patients with pineal region tumors treated at one institution over 19 years. Results. This series consists of 19 germinomas, 12 non-germomatous germ cell tumors (teratoma, embryonal carcinoma, chorionicarcinoma), 4 pineoblastomas, 1 pineocytoma, 15 pineoblastomas (pineoblastoma, 3 astrocytomas, and 1 pinealoma). Patients included 36 boys and 14 girls, with an age range of 6 months to 16 years (mean 9.5 years). The preoperative MRI report included the correct histopathologic diagnosis in the differentials in 46 cases (92%). In 6 of the cases, the report incorrectly indicated the tumor was "likely germinoma." However, the correct histopathologic report was mixed germ cell tumor in 3 cases, PNET in 2, and astrocytoma in 1. Serologic markers were not performed in 48 patients (98%). These tests were normal or mildly elevated in all of the patients with germinomas, PNET, astrocytoma, or pineocytoma. However, they were elevated in only 5 of the 12 (42%) non-gemnoromatosus germ cell tumors (pNET, astrocytomas, pineoblastomas).

Preoperative and serologic testing of pineal region tumors is not essential in making a histologic diagnosis, and could lead to inappropriate therapy.

31. Intracystic Irradiation: An Effective, But Underutilized Therapy for Cystic Craniopharyngioma
Corey Raffel, MD, PhD (Rochester, MN)
Introduction. Despite the relative rarity of craniopharyngioma, both controversial and problematic. Treatment options include surgical resection, external beam irradiation, stereotactic radiosurgery and intracystic therapy. Each type of treatment has both advantages and drawbacks. For example, surgical resection can result in cure in skilled hands, but is complicated by adhesions, postoperative hypophysitis, hypothalamic dysfunction and tumor recurrence. We present 5 patients treated with stereotactically guided intracystic instillation of radioactive colloidal radioactive phosphorus. Three patients were female, age ranged from 4 to 6 years (mean of 2.8 years) at the time of intracystic treatment. Two patients were treated at initial presentation, and 3 at recurrent tumor. One patient at initial presentation, and 2 at recurrent.

Results. Patients were treated using framed stereotaxy. After application of the head frame, an MRI scan was obtained, cyst volume calculated, target chosen, and radioactive phosphorus injected into the cyst. The dose of radiation will be determined. All patients experienced both symptomatic and radiographic improve without untoward reaction. With mean follow-up of 23.8 months, no patient has evidence of tumor growth. These results suggest that intracystic injection of radioactive colloidal radioactive phosphorus is an effective treatment for cystic craniopharyngioma, but at present is underutilized. We believe that this option is underutilized, based on the number of craniopharyngiomas seen at our institution and the number of patients treated with this therapy.

32. The Management of Cysts in Pediatric Craniopharyngiomas
Scott Leary, MD, Mark D. Krueger, MD, J. Gordon McCrumb, MD (Los Angeles, CA)
Introduction. The management of cystic craniopharyngiomas in children continues to evolve considerable controversy. This study evaluates our practice of maximal tumor resection, rather than solely addressing the cystic component.

Method: We retrospectively reviewed 30 consecutive cases of craniopharyngioma. 21 of these patients presented with cysts greater than 1 cubic centimeter. This group included 13 boys and 8 girls, and ranged in ages from 3-14 years. Initial operative approaches included enucleation cystic enucleation in 9 patients, subtotal in 7, orbitozygomatic in 3, and transphenoidal in 2. Follow-up varied from 1 to 9 years (median 2.5 years), and included at least one post-operative MRI.

Results. 10 patients (71%) had gross total resection, with no evidence of recurrence of tumor or cyst on follow-up imaging. 1 patient had stable residual tumor at 3 years, with no cyst recurrence. 1 patient had solid tumor recurrence at 2 years, which has been stable after stereotactic radiosurgery. 4 patients underwent a second craniotomy at 13 months to 3 years after the initial surgery for cystic tumor recurrence, and none have had additional recurrences. Non-transient operative morbidity included diabetes insipidus in 20 patients (85%), hypothyroidism in 16 (7%), visual defects in 5 (24%), cranial nerve deficits in 4 (19%), and strokes in 3 (14%). There were no peri-operative deaths, although 2 patients have died during follow-up.

Conclusion. These results demonstrate that cysts associated with craniopharyngiomas can be controlled by surgical resection. Our outcomes offer a comparison with treatments that only address the cyst and not the solid component of the tumor.

33. Management and Prognosis of Midbrain Tectal Tumors in Children
Chen Rongpeng, MD, PhD; Rick J. Klappe, MD, Karl Rothauer, MD, Fred Epstein, MD, George Jallo, MD (New York, NY)
Introduction. We reviewed our experience with intracranial gliomas of the pineal region in children to better understand the natural history of these tumors and current management strategies.

Methods. Thirty-one patients were identified who had lesions which were defined as an intracranial lesion of the midbrain primarily localized to the region above the aqueduct, excluding pineal region tumors. Follow up data was obtained from the medical charts, contact with physicians treating the patients, and telephone interviews with the patients.

Results. Most patients presented with symptoms of increased intracranial pressure caused by obstructive hydrocephalus at the level of the third ventricle. All patients underwent a CSF diversion procedure fourteen (45%) had indwelling ventricular catheters alone, eight (26%) had endoscopic third ventriculostomy; and six (29%) had a combination of both procedures. All histologic samples obtained from the biopsied patients (7/31) revealed low grade astrocytomas. There were no mortalities within the complete follow-up groups. 10.7 years of group of 24 patients. Patients with radiographic gaddlinum enhancement more often experienced progression in this disease.

Conclusion. Clinical follow up has revealed that the natural history of these tumors is primarily a slow relatively low malignancy rate, particularly in those patients with endoscopic third ventriculostomies experienced a longer period of symptom-free survival and therefore this procedure has evolved to be the procedure of choice for tectal gliomas.
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34. Recovery of Cranial Nerve Function Following Surgery for Medulloblastoma Tumors
Georgia M. DeAngelis, MD, PhD; Andrew A. Ziskind, MD; Tanim Shrinivas-Meher, NP; Linda Velezquez, MD; Karl Kohlhut, MD; Rick Abbott, MD (New York, NY)

Introduction: Although the optimal treatment for intrinsic focal tumors of the medulloblastoma tumors remains controversial, many suggest that primary surgery is the treatment of choice for these tumors. The postoperative surgical morbidity includes loss of lower cranial nerve function and significant motor deficits. The recovery of lower cranial nerve dysfunction following radical surgery has not been previously reported.

Methods: Forty-one patients with tumors involving the medulloblastoma were operated on between 1986 and 1997. Nineteen (46%) of these children suffered loss of lower cranial nerve function requiring tracheostomy, ventilator support and feeding gastrostomy. A retrospective analysis of this patient population and the time to cranial nerve recovery is undertaken.

Results: Thirteen of the nineteen patients (68%) had a full recovery of lower cranial nerve function. Two patients (11%) have made significant improvement in their lower cranial nerve function and four others (21%) have remained without lower cranial nerve function.

Conclusion: Lower cranial dysfunction is common following surgery for intracranial medulloblastoma tumors. However, the majority of patients who do require tracheostomy or gastrostomy tubes will recover cranial nerve function.

35. The Anterior Interhemispheric Trans-Choroidal Approach to Pineal Region Tumors
Henry Aryan, MD; Kevin Yu, MD; Rachel Landa, MD; Bruce M. Chopra, MD; Ha S. Meltzer, MD; Michael L. Levy, MD; PhD; FAC (Los Angeles, CA)

Introduction: The anterior interhemispheric transchoroidal approach (AIT) represents a relatively newly-developed cohort of resection. Patients commonly present in childhood, with a rapidly progressive clinical course and less than 1 year survival. Treatment regimens have been non-uniform.

Methods: We retrospectively reviewed this group of patients seen at our institution who were treated using a uniform protocol.

Results: Over a 6 year period 11 patients, 6 boys and 5 girls, were diagnosed with craniopharyngioma. The median age was 61 months, and ranged from 40 to 88 months. Presenting signs and symptoms began on average just over a month before diagnosis and included: headache (46%), nausea/vomiting (56%), lethargy (27%), seizures (27%), cranial nerve functioning (46%), ataxia (18%), and long tract functions (27%). Tumor location was cortical in 4 patients, pineal region in 4, posterior fossa in 2, and spinal in 1. One patient had disseminated disease on the initial imaging study, 7 patients had disseminated tumor subsequently. Treatment consisted of chemotherapy alone in 2 patients, chemotherapy and cranial irradiation in 2, and chemotherapy and cranial irradiation in 3. Five patients are alive, three have died, and three were lost to follow-up. The average time to death was 21 months and ranged from 40 months to 40 months. Among the surviving patients, the average length of follow-up is 32 months and ranges from 4 to 40 months. Conclusion: ATRT represents a malignant tumor, with rapid progression. Further study is necessary to determine efficacy of therapy.

36. The Malignancy of Atypical Teratoid Rhabdoid Tumors
Michael L. Chen, BA; Mark D. Knepper, MD; John G. Corrigan, MD (Los Angeles, CA)

Introduction: Atypical teratoid rhabdoid tumors (ATRT) represent a relatively newly-defined cohort of resection. Patients commonly present in childhood, with a rapidly progressive clinical course and less than 1 year survival. Treatment regimens have been non-uniform.

Methods: Since December of 1995, 59 endoscopic surgical procedures were performed for an intracranial tumor. Of these patients, 16 had an intracranial tumor with concomitant hydrocephalus and underwent either endoscopic tumor biopsy or resection. The radiologic, the surgical, the clinical, and the patient outcome were reviewed.

Results: Tumor location was categorized as third ventricular in 7 and lateral ventricle in 2. Stereotactic image guidance was used in 12 patients for ventricular cannulation while in 4 a free-hand technique was utilized. Ventricular irrigation and continuous irrigation was used in all patients once ventricular access was accomplished. In all patients the ventricular compartment was successfully cannulated and the intended goal was accomplished in 13; 16 had successful diagnostic sampling and 3 had complete resection of a solid cyst. There were no complications related to the endoscopic procedure and no patient required delayed intervention for symptomatic hydrocephalus.

Conclusion: Endoscopic biopsy or resection of intracranial brain tumors in patients without hydrocephalus can be safely performed using a technique which includes stereotactic guidance, ventricular irrigation, and continuous intraventricular irrigation. The aforementioned technique satisfied the intended surgical goal in all cases, was uniformly effective and did not lead toward the development of hydrocephalus.

38. Atlanto-occipital Dislocation in Children: A Retrospective Study of Stabilization Techniques and Outcomes
Scott Soleau, MD; R. Shane Tubbs, PhD; PA-C; Daniel B. Weble, BS; W. Jerry Oakes, MD (Birmingham, AL)

Introduction: Atlanto-occipital dislocation (AOD) secondary to blunt trauma in the pediatric population remains a common cause of significant morbidity and mortality. The diagnosis of this potentially fatal injury can be made readily and expeditiously with advanced imaging tools. There are a few studies that have discussed the options and effectiveness of occipito-cervical stabilization techniques in the pediatric population.

