san francisco 2004

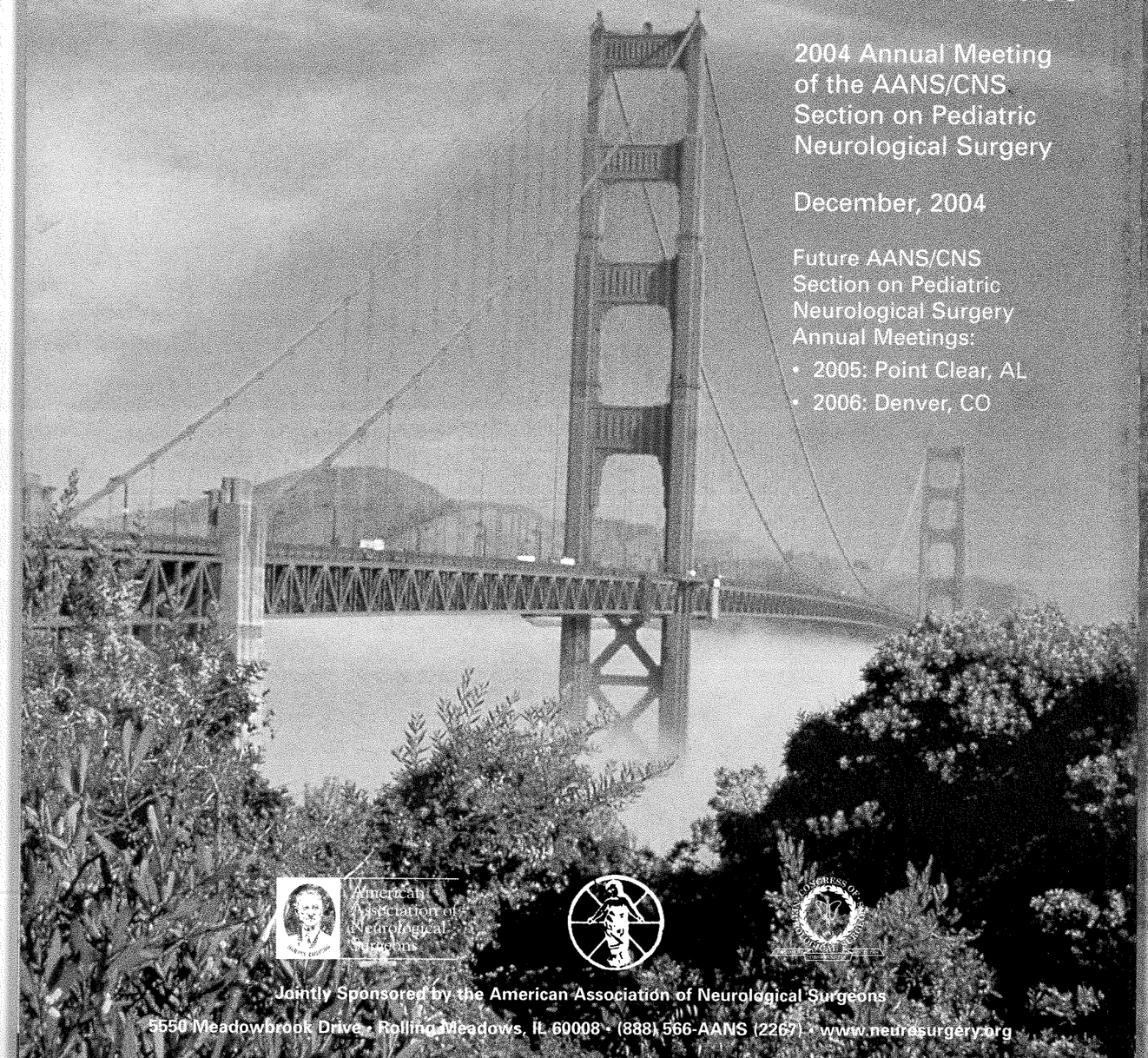
save the date

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



American Association of Neurological Surgeons

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Flannery

The 32nd Annual Meeting of the AANS/CNS
Section on

pediatric

Neurological Surgery

rogram book

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

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American Association of Neurological Surgeons

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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 Essentials 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 Neurological 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

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table of contents

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

officers and standing committees

pediatric section chairs

1972–73 Robert L. McLaurin
1973–74 M. Peter Sayers
1974–75 Frank Anderson
1975–76 Kenneth Shulman
1976–77 E. Bruce Hendrick
1977–78 Frank Nulsen
1978–79 Luis Schut
1979–81 Fred J. Epstein
1981–83 Joan L. Venes
1983–85 Harold J. Hoffman
1985–87 William R. Cheek
1987–89 David G. McLone
1989–91 Donald H. Reigel
1991–93 R. Michael Scott
1993–95 Arthur Marlin
1995–97 Harold L. Rekate
1997–99 Marion L. Walker
1999–01 John P. Laurent
2001–03 Thomas G. Luerssen
2003–05 Andrew D. Parent

officers

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

executive committee

Members at Large (two-year terms) ..... Bruce A. Kaufman, MD (2003–2005)
Frederick A. Boop, MD (2003–2004)
Alan R. Cohen, MD (2002–2004)

standing committees

Nominating Committee ..... Marion L. Walker, MD (1999)
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. Krieger, MD (2003–2005)
Roger Hudgins, MD (2003–2005)

Program and Continuing Education Committee ..... Chair: Ann Marie Flannery, MD, FACS, FA (2003–2005)
Vice Chair: Joseph R. Madsen, MD (2002–2004)
Ex Officios: 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 Oakes, MD
2006: Michael H. Handler, MD

ad hoc committees

Traveling 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 ..... Harold L. Rekate, MD

Liaison to the American Academy of Pediatrics ..... Joseph H. Piatt, Jr., MD

Liaison to the Joint Council of State Neurosurgical Societies ..... Michael Heafner, MD

Representative to AANS Executive Committee ..... Thomas G. Luerssen, MD

Representatives to CNS Executive Committee ..... Andrew D. Parent, MD
Rick Abbott, MD

Representative to the Quality Assurance Committee ..... Chair: Paul A. Grabb, MD

Representative to the Washington Committee ..... Thomas G. Luerssen, MD

Representative to the Neurological Surgery Political Action Committee ..... Michael Medlock, MD

Representatives to the Outcomes Committee ..... Bruce A. Kaufman, MD
John R.W. Kestle, MD, MSc

Representative to ISPN ..... 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 Kaveler 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 (Mormons) 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. Bucy
1980 Floyd Gilles
1981 Panel Discussion
1982 Panel Discussion
1983 Derek Harwood-Nash
1984 Anthony E. Gallo, Jr.
1985 Frank Nulsen
1986 William F. Meacham
1987 Dale Johnson
1988 Joseph J. Volpe
1989 Martin Eichelberger
1990 George R. Leopold
1991 Judah Folkman
1992 Olof Flodmark
1993 Maurice Albin
1994 Blaise F.D. Bourgeois
1995 Robert H. Pudenz
1996 Samuel S. Flint
1997 M. Michael Cohen, Jr.
1998 Robert A. Zimmerman
1999 David B. Schurtleff
2000 Steve Berman
2001 Alejandro Berenstein
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 Guillemin
1991 Robert L. McLaurin
1992 Joseph Murray
1993 Eben Alexander, Jr.
1994 Joseph Ranschoff
1995 John Holter
1996 None
1997 Maurice Choux
1998 Lisa Shut
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. DELBIGIO 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 Cord as a Cause of Scoliosis in Children with a Myelomeningocele