Methods: We reviewed eight cases 4 males, 4 females of post-traumatic AOD that were admitted to our facility from 2000-2003. Ages ranged from 14 months to 17 years. All patients had a complete pre-operative neuro-diagnostic work-up (plain x-ray, CT, MRI). Each patient underwent an occipito-cervical fusion procedure using the inside/outside technique along with autologous bone graft (iliac as described by the senior author.

Results: All patients tolerated the procedure well. No patient required halo-fixation; only a cervical collar was used for follow-up surgery. Mean follow-up time was 15 months (range 3 months-2 years). Outcome measures included appearance of graft healing on diagnostic imaging and functional performance.

Conclusion: All patients were independently ambulatory at 18 months, one patient died from pneumonia, two patients had complete quadriparesis at presentation, and one patient had a residual hemiparesis. We present a retrospective analysis on a particular treatment option for patients who have suffered a post-traumatic AOD. The inside/outside technique is a safe and dependable method of occipito-cervical stabilization in children with acceptable rates of bony fusion and no need for rigid external orthotic devices after surgery.

39. Persistent Syringomyelia Following Pediatric Chiari I Decompression: Radiologic and Surgical Follow-Up
Scott Soleau, MD; R. Shane Tubbs, PhD; PA-C; Daniel B. Weble, BS; W. Jerry Oakes, MD (Birmingham, AL)

Introduction: 16 of our surgical series of patients with both Chiari I malformation and syringomyelia continued to have a significant syringomyelia following their first decompressive procedure. All but one of these had resolution of their syringomyelia after a second operation. We have analyzed this cohort to discern for possible radiologic or surgical findings that may aid in predicting which patients are likely to respond to their first decompressive procedure.

Methods: The authors retrospectively reviewed radiologic and operative data of eight patients who continued to have syringomyelia following a decompressive procedure.

Results: Seven patients had complete resolution of their syringomyelia following a second operation. Radiographically, three had ventrilocisternal stents placed, one patient in whom the dura was not opened at first operation, a second operation revealed an arachnoid web, one patient had scarring between the left and right PCA thus occluding the fourth ventricular outlet, and four patients underwent unilateral tonsillar coagulation. Two patients had small fourth ventricles. Four patients had grade III diencephalic retraction and one of these failed to improve following their second operation. Two patients were noted to have caudal descent of the brain stem.

Conclusion: No radiologic measure was found to predict which patients would not respond to their first decompressive procedure. Further, no operative finding was extraordinarily unique to any one patient. All but one patient in whom refractive comparison of a patient foramen of Magendie was made had resolution of their syringomyelia.

AANS/SECTION on Pediatric Neurosurgical Surgery, December 2-5, 2005 Salt Lake City, Utah
oral abstracts

40. Scoliosis and Chiari I Malformations in Children
Mark D. Kneiger, MD; J. Gordon McDonald, MD. AAOS Abstracts. CAI introduction. The identification of Chiari I malformations has increased in recent years, commonly occurring for scoliosis treatment, however, remains controversial, and the expected success determinants uncertain.

methods: We conducted a 10-year retrospective review of children who were discovered to have a Chiari I malformation during an evaluation for scoliosis. 73 patients were identified, ranging in age from 6 months to 18 years (median 12 years). Included were 39 girls (54%) and 34 boys (46%). All had hydrocephaly on MRI of the spine. None of these patients were referred for specific neurological complaints, but 12 (16%) had neurological signs on exam. All were treated with a cranio-cervical decompression in a standard fashion. Follow-up ranged from 3 to 96 months with a median of 35 months. Outcome was evaluated by MRI at 6 months in all included patients.

results: At the 6 month MRI scan, 51 (71%) patients had total or near total resolution of the syrinx and 65 (92%) had a significant reduction in the syrinx with respect of the cerebellar tonsils. Persistently large syringes were treated with re-operation in 6 cases, and shunts for hydrocephalus in 2. The scoliosis in 14 (18%) patients progressed requiring subsequent spine surgery and 28 (37%) required bracing. 31 children had reduction of their scoliosis with no additional therapy.

conclusion: This large series suggests the efficacy of treatment for scoliosis related to Chiari I malformations with syringes in children, and the need for MRI imaging even in the absence of neurological signs and symptoms.

41. Posterior Fossa Decompression Without a Durapex for Treatment of Chiari II Malformation
Prathvi Narayani, MD, Sarah Jost, MD; Jeffrey R. Leonard, MD; Matthew D. Smith, MD; Jeffrey G. Johann, MD; Tae Sung Park (St. Louis, MO) introduction. Hindbrain compression in Chiari II patients may be from the bone and the atlanto-occipital membrane rather than the dura. Furthermore, the dura matter in young children may be more distensible compared to adults. Posterior fossa decompression without a duroplasty may be sufficient to relieve symptoms. Leaving the dura intact also decreases the risk of catastrophic hemorrhage from sinunasal fistulas.

methods: Over a 13 year period, 11 patients with symptomatic Chiari II malformations underwent decompression without a duroplasty. The age range was 1 month to 5.5 years (mean 17.3 months). All patients had functioning shunts prior to surgery. Cerebral atrophy in 10 out of 11 patients with division of the dural band was performed on all patients based on findings in pre-operative magnetic resonance imaging (MRI) and intraoperative ultrasound (IOUS). Intraoperative US was used to confirm cerebrospinal fluid (CSF) flow posterior to the neural elements after decompression. The mean follow-up was 4.06 years (4 months to 12 years).

results: There was complete resolution of symptoms in 4 patients, partial improvement in 5, and no change in 2. One patient had worsening of symptoms despite initial improvement, due to bony regrowth and an enlarging syrinx, requiring a second decompression and duroplasty. There was no operative mortality or mortality.

conclusion: Posterior fossa decompression without duroplasty is a viable treatment option for selected infants and young children with Chiari II malformation.

42. Dural Splitting Craniocecal Decompression: Reduced Operative Time, Hospital Stay and Cost with Equivalent Early Outcome
Nathan R. Saldeen, PhD, MD; Farhad M. Limonadi, MD; Susan D. Durham, MD; Pamela Mansfield, CRNA introduction. Traditional practice for decompression of Chiari I malformation includes duraplasty, although good pre-operative outcomes have been achieved using a dural splitting technique.

methods: A prospective series of 24 consecutive patients (age 3 to 19 years) with Chiari I malformation (12 with syrinx) underwent craniocecal decompression in a single institution. Patients with syringomyelia, an allagrade duraplasty was utilized. In patients without syringomyelia intraoperative ultrasound confirmed adequate tentorial decompression by presence of paracollicular bands at the foramen magnum and C1 arch plus partial resection of the outer leaf of the dura. The C1 arch plus partial resection of the outer leaf of the dura.

results: Patients in the two groups were of similar age and functional status. Average follow-up length was 2.4 months. Dural splitting decompression required significantly shorter average procedure time (160 vs 199 minutes, P=0.001), total operating room time (106 vs 249 minutes, P=0.001), length of stay (2 vs 5 days, P=0.001), and perioperative charges (3,615 vs 5,109 dollars, P=0.001) compared with the duroplasty group. 83% of dural splitting decompression patients and 88% of duroplasty patients experienced complete or significant resolution of all symptoms (p=NS). One duroplasty patient suffered from a symptomatic meningioma after hospital discharge. There were no complications in the dural splitting decompression group.

conclusion: Dural splitting craniocecal decompression in pediatric Chiari I malformation with syringomyelia provides good early clinical results and significantly reduces resource utilization. A prospective randomized trial of the impact of surgical technique on the long term clinical outcome of craniocecal decompression is justified.

43. Withdrawn

44. Craniosynostosis: Surgical Anatomy and Strategies for Separation
Suman R. Bajaj, PhD, MD; Monika P. Pantal, MD; Zachary J. Walker, MD (Salt Lake City, UT) introduction. The separation of cranio-synostosis is a complex undertaking which requires the reconstruction of the craniofacial skeleton. This is achieved through neurovascular, dural, cranial and cutaneous entities. The reproducible finding of a shared superior orbital fissure (SSOF) is amongst the most technically challenging issues faced during separation.

methods: Venous strategies have been employed for sinus reconstruction during non-staged separation including the use of venous grafts and dural reconstruction. By contrast, our approach has been to stage the separation, serially isolating one twin from the shared SSOF. Forced deep venous drainage allows the twin to receive the shared SSOF and negates the need to reconstruct a SSOF sinus in the other twin.

results: Conclusion. We will discuss this approach and the limitations inherent to our strategy in the context of our experience and recent cases.

45. Efficacy of Scheduled Non-Corticosteroid Analgesics in Children after Suboccipital Craniotomy
Matthew D. Smyth, MD (St. Louis, MO); John J. Flaherty, MD; Paul A. Bubba, PhD, MD; Robert G. Chesnut, III, MD; W. Jerry Oakes, MD (Birmingham, AL) introduction. Though complications related to the interhemispheric approach including hemiparesis, memory loss, and mood have been cited, few series actually detail surgical morbidity.

methods: A retrospective review of 103 children over 15 years. Multivariate analysis (p<0.01) was utilized to evaluate potential relationships between multiple demographic and clinical variables. Survival, Hemiparesis and CSF diversion.

results: There were 49 female (mean age 10.07 ± 0.71). Mean follow-up was 2.8 years. Patients were evaluated at a mean of 0.6 hours. EBL was 278 ± 122. Patients entered at 37 of 3. Patients spent an average of 37 days in the ICU and 19.0 days (1-129) in the hospital. Bridging veins were sacrificed in 96 patients (25 single, 13 multiple).

46. Complications of the Interhemispheric Transcallosal Approach in Children
Kavin Yu, MD; Burk M. Oguz, MD; Henry Aryan, MD; Ralph Janda, MD; Henry S. Matzer, MD; Michael L. Levy, MD; PhD, FAC, San Diego, CA introduction. Though complications related to the interhemispheric approach including hemiparesis, memory loss, and mood have been cited, few series actually detail surgical morbidity.

methods: A retrospective review of 103 children over 15 years. Multivariate analysis (p<0.01) was utilized to evaluate potential relationships between multiple demographic and clinical variables. Survival, Hemiparesis and CSF diversion.

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47. Treatment of Intraventricular Air Embolism in Posterior Fossa Surgery in Children by Central Line Placement—A Risk/Benefit Analysis
Kelly Szantay, MD; Michael D. Taylor, MD; Fredrick A. Boop, MD; Robert A. Sanford, MD (Memphis, TN) introduction. Placement of central venous catheter for the treatment of air embolism has been widely accepted in pediatric anesthesiology, with some authors suggesting that it is malpractice to perform a posterior fossa craniotomy without a central venous line. Our investigation was to determine the benefits of these catheters in children undergoing posterior fossa craniotomy has caused us to critically examine this practice and develop the following recommendations.

methods: A retrospective review of 285 children less than 18 years of age undergoing posterior fossa craniotomy before and after a central venous line was placed at a single institution. From 1985-2000, all children were 1) operated upon in the prone position 2) had routine placement
48. Transsphenoidal Transtemporal Myelomeningocelephalocele Repair in a Newborn via a Transoral Approach

Luis R. Rodriguez, MD, Emrun Abidi, Douglas J. Gunst, Steven R. Buchman, MD, Karin M. Murasko, MD (Memphis, TN)

Introduction: Transsphenoidal and/or transoropharyngeal approaches are the surgical treatments of choice for large meningomyeloceles due to the risk of neurovascular encasement and potential for cure. The aim of the present study was to evaluate the outcomes of infants undergoing transoral repair of myelomeningocelephalocele repairs.

Results: A retrospective analysis of 107 cases identified 10 newborns who underwent transoral repair from 2010 to 2020. The mean age at surgery was 5.1 months (range: 1-6 months). The mean follow-up duration was 29.4 months (range: 1-96 months). The most common surgical indication was the presence of a meningomyelocelephalocele (90%). Intraoperative and postoperative complications were noted in 14% and 29% of cases, respectively. The most common complications included CSF leakage, meningitis, and Houses-Weber grade II/III meningocoele. There were no cases of early or late mortality. The mean duration of hospital stay was 11.7 days (range: 3-30 days).

Conclusion: Transoral repair of large myelomeningocelephalocele is a safe and effective treatment option for newborns. However, these patients require close monitoring and early intervention to prevent potential complications. Further studies with longer follow-up periods are needed to evaluate the long-term outcomes.

oral abstracts

54. Identification of Phenotypic Neural Stem Cells in Pediatric Brain Tumors

Stephen L. Muhi, MD; Yun Yung, BS; David Lum, BS; Samuel Chesner, MD, PhD; Roe Regan, MD; John R. Stanford, CA

Introduction: Gliomas have been shown to express markers specific for primitive, undifferentiated neural cells. In this study, we test the hypothesis that cells from pediatric brain tumors carry the stem cell phenotypic marker, CD133+, and thereby have stem-like properties.

Methods: Tumor tissues were collected from the operating room with an institutional review board approved protocol and were dissociated and labeled with fluorochrome-conjugated antibodies against a panel of markers: anti-CD133/PE, anti-CD24/FITC, anti-CD44/PE, anti-A Kes/FITC, anti-AMH class I/PE and anti-AMH class I/PE. Cells were sorted and analyzed with flow cytometry and activity of cultured cells using a cell growth assay

Results: Two out of the five pediatric brain tumors collected contained populations of CD133+ positive cells. The CD133+ cells were identified as being either a glioblastoma or a malignant teratoma. Neither the germinoma nor the plasmacytoid epidermoctroma revealed any CD133+ cells. The majority of the CD133+ cells carried the positive phenotype of a stem cell, e.g., the expression of neural stem cell markers: CD133+/CD24+/CD34-+CD45-. When isolated and cultured, these cells formed cystspheres and co-expressed beta-tubulin and GFAP. Conclusion: We have identified a population of cells that carry the putative neural stem cell marker in an early study of pediatric brain tumors. The identification of neural stem cells within pediatric brain tumors may have important overviews with development biology and neuro-oncogenesis.

55. Tolerance of Intestinal Infusion of Carmustine in the Rat Brainer: A Potential Therapeutic Strategy for Diffuse Pontine Gliomas

Erika V. Mark, BS; Giuseppe Ozogeczko, MD; Mark A. Edger, MD; Ion J. Dunel, MD; Mark S. Mouwenda, MD (New York, NY)

Introduction: Intestinal infusion of Carmustine (BCNU) into the rat brain in conjunction with systemic administration of 0.6%BCNU (O6-BG) was performed in an effort to assess clinical tolerance.

Methods: A total of twelve rats underwent stereotactic cannula placement into the pontine segment of the brain stem. Six of the rats underwent 24h infusion of BCNU (Volume of Injection [VI] 200 μl) at its maximal concentrated dose (3.3 mg/ml) in 5% dextrose water. Six additional rats underwent 24h infusion of BCNU preceded by an intraperitoneal (i.p.) injection of O6-BG at 5 mg/kg. Serial neurological examinations were performed on all animals. Histological analyses were performed immediately or 2 weeks following sacrifice. Postoperatively, there were no neurological changes in any of the animals.

Results: Postmortem histological examination of the brains showed small pontine cavity lesions ranging from 20 to 250 μm in diameter. No empty or necrotic areas were found to have CD133+ cells. The majority of the CD133+ cells carried the positive phenotypic marker profile of neural stem cells: CD133+/CD24-/CD34+/CD45-. When isolated and cultured, these cells formed cystspheres and co-expressed beta-tubulin and GFAP. Conclusion: We have identified a population of cells that carry the putative neural stem cell marker in an early study of pediatric brain tumors. The identification of neural stem cells within pediatric brain tumors may have important overviews with development biology and neuro-oncogenesis.

56. Short- and Long-term Shunting Reduces Reactive Astrocytosis in Experimental Hydrocephalus

Janet M. Miller, BS, James P. McAuliffe, PhD (Dartmouth, N.H.)

Introduction: Persistent gliosis in shunt-dependent hydrocephalus could alter biomechanical properties, impair cerebral perfusion and impede neuronal regeneration. Previous studies suggest that gliosis may persist after shunting but these findings are based on relatively short post-shunt survival times.

Methods: To determine the effects of protracted post-shunt recovery time on hydrocephalus-induced astrocytosis, we have placed neonatal low-pressure ventriculostomy-subarachnoid shunts in 15-day old rat brains with severe congenital hydrocephalus, sacrificed these animals 3 or 6 months later and dissected tissue from parietal (Pc) and occipital (Oc) cortices for gliofibrillary acidic protein (GFAP) levels and GFAP immunohistochemistry

Results: Preliminary data indicate that, beginning at 12 days of age, GFAP protein levels rose 16%/Pc and 36%/Oc as untreated animals became severely hydrocephalic. All shunted animals exhibited markedly reduced ventricular volume and normal cortical malformations in all animals.

57. Cytokines IGF-1, IGF-2, and TGF-B1 in a Congenital Hydrocephalyus Rats Model

Michael W. Morgen, PhD, Jennifer A. Stewart, MS, Allison N. Smith, BS, Jocelyn A. Ise, BSc(Hons) (Phillips Health Sciences, Revelstoke, BC)

Introduction: Complex signaling mechanisms of growth factors and cytokines are moderately tight. An imbalance of these critical biomolecules may cause an increase of GFAP accumulation in hydrocephalic brains.

Methods: Protein levels for IGF-1, IGF-2, and TGF-B1 in hydrocephalyus model and Sprague-Dawley control rats were measured on patient EEG electrodes and from postnatal day 1 (O1D) and D15 rats matched for extent using indirect ELISA assay.

Results: IGF-1 in O1D whole brain increased in IGF-1 whole brain on SD but were less in IGF-1 in brain and remained lower than SD (T2) and O1D control. IGF-2 was lower in IGF-2 in brain and SD on IGF-2 and were but approximately equal in IGF-2 and SD whole brain until postnatally D3. Subsequently, significant reductions were found in IGF-2 in normal (norm) and HC (hydrocephalic) rats relative to SD. IGF-1 increases were seen in IGF-1 in brain on SD and IGF-2 with decreases found on E19 and E20.

TFGF-1 in HC was lower postnatally relative to SD and on E19 and on E20. Conclusions: IGF-1 and IGF-2 are expressed prenatally in the mammalian brain, and stimulate proliferation of natural and gelatin precursors and their phenotypic differentiation. IGF-2 is primarily expressed in tissues that contact CSF, such as the choroidal plexus and meninges, and the ubiquitous cytokines, TGF-B1 is known to affect factors that secreted by CSF. IGF-13 can force tumor cells to modulate cell surface receptors (Igf-13-15). We are conducting investigations to determine if these mechanisms also influence pediatric MEAs, and we believe that a similar study will suggest novel immunotherapeutic strategies specifically for the treatment of pediatric MEAs.
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results. Hindbrain herniation was observed in 43% of animals not repaired in utero. No animal developed hydrocephalus. Animals with hindbrain herniation had a smaller posterior fossa, depressed mental status, and decreased feeding behavior. Statistically significant lower neonatal weights were seen in the hindbrain-herniated pathway in unrepaired MCM animals compared with controls, suggesting impaired fiber tract development. No animal developed split sutures, leukencephalitis, syringomyelia, quadrigeminal cyst, dysgenesis/agenesis of the corpus callosum, polygyricia, and/or periventricular gray matter heterotopia, or anencephaly.

Conclusion. The sheep MCM model is an injury model and reproduces the CSF leak, but not the human developmental defect. Therefore, the sheep model does not develop all aspects of the human disease. However, the model does suggest that the CSF leak contributes to hindbrain herniation, development of a smaller posterior fossa, decreased in mental status, and cortical dysplasia. This model was supported by NISRA F32 HD42921-01 (VCX).

60. Raised Intracranial Pressure in Isolated Sagittal Sinostitis—
The Oxford Experience

David McCaulay, FRCS, Esem EI Ganil, FRCS, Peter Richards, FRCS, Steve Hall, FRCS (Oxford, United Kingdom)

Introduction. Sagittal sinus thrombosis is often considered a cosmetic issue only. It is observed an intracranial pressure (ICP) is raised in a significant proportion of patients and this may have neurodevelopmental sequelae. This study aims to identify the prevalence of raised ICP in a subgroup of patients who had ICP monitoring performed.

Methods. Patients with isolated non-supratentorial sagittal sinus thrombosis were identified from the registry of the Oxford cranial surgical team. Medical records were reviewed and a combined retrospective/prospective study is being conducted. Current patients are included only after the decision for monitoring has been made by the multidisciplinary cranial team. All patients are monitored for 24–48 hours. For this study, retrospectively ICP data was interpreted independently by two neurosurgeons. Current studies are reported by one consultant and independently interpreted by the second. Baseline ICP is accepted up to 20 mmHg, and on the sleep trace up to 4 T-wave waves to 30 mmHg accepted to be within normal limits.

results. At the time of abstract submission, 146 patients were identified within the search criteria. A total of 31 ICP traces have been recorded in 25 patients. 30% of records show abnormal ICP within the study parameters.

Conclusion. This study suggests a high prevalence of abnormal ICP in those patients monitored. The parameters for normal ICP are generous compared with those documented in the literature, and may therefore underestimate the true prevalence in this condition.


David J. Donahue, MD, Deepak Seth (Fort Worth, TX)

Introduction. Complex craniofacial procedures represent a management option for patients with craniosynostosis. The "Pi Procedure," or variations thereof, often involves acute alteration of cranial shape, including calvarial fronto-sagittal advancement. Anecdotal reports have even reported demonstration of flow reversal during and after fronto-sagittal advancement. We sought to determine whether flow reversal, as determined by transcranial doppler (TCD), is a concomitant of cranial shortening during pi procedure performed in our institution.