1990 CHRISTOPHER D. HEFFNER Basilar Pons Attracts its Cortical Innervation by Chemotropic Induction of Collateral Branch Formation

1991 P. 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. WEHBY Metabolic Demonstration of Retained CNS Function in the Rabbit Model of Infantile Hydrocephalus

1994 ELLEN SHAVER Experimental Acute Subdural Hemotoma in Infant Piglets

1995 SEYED M. EMADIAN Correlation of Chromosome 17p Loss with Clinical Outcome in Patients with Primitive Neuroectodermal Tumors

1996 JOHN PARK Platelet Derived Growth Factor Induces Differentiation of Neuroepithelial Stem Cells into Neurons

1997 MICHAEL J. DREWEK 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. BULSARA Novel Findings in the Development of the Normal and Tethered Filum Terminale

2001 DAVID I. SANDBERG Convection Enhanced Delivery into the Rat Brain Stem: A Potential Delivery for the Treatment of Diffuse Pontine Gliomas

2002 DAVID ADAMSON Mechanisms of Reclosure in 2 Surgical Models of Myelomeningocele 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 NESHER G. ASNER Venous Sinus Occlusion and Ventriculomegaly in Craniectomized Rabbits

1992 MARCIA DASILVA 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. WEHBY-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

1998 DANIEL LIEBERMAN In Vetro Detection of Fluid Flow in Ventriculoperitoncal Shunts (VPS) Using Contrast Enhanced Ultrasound

1999 KIMBERLY BINGAMAN 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 MEDOW Quick Brain MRI vs. CT Scan for Evaluating Shunted Hydrocephalus

2002 JONATHAN MILLER Abberant Neuronal Development in Hydrocephalus

2003 TO BE ANNOUNCED

program schedule

tuesday, december 2

2:00–7:00 PM
Registration

Noon–5:00 PM
Advanced Coding Seminar
"Advanced Coding Strategies for Pediatric Neurological Surgeons"
Faculty: John G. Piper, MD

Upon completion of this course, participants should be able to:

1. Describe the 2003 CPT, ICD-9 and Medicare updates.
2. Choose the correct CPT code(s) for frequently performed pediatric neurosurgical 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 mutism, Chiari I, management of non-neurosurgical problems in myelomeningocele, and opthalmological evaluation. The seminar will conclude with a discussion on practice models.

2:00–6:00 PM
Poster Set-up for Medical 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 AM–5:00 PM
Registration

8:00–8:05 AM
Welcome and Opening Remarks

8:05–9:50 AM
SCIENTIFIC SESSION I
Hydrocephalus
Moderator: Bermans J. Iskandar, MD; David Douglas Cochrane, MD

Upon completion of this program, participants should be able to:

- Evaluate the effect of appropriate techniques in the evolving treatment of Hydrocephalus and the effect they have on the practice of pediatric neurosurgery.

8:06–8:19 AM
1. Endoscopic Third Ventriculostomy in Infants
   David Sacco, MD; Kenneth Shapiro, MD; Frederick Sklar, MD; Bradley Weprin, MD; Dale Swift, MD (Dallas, TX)

8:19–8:32 AM
2. Indication for Endoscopic Third Ventriculostomy (ETV) in Children with Posterior Fossa Tumors
   Michael J. Fritsch, MD (Kiel, Germany)

8:32–8:45 AM
3. Endoscopic Third Ventriculostomy for Hydrocephalus Secondary to Central Nervous System Infection or Intraventricular Hemorrhage in Children
   Matthew D. Smyth, MD (St. Louis, MO); R. Shane Tubbs, PhD, PA-C; John C. Wellons, III, MD; W. Jerry Oakes, MD; Jeffrey P. Blount, MD; Paul A. Grabb, MD (Birmingham, AL)

8:45–8:58 AM
4. Interpretation of Overnight Monitoring of ICP in Shunted Children—An Observational Study
   Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Sandeep Sood, MD; Steven D. Ham, DO; James McAllister, II, PhD (Detroit, MI); Zofia Czosnyka, PhD; Marek Czosnyka, PhD (Cambridge, United Kingdom)

8:58–9:11 AM
5. Non-invasive ICP and Compliance Monitoring to Detect Shunt Malfunction
   Jotham C. Manwaring, BS; Kim H. Manwaring, MD; Phoenix Children's Hospital (Phoenix, AZ); Brain Instrumentation Lab; Brigham Young University

9:11–9:24 AM
6. Serum and CSF C-Reactive Protein in Shunt Infection Management
   Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Kimberly Ostrowski, MS; Jau-Wen Chu, PhD; Emily J. Draper, BS; James P. McAllister II, PhD; Steven D. Ham, DO; Sandeep Sood, MD (Detroit, MI)

9:24–9:37 AM
7. Complications Associated with Ventriculo-Subgaleal Shunting
   Scott W. Soleau, MD; R. Shane Tubbs, PhD; Jason T. Banks, MD; Matthew D. Smyth, MD; John C. Wellons, MD; Jeffrey P. Blount, MD; Paul A. Grabb, MD; W. Jerry Oakes, MD (Birmingham, AL)

9:37–9:50 AM
8. Noninvasive MRI Phase Contrast Flow Studies: Determination of Raised ICP and Shunt Malfunction in Hydrocephalus
   Roberta P. Glick, MD; Terry Lichtor, MD, PhD; Noam Alperin, MD; Patricia Raksin, MD; Anusha Sivaramakrishnan; Sushma Surapaneni (Chicago, IL)

9:50–10:10
Beverage Break in Exhibit Hall with Exhibit & Poster Viewing

10:10–11:15 AM
SCIENTIFIC SESSION II
Tumors I
Moderators: Jeffrey H. Wisoff, MD; Ian F. Pollack, MD

Upon completion of this program, participants should be able to:

- Review the treatment and outcome of common and uncommon brain tumors.