Methods. Forty-five children with sagittal synostosis underwent contemporaneous TCD transcranial doppler evaluation during their pi procedure. We attempted to record middle cerebral artery flow velocity bilaterally, employing standard transcranial techniques at the following surgical stages: 1. After craniectomy ("baseline"); 2. Upon anterior-posterior cranial shortening ("acute"); and 3. Before closure ("resolved"). Values for ICP and mean systemic blood pressure were also measured and recorded.

results. We were able to isolate 44 children aged 3.5 to 17 months (mean age 5.73 mos; median age 5 months). Calculated baseline ICP was 0.743 ± 0.060 (range 0.469–0.970); average acral ICP was 0.780 ± 0.000 (range 0.573–0.945); average delayed ICP measured 0.765 ± 0.082 (range 0.455–0.951). Change of transcranial doppler during cranial shortening proved to be statistically insignificant, and flow-reversal (i.e. ICP 1.000 was not encountered. Similarly, TCD remained stable throughout the procedure, showing no fluctuations (i.e. Cushing Response) during cranial shortening.

Conclusion. Flow reversal does not occur following AP cranial shortening in patients who have undergone adequate osteotomies and maintain excellent postoperatively as an extended spine. No patients had new stroke or died from this procedure.

62. Management of Sagittal Craniostomoty-Feasibility Study in Sagittal Synostosis

David F. Jimenez, MD, Constance M. Barone, MD, Maria McGee, MD, Cathy Cartwright, RN, MSN, Lynette Bakar, RN, BSN (Columbia, MO)

Introduction. Endoscopic techniques were introduced 19 years ago for the management of patients with sagittal synostosis. Presently herein, we are reporting the results of 134 of these patients consecutively.

Methods. The population consisted of a total of 97 males and 37 females, ages ranged between 12 days and 9.5 months with a mean of 3.5 months. The patients were operated within two small incisions near the lambda and vertex. With endoscopic assisted visualization, a wide vertebral craniectomy with bilateral temporal and parietal barrel shape osteotomies were performed. Patients were treated with post-operative cranial orthotic therapy for cranial reshaping.

results. The overall blood transfusion rate was 9.14%. Two intra and 11 post-operative transfusions. The average craniofacial width was 5.4 cm and the length 10 cm. Estimated blood loss mean was 29.5 cm² with a range between 5 cm and 150 cm. Blood loss was pre-operative hematocrit was 32% and post-operative 27%. All except 7 patients were discharged the morning following surgery. The majority of the patients did not experience facial swelling and none had post-operative favors. Anthropometric measurements, indicated that correction to normal levels, was achieved in over 90% of the patients. There were no intra-operative mortalities, infections, hemorrhages, or various sinus injuries.

Conclusion. Our long term results indicate that patients who achieve normocephaly at 18 months of age maintained their head shape longitudinally. Detailed anthropometric measurements and CT scans will be presented. Excellent results, immediate molding and high patient satisfaction indicate that endoscopic management for sagittal synostosis provides an excellent alternative for treatment of this condition.

63. Emergency Cranial Vault Reconstruction in Pediatric Patients with Sin Verticale Syndrome

Albert E. Telfair, MD, Juanita Cross, BS, Leslie N. Sutton, MD (Philadelphia, PA)

Introduction. Sin verticale syndrome (SVS) is an uncommon complication of ventricular shunting for the treatment of hydrocephalus. Calvarial expansion surgery as a therapeutic strategy for increased intracranial pressure (ICP) in patients with SVS has been well described. Here we detail 9 cases in which patients with acute intracranial hypertension secondary to shunt malfunction in the setting of SVS were treated emergently with calvarial expansion surgery.

Methods. The medical records and radiographs for all patients undergoing emergency cranial vault reconstruction at the Children’s Hospital of Philadelphia between 1992 and 2000 were reviewed in this IRB approved study.

Results. The study group included 7 females and 2 males. The mean age of initial shunt placement was 3 months and the mean number of shunt revisions prior to calvarial expansion was 4 (range 0 to 7). Two patients underwent sub-temporal decompression prior to emergency calvarial expansion. The mean age at surgery was 46 months. Three patients required multiple emergency calvarial expansion procedures. Of 13 expansion procedures, 92% were pre-empted by proximal shunt malfunction and failed revision. Seven were anterior expansions, 5 were posterior expansions, and 1 was a total expansion. Post-operative and follow-up imaging showed small non-collapsed vertices in all patients. Cosmetic outcomes were considered excellent (no obvious deformity) in 8 patients and good (minimal deformity) in 3 patients.

Conclusion. Pediatric patients with SVS and acute intracranial hypertension in the setting of shunt malfunction will need revision or a safe alternative. Additionally, HT and age influenced CI for ESHT patients, though not with statistical significance given our cohort size.

Further research should be pursued to elucidate this trend.

64. Expanded Strip Cranietomy and Postoperative Molding Helmet for Scaphocephaly: Patient Selection Factors in Cranial Orthosis

Howard J. Silberstein, MD, FACSp, Jeffrey M. Martin, MD, Stephen J. Vega, Lan B. Hu, (Rechelter, NYI, Joseph E. Loece (Pittsburgh, PA)

Introduction. This study represents a retrospective analysis to determine if Expanded Strip Cranietomy and Helmet Therapy (ESHT) is more effective than Expanded Strip Cranietomy without Helmet Therapy (ESC) or Calvarial Vault Remodeling (CVR). We additionally examined patient factors which influ-
oral abstracts

notes

65. Visual Field Testing in Deformational plagiocephaly
Paul C. Francey, MD, PhD; Sterling L. Cannon, MD; Aaron Putney, MD; Michael Sankowski, MD (Oklahoma City, OK); William J. Feuer, MD (Miami, FL); Wadad Ahmad, MS; Jayesh Panchal, MD, FRCS (Oklahoma City, OK)

Introduction: Posterior plagiocephaly (PP) is an abnormality of the infant skull resulting in unilateral flattening of the occiput and ipsilateral frontal protrusion. Visual field testing has been suggested as a means of detecting abnormalities in cortical pathway maturation in infants. We performed visual field testing in a group of patients with PP to document presence and severity of visual field abnormalities.

Methods: With approval of the Institutional Review Board, a retrospective chart review of 40 consecutive infants aged 19-53 weeks with a diagnosis of PP was performed. Standardized binocular arc perimeter in the horizontal plane was performed. Both hemifield asymmetry of >20 degrees and a decrease in hemifield values of >50 degrees from established normals were considered abnormal. Visual field data was compared to normative data from a previous study.

Results: 17.5% (7/40) of infants tested had hemifield asymmetry of 20 degrees or more. 35% (14/40) had construction of one or both hemifields by at least 20 degrees less than established normals. There was a significant difference between the worse hemifield measured in each patient and the normal data (p<0.004). The data showed a trend toward delayed progression of visual field compared to the standard curve.

Conclusions: Our study demonstrates a notable incidence of visual field constriction in patients with PP. In addition, patients with PP may have delayed progression of visual field development. Our data sheds doubt on the concept that PP is a benign entity with no neurologic sequela and requires treatment for cosmetic purposes only.

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Authors of the top ten selected poster presentations have been invited to present their posters in a new “Electronic Poster” format.

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This visually stimulating twist on the traditional format of poster presentations will be an exciting addition to the AANSCNS Pediatric Section Annual Meeting.

101. Adjustment and Malfunction of a Programmable Valve After Exposure to Toy Magnets
Richard C. E. Anderson, MD; Marion L. Walker, MD; John R. W. Keestle, MD, MSc (Salt Lake City, UT)
Page 42

102. Standardized Method to Accurately Inject Tumor Cells into the Caudate-Putamen Nuclei of the Mouse Brain
Shiyi Yanke, MD, (Kanagawa, Japan); Ignacio Gonzalez-Gomez, MD, J. Gordon, MD; Walter Leug, MD, (Los Angeles, CA)
Page 42

103. Differential MRI Activation Following Language Tasks in English and Spanish for a Pediatric Patient with a Left Temporal Lobe PNET
Jeffrey R. Leonard, MD; Jason M. Watson, PhD; Jeffrey G. Ojemann, MD; Kathleen B. McDermott, PhD (ST, Louis, MO)
Page 42

104. Use of MRI for Routine Evaluation of Shunted Hydrocephalus in Children
William W. Ashley, MD, PhD, MBA; Robert Knikianth, MD, PhD; Jeffrey R. Leonard, MD, Matthew Smyth, MD; Prithvi Narayan, MD, Tae Sung Park, MD (ST, Louis, MO)
Page 43

Jaime K. Liu, MD; Gregory T. Shaw, BA; John R. W. Keestle, MD, MSc; Marion L. Walker, MD (Salt Lake City, UT)
Page 43

106. An Internet Site for Patients’ Shunt Information
Pat L. Barchetder, MSN, RN; Michael H. Hender, MD (Gainesville, GA); Cynthia S. Solomon, CEO (Sonoma, CA)
Page 43

107. Lepomeningeal Cyst Development After Endoscopic Craniosynostosis Repair
Henry E. Arvay, MD, Hal S. Metzner, MD; Gregory G. Geras, MD; Rahil Jandali, MD; Michael L. Levy, MD, PhD (San Diego, CA)
Page 43

108. Multiple Cerebellar Pilocytic Astrocytomas in Neurofibromatosis Type 1
Edward R. Smith, MD; William E. Butler, MD (Boston, MA)
Page 44

109. Withdrawn

110. Frameless, Pinless Stereotactic Neuroendoscopy in Children
John F. Rezner-Cerniai, MD; Frank J. Blok, PhD; David W. Pincus, MD, PhD (Gainesville, FL)
Page 44

111. Complications Following Disconnective Hemispherectomy in Pediatric Epilepsy
Sandrine N. de Ribaviere, Roy T. Danal (Lausanne, Switzerland); Giovanni Broggi, MD (Milano, Italy); Jean-Pierre Farner, MD; Jose L. Montes, MD (Montreal, PQ, Canada); Kathleen Meagher-Wernure, (Lausanne, Switzerland)
Page 45

AANSCNS section on pediatric neurological surgery

december 2-5, 2003 salt lake city, utah
101. Adjustment and Misfunction of a Programmed Valve After Exposure to Toy Magnets
Richard C.E. Anderson, MD, Marion L. Walker, MD, John R.W. Kestle, MD, MSc (Salt Lake City, UT)

Introduction. The use of programmable valves is becoming more popular among neurosurgeons, especially in cases where the optimal pressure for CSF diversion is not clear. While inadvertent adjustments and malfunctions of programmable valves have been previously reported near areas of powerful electro-magnetic fields (e.g., MRI), effects of small magnetic fields are not well known. We present a case where playing with magnetic toy magnets induced a shunt malfunction by altering the valve pressure and preventing further adjustment of the valve.

Methods. A four-year-old boy with hydrocephalus underwent shunting with a codan-medos anti-siphon programmable valve set at 10 cm H2O. He subsequently presented with 2 days of increasing headaches, nausea, and vomiting.

Results. Head CT demonstrated marginally increased ventricles and short series showed the valve pressure at 150 cm H2O. More extensive questioning of the parents revealed that the child had been playing with new toy magnets prior to symptom development. The valve was successfully reduced back to 70 cm H2O, but without clinical improvement. In the OR, brisk proximal flow was obtained but no flow could be forced through the valve. The valve was replaced and set at a pressure of 70 cm H2O. He clinically improved and was discharged home. Further testing of both strata and codan-medos programmable valves with the magnets revealed significant alterations of pressure settings even after minimal exposure.

Conclusions. When children with programmable valves present with shunt malfunction, questions in the history should be included which may help identify any magnetic toys so they can be removed.

102. Standardized Method to Accurately Inject Tumor Cells into the Cadaveric Putamen Nuclei of the Mouse Brain
Shinya Yemada, MD, (Kanagawa, Japan); Ignacio Gonzalez-Gomez, MD, J. Gordon Corbett, MD; Walter Leug, MD, Los Angeles, CA

Introduction. An improved technique is required for tumor cell implantation into the mouse brain.

Methods. The stereotactic injection of 0.5 to 5 ul of indocyanine green over 5 to 40 minutes into the cadaveric putamen nuclei of the mouse was done followed by sacrifice and examination of the brain injection site. 1 ul containing 105 UBFM glioma cells were stereotactically implanted into the caudate/putamen nuclei over 20 minutes. The animals were sacrificed from one hour to 6 days after implantation and the brain examined and tumor size measured.

Results. Injection of 1 ul of indocyanine green over 20 minutes produced a spherical deposit of dye within the 

103. Differential MRI Activation Following Language Tasks in English and Spanish for a Pediatric Patient with a Left Temporal Lobe INET
Jeffrey R. Leonard, MD, Jason M. Watson, PhD, Jeffrey G. Ojemann, MD, Frank H. McDermott, PhD (St. Louis, MO)

Introduction. Neurosurgical procedures involving dominant hemispheric frontal and temporal cortex can put language function at risk. In the present study we adopted a recently developed MRI procedure allowing rapid and robust activity in anterior and posterior language regions of individual healthy young adults for the purpose of studying the language of child with a left temporal lobe tumor.

Methods. An 11-year-old, right-handed Mexican-American male, whose first language is Spanish, presented with headaches, intermittent emesis, and no other neurologic complaints. MR imaging showed a heterogeneously enhancing 3.5 cm left temporal lesion. He underwent resection of the lesion but was unable to tolerate the awake portion of the procedure.

Results. The results of the fMRI study on this patient showed activation related to semantic associations infrontral and temporal regions for both the previously published English and a novel version using Spanish materials). These areas are consistent with previous reports in English controls. The English materials elicited enhanced activation posterior to the motor area for English relative to the Spanish materials.

Conclusions. Although this patient did not tolerate awake craniotomy, other pediatric cases enrolled in this protocol have shown strong correlations between regions identified by fMRI and those identified with intraoperative cortical stimulation mapping in both frontal and temporal cortex. These findings suggest that this fMRI protocol may be useful in planning neurosurgical procedures for pediatric patients who may be at risk for language impairment. Furthermore, neural regions supporting verbal semantic processing may be somewhat different between languages in the hemisphere. We recommend the use of rapid sequence MRI for non-emergent evaluation of pediatric hydrocephalus.

104. Use of MRI for Routine Evaluation of Shunted Hydrocephalus in Children
William W. Ashley, MD, PhD, MBA; Robert McKnight, MD, PhD, Jeffrey R. Leonard, MD; Matthew Smyth, MD; Prathivai Narayanan, MD; Tae Song Smyh, MD (St. Louis, MO)

Introduction. Shunted hydrocephalus patients require regular radiographic evaluation in order to diagnose malfunction and/or infection. CT is used because it rapidly acquires high quality images. However, CT exposes pediatric patients to especially high levels of radiation. Standard MRI requires longer image acquisition time and is associated with movement artifact. MRI in the children usually requires sedation. Standard MRI provides greater structural resolution but visualization of ventricular catheters is relatively poor. Recently, rapid sequence MRI has shown promise for providing high quality images. We analyze a series of over 20 patients that were imaged using rapid MRI and show that it can be effectively used to evaluate hydrocephalus.

Methods. We performed a retrospective analysis of pediatric hydrocephalus patients imaged with conventional and rapid sequence MRI. Radiologist reports were reviewed to assess the ability of a radiologist to visualize the shunt catheter. Two resident physicians were asked to retrospectively localize the ventricular catheter and assess image quality.

Results. Postoperatively, the patient increased in her motor strength and ambulation. There was no CSF leak. Conclusion. Spinal extradural arachnoid cysts are rare lesions that can cause spinal cord compression in children. Non-communicating lesions of this type are extremely rare, and they can be removed entirely leaving the dura intact. The authors review the literature and discuss the proposed underlying mechanisms of cyst formation.

James K. Liu, MD; Gregory T. Shari, BA; John R.W. Kestle, MD, MSc; Marion L. Walker, MD (Salt Lake City, UT)

Introduction. Extraventricular arachnoid cysts in the spine are uncommon in the pediatric population. They may be associated with trauma, neural tube defects, and Marfan's syndrome. They often communicate with the intraspinal subarachnoid space through a small defect in the dura or diverticulum. We present a case of a child who presented with spinal cord compression secondary to a large spinal extradural arachnoid cyst that did not communicate with the subarachnoid CSF column. Methods. This 11-year-old girl presented with several years of urinary urgency, which progressed to lower extremity weakness, myelopathy, and severe gait ataxia in the last 6 months. An MRI of the spine demonstrated a large extradural arachnoid cyst extending from T8 to T12. The patient underwent a thoracic laminectomy for an en bloc resection of the spinal extradural arachnoid cyst. Intraoperatively, the dura was intact and there was no evidence of communication intradurally to the subarachnoid space.

Results. Postoperatively, the patient improved in her motor strength and ambulation. There was no CSF leak. Conclusion. Spinal extradural arachnoid cysts are rare lesions that can cause spinal cord compression in children. Non-communicating lesions of this type are extremely rare, and they can be removed entirely leaving the dura intact. The authors review the literature and discuss the proposed underlying mechanisms of cyst formation.

106. An Internet Site for Patients’ Shunt Information
Patti L. Batchelder, MSN, RN, Michelle A. Dulay, MA, RN, (Cali, CO)

Introduction. In today’s mobile society, it is not unusual for shunted patients to require evaluation far from their primary neurosurgeon. Assessing shunt function for physicians not familiar with the patient’s medical history and baseline information can be difficult and time consuming. We have taken a software program designed to store medical records and customized it for patients with hydrocephalus. The website allows for storage of current information regarding the patient’s shunt, including baseline CT scans, type of shunt, name of neurosurgeon, and dates of recent operations. It also includes a printout of the emergency card listing names of neurosurgeons, medications and emergency contact numbers. The secure site can be accessed by the patient and provided to physicians from any computer linked to the Internet. Information can be continually updated by the patient and by physicians to whom the patient provides access. Use of this website will facilitate the management of shunt patients whenever they find themselves ill with symptoms suggesting a shunt malfunction.

107. Leptomeningeal Cyst Development After Endoscopic Craniosynostosis Repair
Henry E. Ayman, MD; Hal S. Metzler, MD; Nicholas S. Jonas, MD; James J. Jenabi, MD; Michael L. Levy, MD, PhD (San Diego, CA)

Introduction. Craniosynostosis repair by her age peak occurs as an alternative to traditional craniosynostosis repair. Advocates of this approach assert advantages including decreased blood loss, operative time, and hospital stay while still providing aesthetic results comparable to traditional repair. The difficulties inherent in endoscopic visualization may result in complications, however, which could temper enthusiasm for this procedure. The authors report a...
108. Multiple Cerebellar Pilocytic Astrocytomas in Neurofibromatosis Type I
Edward R. Smits, MD; William E. Butler, MD (Boston, MA)
Introduction. Patients with neurofibromatosis type I (NF1) are known to have an increased risk of developing intracranial tumors, including pilocytic astrocytomas. However, the appearance of multiple pilocytic astrocytomas in a given patient is extremely rare, having only been reported once in the cerebral hemispheres. We report what we believe is the first documented case of multiple pilocytic astrocytomas in the cerebellum.

Methods. Case report.

Results. A 17-year-old patient with a known history of NF1 presented with a several week history of progressive nausea, vomiting, and ataxia. Imaging disclosed three enhancing lesions of the cerebellum, including the left hemisphere, vermis and left tonsil, with associated obstructive hydrocephalus. The multiple lesions presented a diagnostic challenge. Evaluation included computerized tomography, magnetic resonance imaging and cerebral angiography. Resection of the lesions via suboccipital craniotomy was performed and pathology was consistent with pilocytic astrocytoma. Postoperatively the patient has done well.

Conclusion. The occurrence of multiple pilocytic astrocytomas in NF1 has been reported only once before, but never in the cerebellum. The clinical, radiographic and pathologic findings of this case, along with review of the literature are discussed. The multifocal nature of these tumors presents unique challenges in clinical management, particularly regarding diagnosis and surgical planning for resection. This case suggests an interesting pathophysiological mechanism underlying the development of these lesions.

110. Frameless, Pinless Stereotactic Neuroendoscopy in Children
John F. Reavey-Cottrell, MD; Frank J. Bova, PhD; David W. Pinus, MD, PhD (Geneva, FL)

Summary. Frameless neuronavigation has been established as a useful adjunct to endoscopic neurosurgery. Stereotaxis provides targeting information for initial endoscope placement and may be extremely helpful in patients with abnormal anatomy by providing real-time feedback as the endoscope is moved within the ventricular system. However, neuronavigation is typically limited in young children by the use of rigid head fixation with pins. Pin fixation may be difficult and hazardous for patients under the age of 2 with risks including scalp laceration, skull fracture, dural injury and intracranial hematoma. We have adapted a pinless head fixation system, consisting of a headbag device, for use with frameless neuronavigation. We have applied this technique to seven patients (2 females, 5 males; age range 6 to 17 years old). Patients underwent either an endoscopic ventricular cyst fenestration or an endoscopic third ventriculostomy. Six of seven procedures were successful, with one operation aborted secondary to unstable anatomy. The system provides a good immobilization and is simple and easy to use. This pinless, frameless method offers a new option to the population of patients who require a neuroendoscopic procedure and are unable to tolerate rigid head fixation.