10:10–10:23 AM
9. Resection of Pediatric Brain Tumors in the United States, 1988–2000: Progressive Centralization and Specialization of Care
   Edward R. Smith, MD; William E. Butler, MD; Fred G. Barker, MD (Boston, MA)

10:23–10:36 AM
10. The Association Between Tumor Resection and Survival in Pediatric Anaplastic Astrocytomas
    Chirag D. Gandhi, MD (New York, NY); Michael L. Chen, BA; Tien Nguyen, MD; Anthony Kim, MD; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

10:36–10:49 AM
11. Radiation-Induced Glioma Following Treatment of Primary Central Nervous System Neoplasms in Children
    Stephanie Greene, MD; Liliana C. Goumnerova, MD (Boston, MA)

10:49–11:02 AM
12. Management and Outcome of Choroid Plexus Carcinoma in the Very Young
    Saadi Ghatan, MD; Richard C. E. Anderson, MD; Mark M. Souweidane, MD; Neil A. Feldstein, MD, FACS (New York, NY)

11:02–11:15 AM
13. Cerebellar Mutism Syndrome (CMS) After Posterior Fossa Surgery: A Prospective Study of Two Large Cohorts of Medulloblastoma
    Karin M. Muraszko, MD; Patricia Robertson, MD (Ann Arbor, MI); Mark Dias, MD(Hershey, PA); Amar Gajjar, MD (Memphis, TN); Jeffrey Allen, MD (New York, NY); Roger Packer, MD (Washington, DC)

11:15–11:20 AM
Introduction of 2003 Raimondi Lecturer
Marion L. Walker, MD

11:20–11:50 AM
Raimondi Lecture
"The Building of a Global Business in Order to Fight Cancer"
Jon M. Huntsman, CEO of Huntsman, LLC, founder of the Huntsman Cancer Institute at the University of Utah
Moderator: Andrew D. Parent, MD

11:50–12:05 PM
Special Lecture
"Professional Liability: Dealing with the Crisis"
Stewart B. Dunsker, MD

12:05–1:15 PM
Lunch in the Exhibit Hall and Poster Viewing

1:15–2:10 PM
SCIENTIFIC SESSION III
Vascular
Moderators: R. Michael Scott, MD; Rick Abbott, MD

Upon completion of this program, participants should be able to:

- Discuss new information on vascular malformations and cerebral blood flow in children.

1:15–1:28 PM
14. Denovo Cavernous Angioma Formation in Children after Radiation for Intracranial Tumors
    Luis F. Rodriguez, MD; Patricia L. Robertson, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

1:28–1:41 PM
15. Supine vs. Upright Changes in Cerebral Blood Flow and ICP as Measured Non-invasively by MRI
    Thomas M. Moriarty, MD, PhD; Stephen Hushek, PhD (Louisville, KY); Noam Alperin, PhD (Chicago, IL)

1:41–1:54 PM
16. Management of Pediatric CNS Arteriovenous Malformations: The McGill Experience
    Jean-Pierre Farmer, MD, FRCS(C); Abdulrahman J. Sabbagh, MD (Montreal, PQ, Canada); Ayman Albanyan, MD, FRCS(C) (Riyadh, Saudi Arabia); Jose Montes, MD (Montreal, PQ, Canada)

1:54–2:07 PM
17. Thermal Imaging in Pediatric AVM Surgery
    Hal S. Meltzer, MD; Burak M. Ozgur, MD; Kevin Yu, MD; Henry Aryan, MD; Rahul Jandial, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

2:10–3:15 PM
SCIENTIFIC SESSION IV
Functional / Epilepsy
Moderators: John R.W. Kestle, MD, MSc; Frederick A. Boop, MD

Upon completion of this program, participants should be able to:

- Recognize appropriate surgery and complications of treatment in epilepsy and movement disorders in children.

2:10–2:23 PM
18. Functional Hemispherectomy for Epilepsy in Childhood—Institutional Experience
    Prithvi Narayan, MD; Ugur Isik, MD; Edwin Trevathan, MD, MPH; Robert T. Fitzgerald, MD, MPH; Susan T. Arnold, MD; Matthew D. Smyth, MD; Jeffrey R. Leonard, MD; Jeffrey G. Ojemann, MD; Tae Sung Park MD (St. Louis, MO)

2:23–2:36 PM
19. Complications of Hemispherectomy in Pediatric Epilepsy Surgery
    Sanjiv Bhatia, MD; John Ragheb, MD; Glen Morrison, MD; Michael Duchowny, MD; Trevor Resnick, MD; Prasanna Jayakar, PhD (Miami, FL)

2:36–2:49 PM
20. Posterior Cervical Approach for Intrathecal Baclofen Pump Insertion in Children with Previous Spinal Fusions
    James K. Liu, MD; Marion L. Walker, MD (Salt Lake City, UT)

2:49–3:02 PM
21. Low Incidence of Subdural Electrode Grid Related Complications in Prolonged Pediatric EEG Monitoring
    Wael Musleh, MD, PhD; Kurt Hecox; Michael Kohrman; 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 Feiz-Erfan, MD; Harold L. Rekate, MD; Robert F. Spetzler, MD; Eric M. Horn, MD; Mauro A.T. Ferreira, MD; G. Michael Lemole, Jr., MD (Phoenix, AZ); Jeffrey V. Rosenfeld, MB (Melbourne, Australia)

3:15–3:45 PM
Beverage Break in Exhibit Hall with Exhibit & Poster Viewing

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

4:05–5:25 PM
SCIENTIFIC SESSION V
Trauma
Moderators: Mark M. Souweidane, MD; Mark S. Dias, MD
Upon completion of this program, participants should be able to:

- Compare head trauma and epidemiology and treatment strategies.

4:05–4:18 PM
23. Reducing the Incidence of Abusive Head Injuries: The Shaken Baby Syndrome Parent Education Program
Mark S. Dias, MD (Hershey, PA); Kim Smith, RN; Kathy deGuehery, RN; Veetai Li, MD (Buffalo, NY)

4:18–4:31 PM
24. A Simple and Rapid Assessment Tool for Concussive Injury in Children and Adolescents
Rebecca M. Bennett, CPNP; Robert Granville, BS; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

4:31–4:44 PM
25. Getting Better After Traumatic Brain Injury: Age-Dependent Repair and Recovery Processes
Ann-Christine Duhaime, MD; Andrew Saykin, PhD; Brenna Mcdonald, PhD; Gregory Holmes, MD; Brent Harris, MD; Carter Dodge, MD; Paul Tomashosky, BA (Lebanon, NH)

4:44–4:57 PM
26. The Impact of Helmets on Head Injury in Sports
Rahul Jandial, MD; Henry Aryan, MD; Kevin Yu, MD; Burak M. Ozgur, MD; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

4:57–5:10 PM
27. Utility of Serial Computed Tomography Scans in Pediatric Head Trauma
Kenneth C. Liu, MD; Nathan R. Selden, MD, PhD; Susan R. Durham, MD (Portland, OR)

5:10–5:23 PM
28. Skiing and Snowboarding Head Injury: Why are Head Injuries More Common in Snowboarders?
Matthew A. Hunt, MD; Nathan R. Selden, MD, PhD; Susan R. Durham, MD (Portland, OR)

5:30–6:00 PM
Annual Business Meeting

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

thursday, december 4

7:00–8:00 AM
Continental Breakfast in Exhibit Hall

7:00 AM–5:00 PM
Registration

7:00 AM–6:30 PM
Exhibits & Poster Viewing

8:00–10:00 AM
SCIENTIFIC SESSION VI
Tumors II
Moderators: Corey Raffel, MD, PhD; George I. Jallo, MD
Upon completion of this program, participants should be able to:

- Cite the treatments and outcomes of common and uncommon brain tumors.