111. Complications Following Disconnection Hemispherectomy in Pediatric Epilepsy
Sandrine N. de Ribaupierre, Roy T. Daniel (Lausanne, Switzerland); Giovanni Broggi, MD (Milano, Italy); Jean-Pierre Farner, MD; Jose L. Montani, MD (Montreal, PQ, Canada); Kathleen Meagher-Villemure, MD (Lausanne, Switzerland)

Introduction. Hemispherectomy has been performed for over 50 years and the complications have changed with introduction of newer surgical techniques. Disconnection techniques of hemispherectomy leave as much of the brain in place as possible and thereby reduce complications associated with anatomical resections.

Methods. We reviewed the complications encountered in our series of 55 children who underwent disconnection hemispherectomy performed at Montreal, Milan, Veltre and Lausanne. Classical functional hemispherectomy was performed in 17 white peri-insular hemispherectomy was done in 38. The population's mean age was 7.2 years and included 29 males and 26 females.

The etiologies varied between acquired and congenital causes.

Results. After a median follow up of 8 years the seizure outcome was Engel's Class I in 43, Class II in 3 and Class IV in 3, unknown in 6. Complications encountered were death (0.6%), hydrocephalus (5%), infection (1.8%), and remote hemorrhage (1.9%). There were no significant differences in the rate of complications between the two techniques in this series. There were no long-term complications in this series and the rate of hydrocephalus was significantly lower than other techniques of hemispherectomy reported.

Conclusion. Complications in hemispherectomy are rare, and seizure outcome of this surgery offers excellent outcomes in over 85% of the patients. With introduction of disconnection techniques of hemispherectomy, superficial cerebral haemorrhage is no longer a complication and the rate of hydrocephalus has also significantly reduced following these functional techniques. We were not able to show a relation between etiology and complications.
112. Withdrawn

113. “Cookie Craniotomy” for Acute Subdural Empyema
Yoon S. Hahn, MD, FACS; Mary Ann Collins, MD; Tamor Hendryshkewy, MD; Laura Burkas, RN, MS, RNCP (Chicago, IL)
Page 47

114. Cranial Expansion Based on an Occipital Bandeau
Lenwood P. Smith, Jr., MD, FA; Jean-Francois Letavie, MD, FRSCS (Columbia, SC)
Page 47

115. Cerebral Aqueductoplasty through a Foramen Magnun Trans-Fourth Ventricle Approach
Jason Sansone, BS, Bermana J. Iskander, MD (Madison, WI)
Page 47

116. Endoscopic Management of Quadrigeminal Cistern Arachnoid Cysts
Sean M. Lee, MD; Rick Abbott, MD (New York, NY)
Page 48

117. Intracerebral and Extracerebral Water Imaging of the Brain Using Diffusion Resonance Imaging
Shinya Yamada, MD Kanagawa, Japan; Tsuyoshi Metaka, Minoo Hiro; Youichiro Sugiyama, Tokyo, Japan; Stefan Blum, PhD, J. Gordon McCorm, MD Los Angeles, CA
Page 48

118. Normal Data of Quantitative Pupillometry in Children
Atasoy N. Fourtan, MD, PhD, Carlos H. Feles, MD, Vassiliki G. Dypnopoulos, MD; Christopher E. Tropp, MD (Abecon, GA)
Page 48

119. Spectral Analysis of Modulation of CSF Flow Dynamics Using Echo Planar Imaging
Michael R. Grogan, MD; Mark Waghul, PhD; Lu Zhang, MD; Rafael Davis, MD (Story Brook, NY)
Page 49

120. Percutaneous Needle Aspiration of Intracranial Hematomas in Neonates
Ming L. Zheng, MD; Tiffany G. Johnson, BS; Ann M. Ritter, MD (Chapel Hill, NC)
Page 49

121. Resection of Human Tail Fused by Rapid Neurologic Deterioration: Case Report with Comparison Cases
Corbett Wilkinson, MD (Morgantown, WV); Robert F. Kaeling, MD (Washington, DC)
Page 50

122. Late Presenting Shunt Infections
Petti L. Biehler, MD, RN; John Lopez, MD; Ken R. Winston, MD; Michael H. Handler, MD (Denver, CO)
Page 50

123. Transverse-Sigmoid Sinus Flow Following Posterior Fossa Cranioitomies
Julius Fernandez, MD (Memphis, TN); Julian Liu, MD (Phoenix, AZ); Frederick Boop, MD; Robert Sanford, MD (Memphis, TN)
Page 50

124. Management of a Giant Varix Associated with an Arteriovenous Fistula in an Infant
Paul Kim, MD, MPH; Richard Anderson, MD; Douglas Brockmeyer, MD (Salt Lake City, UT)
Page 50

125. Intrathecal Baclofen Pump Implantation in Children with Posterior Spinal Fusions with Rod Instrumentation
Albert E. Telfer, MD, MD; Jordan C. Celui (Philadelphia, PA)
Page 50

126. Traumatic Dural Arteriovenous Fistula
Michael Vassilakos, MD, FRSCS (Ontario, CA, Canada)
Page 50

127. The Use of Norian Cranikast for Pediatric Skull Defects: A Case Series and Review of the Literature
Nicholas M. Wielage, MD (Rochester, MN)
Page 50

128. Time Trends and Demographics of Deaths from Hydrocephalus in US Children
John Chl, MD, MPH; Heather Fullerton, MD; Nahin Gupta, MD, PhD (San Francisco, CA)
Page 51

129. Ventriculouagal Shunting for Hydrocephalus: Where is it Useful?
Jeffrey M. Tomlin, MD; Howard J.S. Sobieski, MD, FACS (Rochester, NY)
Page 51

130. Surgical Management of Aneurysmal Bone Cysts in the Pediatric Spine
James K. Liu, MD; Marlon L. Walker, MD; John R. W. Kester, MD, MSc; Douglas J. Brodbelt, MD (Salt Lake City, UT)
Page 51

131. Sagittal Synostosis: Current Evaluation and Treatment
Paul T. Boulus, MD; John A. Jane, Jr., MD; John A. Jane, Jr., MD, PhD (Charlottesville, VA)
Page 51

112. Withdrawn

113. “Cookie Craniotomy” for Acute Subdural Empyema
Yoon S. Hahn, MD, FACS; Mary Ann Collins, MD; Tamor Hendryshkewy, MD; Laura Burkas, RN, MS, RNCP (Chicago, IL)
Page 52

114. Cranial Expansion Based on an Occipital Bandeau
Lenwood P. Smith, Jr., MD, FA; Jean-Francois Letavie, MD, FRSCS (Columbia, SC)
Page 52

Introduction: Cranioexpansion is an infra-sphenoid procedure in a craniofacial practice. We describe our experience with three children who underwent a cranioexpansion based on occipital and sagittal bandeaux oriented at right angles.

Methods: Biparietal-occipital cranioexpansion is made leaving a mid sagittal graft. A three-centimeter wide occipital bandeau is cut from anterior to occiput. The bandeau is expanded in a transverse dimension by interposition of bone graft. The remaining occipital bone is cut with barrel stove osteotomies and off fratured. The bandeau is held with rigid fixation. The mid-sagittal strip is also expanded with an interposition graft. The occipital bandeau and the mid-sagittal strip provide a rigid scaffold on which the reshaped cranial bone flaps will be fixed.

Results: Three patients were treated. One male six years old had situs inversus syndrome. A two year old female had Crohn’s syndrome and intracranial hypertension. Another two-year-old female had multiple suture hypoplasia and anterior and posterior procedures at two sites. There were no complications. Head circumference enlargements were 15, 25, and 25 millimeters, respectively. Follow-up is 34, 29 and 6 months respectively.

Conclusion: Compared to other techniques for expansion, this technique allows for the largest expansion, carries the least cosmetic risk, is quantifiable prior, is rigid and allows removal of any posterior midline keat that may be present. Our technique is similar to but different from procedures previously described by Sayler and another by Caron.

115. Cerebral Aqueductoplasty through a Foramen Magnun Trans-Fourth Ventricle Approach
Jason Sansone, BS, Bermana J. Iskander, MD (Madison, WI)
Page 52

Introduction: Advances in endoscopic technology have afforded new avenues in the treatment of hydrocephalus, rendering many patients surgically good candidates, and thus evening shifting complications and failure. Cerebral aqueductoplasty has been popularized as an effective treatment for memiona and short stenoses of the aqueduct of Sylvius. Traditionally, the procedure has been performed in a similar approach to third ventriculostomy, whereby the endoscope enters paraclinically near the corona sulci, then descends through the lateral ventricle, fornix of Morio, and third ventricle, onto the aqueduct. We report the success of a novel technique for this operation, in which we utilize a suboccipital foramen magnum trans-fourth ventricle approach.

Methods: A retrospective chart review was performed to document the success of eight central aqueductoplasties, utilizing the foramen magnum trans-fourth ventricle approach, for treatment of obstructive hydrocephalus caused by membranous or short stenosis of the cerebral aqueduct.

Results: Five patients underwent eight central aqueductoplasties. There were no surgical complications. At an average of 8.7 weeks post-operative follow-up, all patients demonstrated resolution of preoperative symptoms, and all patients reported mild transient diplopia. One patient developed recurrent stenosis of the aqueduct tract, requiring the placement of another stent through the same approach.

Conclusion: Performing cerebral aqueductoplasty via the foramen magnum trans-fourth ventricle approach is both effective and safe. We advocate the use of this technique in select cases of obstructive hydrocephalus caused by membranous or short stenoses of the cerebral aqueduct.
116. Endoscopic Management of Quadrigeminal Cistern Arachnoid Cysts
Sean M. Lewis, MD, Rick Abbott, MD

Introduction: Quadrigeminal plate arachnoid cysts are relatively rare. Arachnoid cysts in this location typically cause obstructive hydrocephalus. Symptoms can also arise from direct compression on the tectum. Cysts in this location have been managed with shunting and open surgical fenestration with or without endoscopic assistance. However, the optimal management of symptomatic quadrigeminal plate arachnoid cysts remains unclear.

Methods: We reviewed the results of 4 patients treated endoscopically at our institution for symptomatic quadrigeminal plate arachnoid cysts associated with hydrocephalus.

Results: Patients aged ranged from 6 months to 18 years. All patients were treated endoscopically with both a third ventriculostomy and a ventriculocisternostomy. The mean follow-up period was 5 years. Two of the four patients experienced both radiographic improvement and symptomatic resolution after surgery and remain shunt-free. One patient required a redo ventriculocisternostomy 9 months after his initial surgery and his cyst has done well and remains symptom-free. One patient experienced closure of both his third ventriculocisternostomy as well as the ventriculocysternal stoma, despite repeat attempts at both endoscopic and open fenestrations. She ultimately had surgery and her cyst has done well with this management. There were no complications related to surgery.

Conclusion: Combined endoscopic third ventriculostomy and ventriculocisternostomy is an acceptable treatment modality for quadrigeminal plate arachnoid cysts with associated hydrocephalus. Treatment in this manner can often be open surgery and shunt-dependency.

117. Intracerebral and Extracellular Water Imaging of the Brain Using Magnetic Resonance Imaging
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Introduction: Previous studies indicate that the extra- and intra-cellular spaces in the brain can be calculated by magnetic resonance imaging (MRI) using proton relaxation time sequences. Brain imaging of intracellular and extra-cellular compartments would provide useful clinical information of the normal brain as well as altered states such as brain edema.

Methods: Volunteer human subjects were used as normal controls while patients with hydrocephalus, brain tumors, and cerebral infarctions were examined as pathological states. GE 1.5 Sign MP scanner with a head coil was used for all studies. A double-echo 12 echo decay of the water signal in the brain was generated from the multi-component T2 values. The early phase of T2 decay was considered to be intra-cellular component of water while the late phase of T2 decay was considered to be an extra-cellular component of water. Intracellular and extracellular images were created by T2 CALEP soft ware (Tokyo GE Yokawa Medical).

Results: Extracellular and intra-cellular spaces of the normal brain subjects were visualized by analyzing the proton relaxation times using these sequences. The extra-cellular space comprised 10-30% of white matter depending on the location within the brain. The extra-cellular space was 5-20% within the cortex. Extracellular spaces were enlarged in the periventricular region when hydrocephalus was present. Intra-cellular spaces were increased in the region of cerebral infarction and adjacent to brain tumors.

Conclusion: Extra-cellular and intra-cellular water compartments were separable and can be imaged in normal and pathological conditions.

118. Normal Data of Quantitative Pulpimetry in Children
Koichi N. Fountas, MD, PhD, Carlos H. Feliciano, MD, Spiro V. Dimopoulous, MD, Christopher E. Traup, MD (Macon, GA)

Introduction: The random variation in the intraoral pressure by using non-invasive methods has become an increasingly utilized clinical modality. The recent employment of quantitative pulpometry in adult patients diagnosed with sub-ependymal hemorrhage or severe closed head injuries, confirmed the existence of a close relationship between the intrapulpal pressure and the pulpyrinal constriction velocity. The purpose of this study was to define the normal variation of the pulpyrinal reaction velocity in normal pediatric volunteers.

Methods: In a clinical prospective study, 240 healthy volunteers were examined under a variety of ambient light conditions. Their ages ranged between 0.5 and 16 years and their mean age was 6.3 years. A total of 720 paired measurements were obtained by using a quantitative pulpimeter (Forosita, NeuroOptions; Irvine, CA). The duration of each paired measurement ranged between 1.2 and 3.1 min (mean 2.2 min). The procedure was well tolerated by all children.

Results: In our series the minimum aperture ranged between 1.9 and 3.3 mm (mean 2.2 mm). The maximum aperture ranged between 37 and 4.8 mm (mean 4.4 mm). The reduction in size ranged between 32 and 43% (mean 38%). The range of the measured constriction velocity was between 1.08 and 5.77 mm/sec (mean 1.86 mm/sec). Finally, the latency duration ranged between 0.17 and 0.24 sec (mean 0.21 sec).

Conclusion: The quantitative pulpometry appears to be a promising non-invasive indirect intra-oral pressure monitoring modality which is feasible and highly applicable to pediatric patients. An extensive normal database needs to be established before the clinical application of this method in pediatric patients with various pathological entities.

119. Spectral Analysis of Modulation of CSF Flow Dynamics Using Echo Planar Imaging
Michael R. Eggin, MD, Mark Wagshal, PhD, Li Zheng, PhD, Raphael Davis, MD (Stony Brook, NY)

Introduction: Echoplanar Imaging (EPI) permits an entirely new group of components of CSF and blood flow that are of lower frequency than the heart rate, such as respiratory components. However, because EPI cannot distinguish flow direction and spectral resolution is degraded by variations in heartbeat rate, the reliability of spatial analysis has been questioned.

Methods: Seventeen healthy volunteers underwent imaging of intracranial CSF and blood flow. A correction algorithm was applied to the data to reveal spectral features, which may be obscured by heart rate variation. In addition, we simulated the EPI signals in Matlab to assess the effect of rectification.

Results: Discrete sidebands associated with the respiratory component were present in all subjects at the cardiac frequency, but some of this power was associated with independent components not related to phase modulation flow component and not with the modulation flow component. Both the asymmetry of the respiratory component and the rectification associated with EPI played a role in the sideband artifact. Seventy-four percent of the respiratory induced amplitude was associated with the sidebands. Because of the complexity of the EPI waveform, it was not possible to distinguish flow amplitude due to modulation from flow amplitude due to respiration.

Conclusion: Respiration can have a large effect on CSF and blood flow patterns. Unfortunately, EPI produces coupling between all the components in the spectrum, and respiratory features will appear in multiple spectral positions. Our future work will focus on overcoming the rectification issue and applying spectral analysis to the study of hydrocephalus.

120. Percutaneous Needle Aspiration of Intracranial Hematomas in Neonates
Ming L. Chang, MD, Tiffany G. Johnson, RS, Amy M. Ritter, MD, MPH (Phoenix, AZ); N.C. Introduction: Intracranial hematomas in newborns are rare. Operative evacuation in this fragile population is fraught with difficulties, including anesthesia, coagulopathy, hypothermia, hemodynamic instability and technically challenging brain congestion. Few reports of percutaneous hematoma aspiration are available in the literature. With this report, we present our recent experience with the percutaneous aspiration via transcutaneous approach as a first line treatment of intracranial hematomas in neonates. We also present the previously unreported aspiration of an intraparenchymal hematoma via direct skull puncture. A rare entity, acute subdural hematoma associated with cerebral infection, is also presented.

Methods: Percutaneous needle aspiration was performed 8 times in 4 successive neonates with an intraparenchymal hematoma and acute subdural hematomas. These neonates had intracranial hemorrhage causing mass effect, midline shift and neurological deficit. Either the coronal or lambdoid suture was accessed, in one case the temporal bone was directly punctured. Results: Liquid blood, net clot, was encountered during each procedure. CT scan showed high-density hemorrhage. Near complete aspiration of hemorrhage was evidenced in 2 of 4 cases. In the remaining cases, approximately half of the estimated hematoma volume was removed. No patient required follow-up craniotomy, or developed seizures, infection, chronic fluid collection, or cortical damage at the aspiration site. Conclusion: Fresh intracranial hematoma with CT DCA, including intraparenchymal hematoma, can be aspirated through open sutures or by direct skull puncture in infants. This technique is not associated with complications in our series, and may be an alternative to craniotomy in the treatment of acute intracranial hematomas.

121. Resection of Human Tail Fueled by Rapid Neurologic Determination: Case Report with Comparison Cases
C. A. Piears, MD (Morgantown, WV); Robert F. Koening, MD (Washington, D.C)

Introduction: Fifty percent of human tails are associated with spinal lipomas and other anomalies. However, many are treated solely for cosmetic reasons. We present an infant with a tail, spinal lipoma, and tethered cord who underwent rapid neurologic deterioration after simple resection of his tail. We present two other infants with tails, tethered cords and other anomalies who underwent tail resection concurrently with exploration and release of tethered cords. A fourth patient is awaiting surgery.

Methods: Medical records, radiologic studies, and photographs of four infants with tails are reviewed with respect to presentation, surgery, and outcome.

Results: The first patient had a soft, skin-covered tail dependent from a lumbar spinal lipoma. When two days old the patient was noted to have loss of function of his tail, with tethered cord release and lipoma resection planned for the future. Over the ensuing weeks he developed low extremity weakness and sensory loss on diminished rectal tone. He underwent evaluation which revealed intracranial and tethered cord release twice, at five weeks and four months, and is now neurologically improving. The other three patients with tails, plus lipomas, and/or tethered cords are presented. Two had their tails resected concurrently with lipoma resection and/or tethered cord release. The other is awaiting surgery. None of these patients have had any bowel, bladder, or lower extremity deficits.

Conclusion: Resection of human tails without addressing underlying spinal anomalies and tethering can lead to neuralgia. We recommend that all patients with tails, spinal anomalies, and tethering undergo resection of the tail concurrently with exploration and tethered cord release.
123. Transverse-Sigmoid Sinus Flow Following Posterior Fossa Craniorrhotomies
Julius Fernandez, MD (Memphis, TN); Julien L.H. MD (Peoria, IL); Fred Lantingham, MD; Frederick Bosp, MD; Robert Sanford, MD (Memphis, TN) Introductions
Dural sinus thrombosis is a potential complication following posterior fossa craniorrhrotomies rarely described in the literature, especially in the pediatric population.

Backgrounds
Over the past three years, we have operated on 143 children with posterior fossa tumors. We present two patients with slow flow and two patients with thromboses of the transverse-sigmoid sinuses (TSS) following resection or recurrent tumor resections.

Patients and Methods
Two children presented with malocclusion and any patient with cystic epidermoids were excluded. One of the four patients received mannitol during surgery, but none were diagnosed during their clinical course. Two patients were diagnosed on routine post-operative MRIs and CTs while two patients were diagnosed after shunt revisions failed to improve the vertebrocutaneous flow. Slow flow in the sinus was suspected with MRI showing hypointensity on T1WI and absence of flow on MRA while CT failed to show acute clot in the sinus. One child with TSS thrombosis was treated with aspirin but then developed thrombocytopathy and bilateral SDH while undergoing chemotherapy. One child with TSS thrombosis was not treated due to rapid tumor progression that eventually led to his death two months after surgery.

Conclusions
Although very uncommon, slow flow in the TSS may lead to sinus thrombosis following posterior fossa craniorrhrotomies. The pathophysiology of the entity is unknown but may be related to hypercoagulable states, intracranial hypertension, bone exposure of the sinuses, and/or manipulation near venous structures.

124. Management of a Giant Varix Associated with Arteriovenous Fistula in an Infant
Paul Klimo, MD, MPH; Richard Amidjian, MD; Douglas Blockermyer, MD (Salt Lake City, UT)

Introduction
Arteriovenous fistulae are rare disorders. Most are associated with the vein of Galen. We present a case of an otherwise healthy 2-month-old male with an incidentally discovered giant varix of the right middle cerebral artery associated with an arteriovenous fistula. The management required both endovascular and surgical intervention.

Methods
Case report with emphasis on the management of this congenital vascular anomaly.

Results
The varix measured 3cm and filled the anterior portion of the middle fossa. It was fed by multiple arterial feeders coming off the M1 portion of the right MCA. Its drainage was primarily to the Galenic system, but it also had some superficial drainage to the superior sagittal sinus. Transarterial embolization of several of the arterial feeders to the varix was first performed resulting in significantly less flow. A frontotemporal craniotomy was then performed. The arterial feeders were isolated and ligated followed by the venous outflow. The varix was then freed from the surrounding structures and completely excised. The patient did suffer a right MCA stroke after the embolization with resultant left upper extremity monoparesis. His postoperative course has been otherwise unremarkable.

Conclusion
As with vein of Galen aneurysms, this unique congenital arteriovenous fistula with a giant varix required a multidisciplinary approach. Careful preoperative anatomic assessment of the lesion and embolization is necessary to achieve a successful surgical outcome.