8:00–8:13 AM
29. Pineoblastoma: The St. Jude Experience (1990–2002)
Michael D. Taylor, MD, PhD; Frederick A. Boop, MD; Robert A. Sanford, MD; Amar Gajjar, MD; Miriam Fouladi, MD; Tom E. Merchant, MD; Larry E. Kun, MD (Memphis, TN)

8:13–8:26 AM
30. The Diagnostic Value of Preoperative Radiologic and Serologic Testing in Pineal Region Tumors in Children
Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

8:26–8:39 AM
31. Intracystic Irradiation: An Effective, but Underutilized, Therapy for Cystic Craniopharyngioma
Corey Raffel, MD, PhD (Rochester, MN)

8:39–8:52 AM
32. The Management of Cysts in Pediatric Craniopharyngiomas
Scott Leary, MD; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

8:52–9:05 AM
33. Management and Prognosis of Midbrain Tectal Tumors in Children
Chan Roonprapunt, MD, PhD; Rick Abbott, MD; Karl Kothbauer, MD; Fred Epstein, MD; George Jallo, MD (New York, NY)

9:05–9:18 AM
34. Recovery of Cranial Nerve Function Following Surgery for Medullary Brainstem Tumors
George I. Jallo, MD (Baltimore, MD); Tania Shiminski-Maher, NP; Linda Velasquez, MS; Karl Kothbauer, MD; Rick Abbott, MD (New York, NY)

9:18–9:31 AM
35. The Anterior Interhemispheric Trans-Choroidal Approach to Pineal Region Tumors
Henry Aryan, MD; Kevin Yu, MD; Ralph Jandial, MD; Burak M. Ozgur, MD; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

9:31–9:44 AM
36. The Malignancy of Atypical Teratoid Rhabdoid Tumors
Michael L. Chen, BA; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

9:44–9:57 AM
37. Endoscopic Surgery for Intraventricular Brain Tumors in Patients without Hydrocephalus
Mark M. Souweidane, MD, FACS (New York, NY)

10:00–10:30 AM
Beverage Break in Exhibit Hall with Exhibit & Poster Viewing

10:30–10:50 AM
Special Lecture
"Modeling Medulloblastoma in Mice"
Daniel W. Fults, III, MD, PhD

10:50–11:10 AM
Special Lecture
"Tumor Stem Cells: Key Cells That Maintain Brain Tumor Growth"
Peter B. Dirks, MD, PhD

11:15–12:35 PM
SCIENTIFIC SESSION VII
Spine
Moderators: Douglas L. Brockmeyer, MD; Henry M. Bartkowski, MD, PhD
Upon completion of this program, participants should be able to:

- Compare outcomes and techniques in pediatric spinal disorders.

11:15–11:28 AM
38. Atlanto-occipital Dislocation in Children: A Retrospective Study of Stabilization Techniques and Outcomes
Said Elshihabi, MD; George T. Burson, MD; Glenn T. Pait, MD (Little Rock, AR)

11:28–11:41 AM
39. Persistent Syringomyelia Following Pediatric Chiari I Decompression: Radiologic and Surgical Findings
Scott Soleau, MD; R.Shane Tubbs, PhD, PA-C; Daniel B. Webb, BS; W. Jerry Oakes, MD (Birmingham, AL)

11:41–11:54 AM
40. Scoliosis and Chiari I Malformations in Children
Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

11:54–12:07 PM
41. Posterior Fossa Decompression Without a Durotomy for Treatment of Chiari II Malformation
Prithvi Narayan, MD; Sarah Jost, MD; Jeffrey R. Leonard, MD; Matthew D. Smith, MD; Jeffrey G. Ojemann, MD; Tae Sung Park, MD (St. Louis, MO)

12:07–12:20 PM
42. Dural Splitting Craniocervical Decompression: Reduced Operative Time, Hospital Stay and Cost with Equivalent Early Outcome
Nathan R. Selden, PhD, MD; Farhad M. Limonadi, MD; Susan R. Durham, MD (Portland, OR)

12:20–12:33 PM
43. Withdrawn

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. Muszynski, MD, FACS; Dachling Pang, MD
Upon completion of this program, participants should be able to:

- Recognize recent techniques and technical advances in a variety of pediatric neurosurgical practices.

1:45–1:58 PM
44. Craniopagus Twins: Surgical Anatomy and Strategies for Separation
Samuel R. Browd, MD, PhD; Marion L. Walker, MD (Salt Lake City, UT)

1:58–2:11 PM
45. Efficacy of Scheduled Non-narcotic Analgesics in Children after Suboccipital Craniectomy
Matthew D. Smyth, MD (St. Louis, MO); Jason T. Banks, MD; R. Shane Tubbs,PhD, PA-C; John C. Wellons, III, MD (Birmingham, AL); W. Jerry Oakes, MD (St. Louis, MO)

2:11–2:24 PM
46. Complications of the Interhemispheric Transcallosal Approach in Children
Kevin Yu, MD; Burak M. Ozgur, MD; Henry Aryan, MD; Ralph Jandial, MD; Henry S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

2:24–2:37 PM
47. Treatment of Intraoperative Air Embolism in Posterior Fossa Surgery in Children by Central Line Placement—A Risk/Benefit Analysis
Kelly Scrantz, MD; Michael D. Taylor, MD; Fredrick A. Boop, MD; Robert A. Sanford, MD (Memphis, TN)

2:37–2:50 PM
48. Transsphenoidal Transpalatal Myelomeningoencephalocystocoele Repair in a Newborn Via a Transoral Approach
Luis F. Rodriguez, MD; Emun Abdu; Douglas J. Quint, MD; Steven R. Buchman, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

2:50–3:03 PM
49. Use of a Compact Intraoperative Low-field Magnetic Imager in Pediatric Neurosurgery
Amer F. Samdani, MD (Baltimore, MD); Michael Schulder, MD; Jeffrey Catrambone, MD; Peter Carmel, MD (Newark, NJ)

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

3:25–4:20 PM
SCIENTIFIC SESSION IX
General Interest II
Moderators: John R.W. Kestle, MD, MSc; Douglas L. Brockmeyer, MD
Upon completion of this program, participants should be able to:

- Recognize information which illustrates the recent techniques and technical advances in a variety of pediatric neurosurgical practices.

3:25–3:38 PM
50. Intraoperative Neurophysiological Monitoring for Tethered Cord Surgery
Karl F. Kothbauer, MD (New York, NY)

3:38–3:51 PM
51. Experience Using the Neodynium: Yttrium-Aluminum-Garnet (Nd:YAG) Laser in Pediatric Neurosurgery
James K. Liu, MD; John R.W. Kestle, MD, MSc; Douglas L. Brockmeyer, MD; Carolyn M. Carey, MD; Marion L. Walker, MD (Salt Lake City, UT)

3:51–4:04 PM
52. Surgical Experience: Did it Affect the Results of the Endoscopic Shunt Insertion Trial?
Paul Klimo, MD, MPH; John R.W. Kestle, MD, MSc (Salt Lake City, UT); James M. Drake, MD (Toronto, ON, Canada)

4:04–4:17 PM
53. Posture Independent Piston Valve: A Practical Solution to Maintaining Stable Intracranial Pressure in Shunted Hydrocephalus
Joshua E. Medow, MD; Christopher C. Luzzio, MD (Madison, WI)

4:20–4:30 PM
Hydrocephalus Database Report
Cynthia Soloman and Emily Fudge, Hydrocephalus Association

4:30–5:30 PM
Wine and Cheese Reception
In the Exhibit Hall with Exhibit & Poster Viewing

5:30–6:30 PM
Thursday Night Speaker
Extreme Sports Speaker
Andrew McLean
In the Exhibit Hall

friday, december 5

7:00–8:00 AM
Continental Breakfast in Exhibit Hall

7:00–10:00 AM
Registration

7:00–11:00 AM
Exhibits & Poster Viewing

8:00–9:20 AM
SCIENTIFIC SESSION X
Basic Science
Moderators: Paul A. Grabb, MD; Gary C. Schoenwolf, PhD
Upon completion of this program, participants should be able to:

- Describe developments in basic science relevant to pediatric neurosurgery.

8:00–8:13 AM
54. Identification of Phenotypic Neural Stem Cells in Pediatric Brain Tumors
Stephen L. Huhn, MD; Yun Yung, BS; David Juan, BS; Samuel Cheshier, MD, PhD; Victor Tse, MD, PhD (Standford, CA)

8:13–8:26 AM
55. Tolerance of Interstitial Infusion of Carmustine in the Rat Brainstem: A Potential Therapeutic Strategy for Diffuse Pontine Gliomas
Erika B. Mark, BS; Giuseppe Occhiogrosso, MD; Mark A. Edgar, MD; Ira J. Dunkel, MD; Mark M. Souweidane, MD (New York, NY)

8:26–8:39 AM
56. Short- and Long-term Shunting Reduces Reactive Astrocytosis in Experimental Hydrocephalus
Janet M. Miller, BS; James P. McAllister II, PhD (Detroit, MI)

8:39–8:52 AM
57. Cytokines IGF-1, IGF-2, and TGF-B1 in a Congenital Hydrocephalus Rat Model
Frances W. Morgan, PhD; Jennifer A. Stewart, MS; Allison N. Smith, BS; Jogi V. Pattisapu, MD; Roy W. Tarnuzzer, PhD; Wade's Center for Hydrocephalus Research, ORHS; Pediatric Neurosurgery (Orlando, FL)

8:52–9:05 AM
58. Death Receptor Ligands and Decoy Receptors in Pediatric Medulloblastomas
Richard C. E. Anderson, MD; Daniel W. Fults, MD; John R.W. Kestle, MD, MSc; Douglas L. Brockmeyer, MD; Marion L. Walker, MD (Salt Lake City, UT); David E. Anderson, PhD (Davis, CA)

9:05–9:18 AM
59. Myelomeningocele: Characterization of a Surgically Induced Sheep Model and its Similarities and Differences to the Human Disease
Cornelia S. Von Koch, MD, PhD; Nathalie Compagnone, PhD; Shinjiro Hirose, MD; Suzanne Yoder, MD; Diana L. Farmer, MD (San Francisco, CA)

9:20–9:40 AM
Beverage Break in Exhibit Hall with Exhibit & Poster Viewing

9:40–11:00 AM
SCIENTIFIC SESSION XI
Craniosynostosis
Moderators: Ann Marie Flannery, MD, FACS, FA; David F. Jimenez, MD
Upon completion of this program, participants should be able to:

- Describe the techniques and outcomes in craniosynostosis surgery.

9:40–9:53 AM
60. Raised Intracranial Pressure in Isolated Sagittal Synostosis—The Oxford Experience
David McAuley, FRCS; Essam El Gamal, FRCS; Peter Richards, FRCS; Steve Wall, FRCS (Oxford, United Kingdom)

9:53–10:06 AM
61. Transcranial Doppler Evaluation of Middle Cerebral Artery Blood Flow During Pi Procedure in Children with Sagittal Synostosis
David J. Donahue, MD; Deepak Sobti (Fort Worth, TX)

10:06–10:19 AM
62. Management of Sagittal Craniosynostosis: Seven Year Experience in 134 Patients Using Endoscopic Wide Vertex Craniectomies and Bilateral Barrel Stave Osteotomies
David F. Jimenez, MD; Constance M. Barone, MD; Maria McGee, MD; Cathy Cartwright, RN, MSN; Lynette Baker, RN, BSN (Columbia, MO)

10:19–10:32 AM
63. Emergency Cranial Vault Reconstruction in Pediatric Patients with Slit Ventricle Syndrome
Albert E. Telfeian, MD; Juanita Celix, BS; Leslie N. Sutton, MD (Philadelphia, PA)

10:32–10:45 AM
64. Expanded Strip Craniectomy and Postoperative Molding Helmet for Scaphocephaly: Patient Selection Factors in Outcome
Howard J. Silberstein, MD, FACS; Jeffrey M. Tomlin, MD; Stephen J. Vega; Lan B. Hua (Rochester, NY); Joseph E. Losee (Pittsburgh, PA)

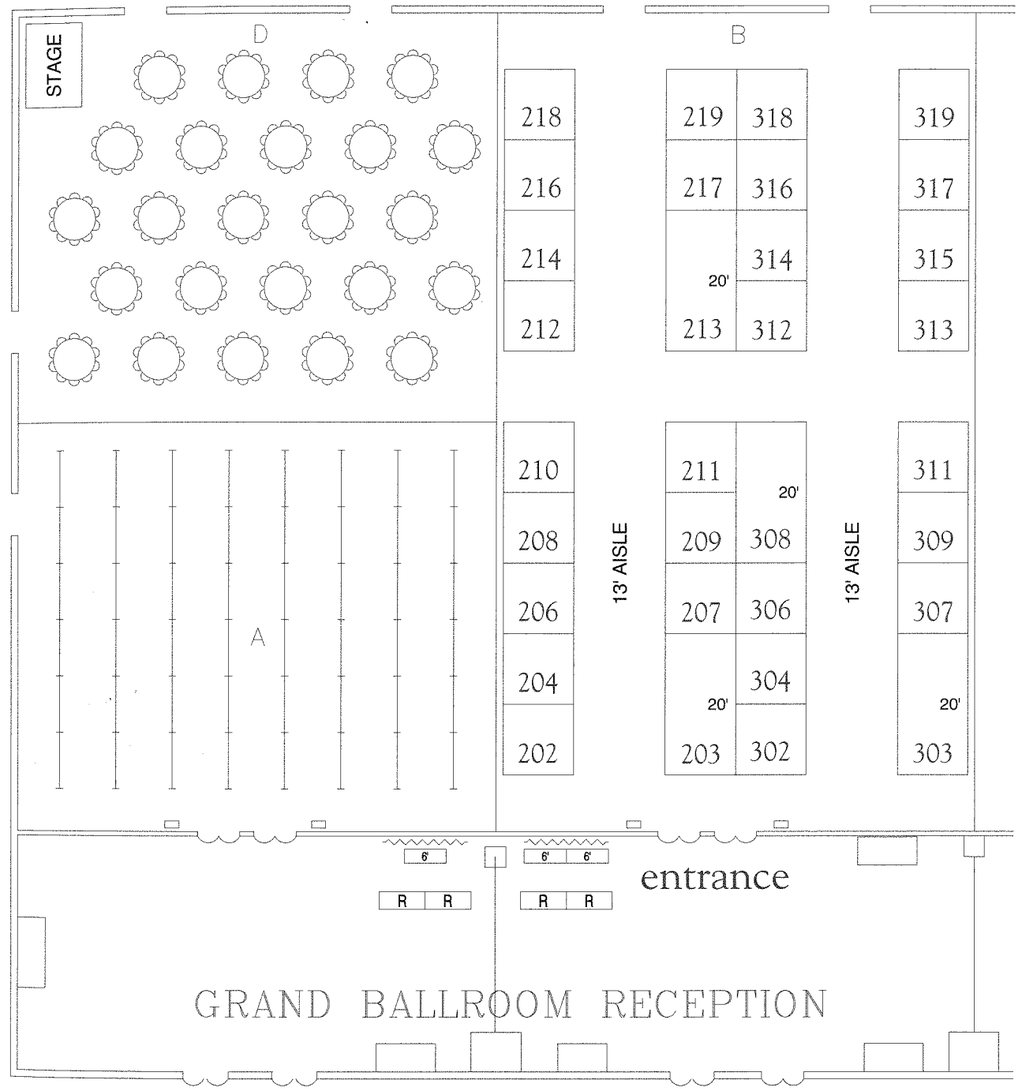
10:45–10:58 AM
65. Visual Field Testing in Deformational Plagiocephaly
Paul C. Francel, MD, PhD; Sterling L. Cannon, MD; Aaron Fortney, MD; Michael Siatkowski, MD (Oklahoma City, OK); William J. Feuer, MS (Miami, FL); Warda Ahmad, MS; Jayesh Panchal, MD, MBA (Oklahoma City, OK)