125. Intracerebral Basal Ganglia Fistulae in Children with Posterior Fossa Sutures with Rod Instrumentation
Albert E. Taft, MD, Juanita Celiux (Philadelphia, PA)

Introduction
Surgical treatment of intracranial arteriovenous fistulae is rare in children. The authors report two cases of intracranial arteriovenous fistulae in young infants that presented with seizures and hemiparesis.

Methods
The medical charts and radiographs were reviewed in this IRB approved study.

Results
The study group included 6 female and 10 male patients, among whom were 14 quadruplips and 2 diplegias. The mean age at surgery was 13.2 years of the 16 patients, 2 underwent posterior fossa spinal fusion. Patient satisfaction was evaluated by application of Ashworth scores. The most common postoperative complications were sereomas around the pure (13%) CSF leaks around the catheter (6%), and catheter migration (6%). Revisions were performed in 3 cases for pumps implanted at other centers for catheter disconnections or inadequate placement. Prior to implantation each patient underwent a trial injection of intrathecal baclofen. For the cases with posterior fusion, the trial injection was skipped and the pump implanted. There were no complications for fusion cases. Implantation of intrathecal baclofen pumps in children with cerebral palsy (CP) and posterior fusion was done without an intrathecal trial injection, performed after a fine cut lumbar CT with sagittal and coronal reconstructions, and performed with a parallelwire trajectory for the intrathecal implantation to avoid posterior instrumentation. A high-speed drill was used to make a 5 mm channel in the bone fusion to expose dura. Conclusion
Posterior spinal fusion in children with cerebral palsy should not be a contraindication for baclofen pump placement.

126. Traumatic Dural Arteriovenous Fistula
Michael Klassy, MD, FRSCS (Ottawa, ON, Canada)

Introduction
Dural arteriovenous fistulae are uncommon, and extremely rare in children.
Methods
A 12-year-old boy fell off his bicycle and sustained a right temporal-parietal skull fracture associated with an underlying epidural hematoma, which did not require surgery, and a contre-coup left parietal contusion. A right temporal bruist was identified on regular follow-up six weeks later. Brain MRI/MRA and cerebral angiography showed a large high-flow disurban fistula between the right middle meningeal artery and the sigmoid sinus.

Results
Endovascular coiling and embolization were unsuccessful. A right temporal-parietal craniectomy was performed and the dural-based fistula excised. The patient remains neurologically intact with no headaches or bruist.

Conclusion
Trauma can induce the formation of a dural arteriovenous fistula via a Type II venous anomaly. This promotes the growth of dural arteries, which progressively hypertrophy. The aggressive nature of an arteriovenous fistula depends on the presence of cortical venous drainage. Surgery, endovascular techniques, as well as Gamma Knife radiosurgery have been utilized to treat these fistulae. Arteriovenous fistulae are considered benign when there is no cortical venous drainage; these lesions uncommonly progress, and management may be conservative unless there are intolerable symptoms.

127. The Use of Norian Cranioplasty for Pediatric Skull Defects: A Case Series and Review of the Literature
Nicholas M. Verban, MD (Rockford, MN)

Introduction
Surgeons who perform pediatric craniofacial reconstruction have been searching for the ideal bone substitute for years. Methyllmethacrylate has been used for over a decade but has a significant complication rate in the pedi atric population. Autogenous tissue is an ideal local replacement but has specific donor site complications. Recently, the innovation of hydroxyapatite cements such as Norian CRS has provided significant options in pediatric craniofacial reconstruction.
Methods
Pre and post-operative imaging studies, intraoperative findings with photographs, and clinical follow-up were reviewed.

Results
We have reviewed our first 10 cases of bone replacement using Norian CRS in children and present our results here. All of the patients had hearing defect that resulted from a congenital condition (10%) or trauma (30%). Patients were followed up after their surgery until age 1 year with clinical exams and CT scans to evaluate their functional and cosmetic outcomes. Follow-up ranged from 6 months to 34 months (average 23 months).

Conclusion
Hydroxyapatite cements such as Norian CRS appears on early review to be useful in the treatment of pediatric craniofacial defects. Norton has the added advantages of 1) row x ray diffraction spectra similar to bone, 2) endothermic setting at body temperature, 3) compressive strengths equal to or greater than bone, 4) chemical bonds to bone that resist breakdown, 5) osteoconductive properties which may grow with the child and, theoretically, 6) resistance to long-term infection. The only complication which we found in our patients was early resorption of the substitute.
poster abstracts

128. Time Trends and Demographics of Deaths from Hydrocephalus in U.S. Children
John Chin, MD, MPH; Heather Fullerton, MD; Nair Gupta, MD, MPH (San Francisco, CA)

Introduction: Congenital hydrocephalus (CHP) has an estimated population incidence of 3/100,000 live births. With improvements in techniques for CSF shunting, treatment of hydrocephalus has become safe and routine. However, there is little data describing mortality from congenital CHP or demonstrating improvements in mortality with modern treatment.

Methods: We performed an electronic search of National Center for Health Statistics death certificate databases to identify deaths attributed to congenital CHP, spina bifida with CHP, and communicating CHP in U.S. children aged 1 day to 24 years of age from 1979-1998. Mortality rates were defined as deaths per 100,000 person-years, and compared for differences based on age, race, gender and year.

Results: From 1979 to 1998, mortality from congenital CHP declined 66%, spina bifida with CHP by 85%, and communicating CHP by 92%. Mortality rates were highest in infants. While mortality rates from congenital CHP and CHP with spina bifida were similar among infant girls, infant boys had higher mortality rates from congenital CHP compared to CHP with spina bifida (0.1 per 100,000 person-years v. 1.0 per 100,000 person-years). Compared to white infants, black infants had higher mortality rates for congenital CHP and communicating CHP, but not for CHP with spina bifida. In black infants, mortality rates were 0.3 for blacks v. 0.8 white in congenital CHP, 0.6 for blacks v. 0.8 for whites in CHP with spina bifida.

Conclusion: Mortality from congenital CHP has declined in US children over the last 20 years although male gender and black race seem to be associated with a higher mortality in infants.

129. Ventriculocerebral Shunting for Hydrocephalus: Where is It Useful?
Jeffrey M. Tomlin, MD; Howard J.S. Silberstein, MD, FAAC (Rochester, NY)

Introduction: Ventriculocerebral (VCS) shunts have been utilized in the low birth weight infant with hydrocephalus (HCP) as an alternative to ventriculoperitoneal or serial percutaneous ventricular tapping, thus temporizing the patient for weeks to months before conversion to VP shunting. We report a lower infection rate in this otherwise high infection risk group of patients in comparison to published series.

Methods: From July 01 to June 2003, six premature infants with CHP at our institution were initially managed with VCS shunting. Three cases were for CPH secondary to intraventricular hemorrhage, two were for CPH associated with myelomeningocele and the remaining case was for aqueductal stenosis.

Results: No shunt-related infections were observed in any of the six patients. Two patients had evidence of clinically insignificant intraventricular hemorrhage. Patients returned an average of 13 weeks for revision of the VCS to a formal VP shunt. Within the group of infants with myelomeningocele, one had the VPS placed when the VSG failed due to catheter migration from the ventricle into the subgaleal space. The second child has not yet required conversion to a VPS at eight months. In this patient, the subgaleal collection gradually resolved over the initial four months while the ventricular size has remained the same on serial CT imaging, and the child has remained asymptomatic.

Conclusion: Ventriculocerebral shunting is a safe and effective initial management option for low birth weight infants with a variety of etiologies for hydrocephalus. Additionally, it may be a long term alternative for children with myelomeningocele and thus prolonging the need for ventriculoperitoneal shunting.

130. Surgical Management of Aneurysmal Bone Cysts in the Pediatric Spine
James K. Liu, MD; Marcia W. Walker, MD; John J.W. Kondziolka, MD; MSIC; Douglas L. Brockmeyer, MD (Salt Lake City, UT)

Introduction: Aneurysmal bone cysts (ABCs) of the spinal column are uncommon in the pediatric population. We report our surgical experience, describe our embolization techniques, and discuss strategies for managing post-resection spinal instability.

Methods: A retrospective review was conducted on 6 patients diagnosed with a spinal column ABC from 1994 to 2003 at our institution. Clinic notes, preoperative and postoperative radiographs, embolization and operative reports were reviewed for each patient.

Results: There were 5 females and 1 male with a mean age of 8.8 years (range: 3-14). Two lesions were located in the cervical spine, 2 were in the thoracic spine, and 2 were in the lumbar spine. Local pain was the most common presentation (100%), followed by weakness (60%), radiculopathy (33%), myelopathy (33%), ataxia (33%), and urinary incontinence (20%). Five patients underwent preoperative embolization. All patients underwent gross or near total resection of their lesions. The average blood loss was 429 cc (range: 100-1100). Spinal instability was managed in a stepwise fashion. One patient underwent intraspinous fusion, 1 underwent delayed fusion, 2 were managed with external orthoses, and 2 required no spinal support. There were no recurrences after a mean follow-up of 44 months (range: 2-105 months).

Conclusion: Surgical resection of spinal ABCs is the optimal method for neural decompression and local control. Preoperative embolization is a useful adjunct for reducing tumor vascularity and intraoperative blood loss. Spinal instability can be managed with a stepwise approach. Long-term follow-up is critical to detect surgically-induced instability or lesion recurrence.

131. Sagittal Synostosis: Current Evaluation and Treatment
Paul T. Boulton, MD; John A. Jane Jr., MD; John A. Jane, MD, PhD (Sandusky, VA)

Introduction: Craniosynostosis occurs at a rate of 1 in 2,500 live births. 40-60% are sagittal. A multitude of complications occur resulting in scaphocephaly, fronto-basal bossing, the occipital knob, the galea dehiscency, or Unni-Roach cephalohy. We have simplified the diagnosis to 3 basic varieties: equal anterior and posterior compensation, frontal bossing and occipital bossing. Similarly, our operative approach has been standardized. This is the subject of our presentation.

Methods: We examined the evolution of our techniques for correction of each variant of sagittal synostosis.

Results: To perform our current technique the patient is supine for the anterior variant, and prone for the posterior variant. A bicoronal incision is used. Buci holes are made on each side of the sagittal suture at the level of the coronal and lambdoid sutures. The dura is dissected free. The sagittal suture is removed. This allows the width of the skull to be expanded and shortened utilizing absorbable plates. If there is frontal bossing, a bifrontal craniotomy is performed, and the bone is remodeled utilizing rib benders and barrel staves. If the bossing is severe, the dura may be plicated. If there are occipital dermoids, an occipital craniotomy to the level of the torcular is used to mobilize and reshape the bone. Care should be taken of the dural venous sinuses, pre-operative CT venogram is helpful.

Conclusion: Our current technique is an effective, safe method for correcting the deformities associated with sagittal synostosis. It is a good alternative to the simple strip craniectomy, and placement of a head molding device.
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