11:00–11:25 AM
Special Lecture
"Neurofibromatosis I: Bench to Bedside and Back"
David H. Viskochil, MD

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

11:50–Noon
Closing Remarks

the grand america hotel—grand ballroom



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oral abstracts

1. Endoscopic Third Ventriculostomy in Infants

David Sacco, MD; Kenneth Shapiro, MD; Frederick Sklar, MD; Bradley Weprin, MD; Dale Swift, 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 ETV were performed between 3/92 and 6/03. 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 (10), chiari I (6), chiari II (3), tectal plate arachnoid cyst (2), tectal glioma (1), suprasellar cyst (1), and congenital hydrocephalus of unknown etiology (1). Three patients had previous shunts. 17/24 infants (70%) have required no further treatment for hydrocephalus. 7 infants (30%) required subsequent shunt placement. The etiology of hydrocephalus in infants requiring subsequent shunt placement was chiari II (3), chiari I (2), 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 aqueductal stenosis carries the best prognosis for success. Age should not be a deterrent to performing ETV.

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

Michael J. Fritsch, MD (Kiel, Germany)

introduction Controversy exists in regard of the indication for CSF diverting procedures (EVD, 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 secundary 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 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 3 and 8 days after tumor removal. Both patients presented with CSF leaks (1 ependymoma, 1 plexus papilloma).

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 interpeduncular cistern may be distorted due to compression of the brainstem against the clivus. We favorize early immediate tumor removal without prior ETV.

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

Matthew D. Smyth, MD (St Louis, MO); R. Shane Tubbs, PhD, PA-C; John C. Wellons, III, MD; W. Jerry Oakes, MD; Jeffrey P. Blount, MD; Paul A. Grabb, MD (Birmingham, AL)

introduction We review our experience of endoscopic third ventriculocisternostomy (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 (CNS) infection and had neuroimaging consistent with obstruction of the aqueduct, fourth ventricular outlets, or both, at the time of ETV. Charts and imaging studies were reviewed to determine clinical outcomes and predictors of successful ETV. An ETV was deemed successful if the child did not require replacement of a ventriculoperitoneal shunt. For previously unshunted patients, success was defined by resolution of signs/symptoms of ICP with stable or improved ventricular size.

results Thirteen ETV were performed in 12 patients, (7 boys and 5 girls; mean age 9.2 years; range 3.8–21 yrs), with 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 Overnight Monitoring of ICP in Shunted Children—an Observational Study

Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Sandeep Sood, MD; Steven D. Ham, DO; James P. McAllister, II, PhD (Detroit, MI); Zofia Czosnyka, PhD; Marek Czosnyka, 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 compensatory reserve and shunt function.

method 65 overnight datasets and 25 positional maneuvers from 43 monitoring sessions in 32 hydrocephalic children were analyzed prospectively.

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

results Mean ICP was 11.2+/-SD4.3 mmHg. Time trends of ICP indicated overnight vasogenic dynamics in 52 datasets, manifested by episodes (in periods from 1-3 hours) of increased slow ICP wave amplitudes, associated with an increase in ICP pulse amplitude and a decrease in compensatory reserve (if RAP increased to > +0.6). In these periods, mean ICP increased by 53% to 17.1+/-5.8. Peak ICP exceeded 25 mmHg (mean of 34.5+/-9.7 mmHg) in 35 datasets, indicating pathological CSF dynamics associated with active hydrocephalus or a malfunctioning shunt. Positional tests suggested shunt overdrainage in 10 patients.

conclusion Computerized continuous ICP monitoring can assess shunt functioning and characterize the status of CSF compensation in vivo. It furthermore aids clinicians, nurses and parents with permanent bedside trends. Its overall clinical value should be confirmed by a larger clinical study.

5. Non-invasive ICP and Compliance Monitoring to Detect Shunt Malfunction

Jotham C. Manwaring, BS; Kim H. Manwaring, MD; Phoenix Children's Hospital (Phoenix, AZ); Brain Instrumentation 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 monitoringtechniques 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 offset correlating with mean pressure. We discovered, however, that a near linear relationship exists between ICP and brain compliance by measuring the tympanic membrane displacement waveform and comparing in for phase shift difference to external ear perfusion in the ipsilateral ear. This approach allows the patient to be his own control, as the generator of the ICP pulse is the internal carotid artery and the generator of ear perfusional pulse is the external carotid artery.

We have studied 100 young adults in a standardized tilt table test to induce abnormal ICP. The linearity of the relationship is consistent within the subject with excellent repeatability. However, individuals vary in their compliance curves 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 of non-invasive ICP monitoring may improve long-term management of hydrocephalus by guiding the clinician regarding shunt failure as well as optimizing long-term quality of life due to recurring headaches and poor brain compliance as a consequence of chronic over-drainage.

6. Serum and CSF C-Reactive Protein in Shunt Infection Management

Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Kimberly Ostrowski, MS; Jau-Wen Chu, PhD; Emily J. Draper, BS; James P. McAllister II, PhD (Phoenix, AZ); Steven D. Ham, DO; Sandeep Sood, MD (Detroit, MI)

introduction Shunt infections are traditionally managed according to history, clinical findings and CSF investigations. C-reactive protein (CRP), a protein highly sensitive to inflammation, is usually measured in serum to manage inflammatory disease including infection. We evaluated CRP in serum (S-CRP) and CSF (C-CRP) to determine its usefulness in managing shunt infections.

methods 90 patients with suspected shunt infection [S] and 38 controls [C] were investigated. S-CRP and C-CRP in Group[S], and C-CRP in Group [C], were added to routine work-up. A new high-sensitivity CRP assay was used.

results In Group[S] patients with CSF infection (*n*=35) mean S-CRP at presentation was 89.0+SD 67.9 mg/L. S-CRP was normal at presentation in only 1 of these patients. WBC and traditional CSF parameters were less sensitive for CSF infection. S-CRP was 3.6+/-2.4 mg/L in 26 of 38 Group[S] patients without CSF infection. Mean S-CRP of the remaining 12 was 55.8+/-38.6 mg/L. Another source of infection was found in 10; in 2 the reason for CRP elevation remained obscure. C-CRP was generally much lower than S-CRP. In patients with CSF infection, C-CRP was elevated compared to patients without infection and to controls.

CRP ?? Infection guide for reinterpretation

conclusion S-CRP results, which can be obtained quickly, carry, in contrast to WBC, a high specificity to rule out suspected shunt infection prior to shunt tap. Sensitivity is lower since other infections influence S-CRP. C-CRP seems to be more sensitive to shunt infection than traditional CSF parameters. Both C-CRP and S-CRP measurements can help distinguish between CSF contamination at puncture and true infection.

7. Complications Associated with Ventriculo-Subgaleal Shunting

Scott W. Soleau, MD; R. Shane Tubbs, PhD; Jason T. Banks, MD; Matthew D. Smyth, MD; John C. Wellons, MD; Jeffrey P. Blount, MD; Paul A. Grabb (Birmingham, AL)

introduction Ventriculo-subgaleal (VSG) shunting is used for the temporary bypass of the normal cerebrospinal fluid (CSF) pathways. We reviewed all VSG shunting procedures and complications at our institution over the past 6 years.

methods We retrospectively reviewed 170 VSG shunting procedures in 131 patients performed over the last 6 years. All complications were documented and reviewed.

results The majority of patients were either premature infants with intraventricular hemorrhage and hydrocephalus (54%), or patients being treated for shunt infections (24%). The remainder were not deemed suitable candidates for immediate placement of catheters in other locations due to a variety of infectious and neoplastic etiologies. Significant complications included infection (5.4%), wound leakage (4.7%) and intracerebral hemorrhage (1.1%).

conclusion The nature and incidence of complications do not appear to be excessive or extrordinary when compared to other CSF diversion techniques. In fact, the rate of infection seems superior to that seen with traditional external ventricular drainage. We believe the benefits of VSG shunting outweigh the risks.

8. Noninvasive MRI Phase Contrast Flow Studies: Determination of Raised ICP and Shunt Malfunction in Hydrocephalus

Roberta P. Glick, MD; Terry Lichtor, MD, PhD; Noam Alperin; Patricia Raksin; Anusha Sivaramakrishnan; Sushma Surapaneni (Chicago, IL)

introduction Noninvasive phase contrast MRI (pcMRI) is a method that allows for visualization of real time 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 "slit ventricle" syndrome.

methods Patients with slit ventricle syndrome, ventriculomegaly, intracranial congenital cysts, and R/O shunt malfunction (e.g. patients presenting with headache, seizure, dizziness) underwent MRI and MRI-Pc. Several patients had an indwelling EVD at the time of the study for clinical correlation. 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 MRI-Pc was able to non-invasively 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 MRI-Pc is a non-invasive method for determination of ICP that may be useful in the management of patients with hydrocephalus as a diagnostic tool for guiding surgical treatment.

9. Resection of Pediatric Brain Tumors in the United States, 1988–2000: Progressive Centralization and Specialization of Care

Edward R. Smith, MD; William E. Butler, MD; Fred G. Barker, MD (Boston, MA)

introduction We have previously shown lower mortality rates and better discharge disposition after 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 pediatric craniotomies for brain tumor during this period, and there was no significant temporal trend in the number of hospitals where the surgery was performed. Per-hospital median caseload increased from 1.7 to 3/yr and 90th percentile hospital volume increased from 11 to 17/yr, accounting for about one-third of the decrease in mortality observed during this period. Care shifted toward teaching hospitals, from 58% of cases in 1988–90 to 85% in 1997–2000 (p<0.001), and toward surgeons whose practice was predominantly pediatric (median percent of practice age< 19 increased from 12% in 1988–90 to 27% in 1997–2000, p=0.05). These changes indicate both progressive centralization and specialization of U.S. pediatric brain tumor surgery in 1988–2000.

conclusion Or pediatric brain tumor craniotomy in the U.S., 1988–2000, there were trends toward greater centralization of surgery and more specialization of surgeons. The increased per-hospital caseload explained a substantial fraction of the observed decrease in mortality rates during this period.

10. The Association Between Tumor Resection and Survival in Pediatric Anaplastic Astrocytomas

Chirag D. Gandhi, MD (New York, NY); Michael L. Chen, BA; Tien Nguyen, MD; Anthony Kim, MD; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

introduction The benefit of extent of surgical resection for pediatric high-grade gliomas remains controversial. This study attempts to address the association between the extent of resection and the progression-free and overall survival in children with anaplastic astrocytomas.

methods The authors retrospectively analyzed 21 patients who underwent surgical treatment of histologically proven non-brain stem anaplastic astrocytomas at one institution between January 1997 and April 2003. Patients were stratified according to the extent of resection (total resection, subtotal resection, and biopsy) as determined by both surgical observation and post-operative magnetic resonance imaging. Follow-up ranged from 3 months to 14.5 years.

results There were 11 males and 10 females with a mean age of 8.2 years of whom 7 patients underwent total resection, 10 patients underwent subtotal resection, and 4 patients underwent a biopsy. Additionally, 18 patients underwent post-surgical chemotherapy and radiation. The mean progression-free survival of all the patients was 36 months. The stratified progression-free survival for total resection, subtotal resection, and biopsy were 59 months, 24 months, 7 months, respectively. The mean overall survival for all the patients was 48 months and the stratified overall survival for total resection, subtotal resection, and biopsy were 77 months, 27 months, and 10 months, respectively.

conclusion Total resection was associated with higher rates of progression-free and overall survival in children with anaplastic astrocytomas.

11. Radiation-Induced Glioma Following Treatment of Primary Central Nervous System Neoplasms in Children

Stephanie Greene, MD; Liliana C. Goumnerova, MD (Boston, MA)

introduction The risk of developing a primary brain tumor following cranial radiation therapy (RT) has been well-recognized for years. While most of these tumors are meningiomas, twenty-four percent are gliomas. Radiation-induced gliomas are acknowledged to be highly malignant. We elected to study radiation-induced gliomas in patients treated for primary central nervous system neoplasms.

methods Data regarding the primary and secondary malignancy, treatment undergone, patient age, and outcome after secondary diagnosis were collected through a retrospective chart review.

results Eight patients with radiation-induced glioma were identified. The primary diagnoses were three medulloblastomas, one craniopharyngioma, two optic-hypothalamic gliomas, one germinoma, and one ependymoma. The secondary diagnoses were one low-grade astrocytoma, two anaplastic astrocytomas, three glioblastoma multiforme, one gliosarcoma, and one supratentorial primitive neuroectodermal tumor. All secondary tumors were in the initial radiation therapy fields, but not in the area of maximal radiation. The patient age at primary diagnosis ranged from 9 months to 12 years, with a mean of 3.8 years and a median of 2.5 years. The length of time between initial therapy, including RT, and second malignancy ranged from 4 to 12 years, with a mean of 7.5 years and a median of 8.5 years. Seven of the patients have died despite aggressive tumor-directed therapy. The time from secondary malignancy until death ranged from 5 to 18 months, with a mean of 10.1 months and a median of 8 months.

conclusion Radiation-induced gliomas are predominantly higher-grade tumors. They are recognized to behave in a more aggressive fashion than spontaneously arising tumors of similar grade.

12. Management and Outcome of Choroid Plexus Carcinoma in the Very Young

Saadi Ghatan, MD; Richard C. E. Anderson, MD; Mark M. Souweidane, MD; Neil A. Feldstein, MD, FACS (New York, NY)

introduction Choroid plexus carcinoma (CPC) has been associated with a very poor prognosis in children, many of whom are infants and the very young. The purpose of this study was to review the treatment and outcome of children less than 3 years of age with CPC.

methods The medical records of all children with choroids plexus neoplasms who presented to New York Presbyterian Hospital between 1994 and 2003 were reviewed.

results Of these 17 patients, 7 had histologically proven CPC, and 5 of these cases were in children less than 3 years of age (range 4 days–30 months, mean 17 months). There were 3 males and 2 females. All patients underwent surgery with adjuvant chemotherapy; one patient had a gross total resection of his tumor, two had subtotal resections with subsequent chemotherapy and 'second look' surgery, where gross total resection was achieved. In one patient, tumor infiltrating the brainstem could not be resected at the time of the first operation, but residual tumor has completely receded after post-operative chemotherapy. The fifth patient presented as a neonatal hemorrhage, in extremis, and expired despite emergent evacuation of the tumor. The four patients who are alive and well remain disease free at follow-up (6–100 months, mean 46 months).

conclusion Our data, though limited, suggest that the prognosis of these patients is not as dismal as once believed. Adjuvant chemotherapy and 'second look' surgery in the very young may be associated with better outcomes in this subset of patients.

13. Cerebellar Mutism Syndrome (CMS) After Posterior Fossa Surgery: A Prospective Study of Two Large Cohorts of Medulloblastoma

Karin M. Muraszko, MD; Patricia Robertson, MD (Ann Arbor, MI); Mark Dias, MD (Hershey, PA); Amar Gajjar, MD (Memphis, TN); Jeffrey Allen, MD (New York, NY); Roger Packer, MD (Washington, DC)

introduction Cerebellar Mutism Syndrome (CMS) has been retrospectively reported in 8–25% of patients following resection of midline cerebellar tumors. It is a partially reversible syndrome consisting of decreased speech production, ataxia, hypotonia, and labile emotional status, often with onset delayed 1–2 days after the posterior fossa surgery.

methods As part of two cooperative group clinical trials for both high risk (CCG 9931) and standard risk (CCG/POG 9961) medulloblastoma, we included a questionnaire to survey for symptoms of the CMS to prospectively ascertain its incidence in newly diagnosed patients immediately following surgery. Data was submitted on 487/511 patients for a compliance rate of 95%.

results CMS was present in 25% of high-risk patients, and present in 22% of standard-risk patients. There was no correlation of CMS with tumor size, primary tumor location, degree of resection, M-stage or occurrence of csf leak in either group. There was a trend toward an association with postoperative meningitis and intracranial hematoma. Overall, the duration of CMS was >4 weeks in 50%, 1–4 weeks in 40% and <1 week in 10% of the patients. Mutism and ataxia were the features of the syndrome most frequently present at the highest degree of severity.

conclusion In summary, nearly 1 in 4 patients who underwent attempted aggressive resection of a medulloblastoma developed CMS, of which >80% were moderate or severe in intensity. No specific risk factors were associated with its occurrence. These prospective studies indicate that CMS is an important and generally under-diagnosed complication of surgical resection of posterior fossa tumors.

14. Denovo Cavernous Angioma Formation in Children after Radiation for Intracranial Tumors

Luis F. Rodriguez, MD; Patricia L. Robertson, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

introduction Post radiation cavernous angioma formation in children has been previously reported in only a few cases. We report three new cases of denovo cavernous angioma formation in children, and discuss their clinical characteristics.

methods Three patients who underwent radiation therapy and chemotherapy for treatment of intracranial lesions (medulloblastoma, ependymoma, and pineal region germinoma) during childhood were diagnosed with cavernous malformations. All presented with lesion expansion by hemorrhage and lesions arose within the previously irradiated fields. The lesions presented at 3, 7, and 13 years after radiation treatment.

results One patient presented with a R frontal hemorrhage with a negative angiogram and an MRI consistent with a hemorrhagic cavernous malformation. He underwent resection of his lesion with resolution of symptoms. Another child presented with worsening headaches and was found to have enlarging cavernous malformations by MRI. He had progressive evidence of bleeding and mass effect on the fourth ventricle which required suboccipital craniotomy for resection with resolution of his headaches. The last child had evidence of hemorrhage and increasing size of a L temporal cavernous angioma and is currently being followed expectantly.

conclusion Post-radiation cavernous malformations are rare occurrences particularly in the pediatric population. The mechanisms for their formation and the irnatural history are unclear. Based on our experience and review of the literature, the presentation is most frequently associated with hemorrhage and growth of the lesions.

15. Supine vs. Upright Changes in Cerebral Blood Flow and ICP as Measured Non-Invasively by MRI

Thomas M. Moriarty, MD, PhD; Stephen Hushek, PhD (Louisville, KY); Noam Alperin, PhD (Chicago, IL)

introduction Cerebral blood flow (CBF) and CSF flow dynamics can be quantified by MRI. The vertically oriented GE Signa SP MRI scanner allows imaging of the brain in both supine and upright positions. We report here the use of MRI as a noninvasive tool to study the effects of posture on cerebrovascular physiology including total CBF, the distribution of the cerebral venous drainage, and cerebral vascular compliance.

methods Volunteers were studied at upright and supine positions in a SP 0.5T MRI scanner (GE Medical Systems, Milwaukee). An 8"x10" flexible transmit/receive coil was used. Retrospectively gated cine phase contrast scans were used to measure arterial inflow, venous outflow, and CSF flow between the cranium and the spinal canal. An MRV of the neck was obtained with 2DTOF for visualization of the venous drainage system.

results The distribution and the flow dynamics of venous drainage were different between the two postures. In the upright position, the venous drainage shifted from the jugular veins to the epidural and the deep neck veins. Venous flow becomes less pulsatile in the upright position. A 3-to 4 fold increase in cerebral vascular compliance was found in the upright position. A lower total CBF and a large (2–3 fold) increase in the intracranial compliance (decrease in ICP) were also measured in the upright position. A lower cerebral vascular compliance was found in the supine posture.

conclusion This ability to non-invasively study cerebral physiology in both upright and supine postures may provide an important diagnostic and research tool for normal and diseased states.

16. Management of Pediatric CNS Arteriovenous Malformations: The McGill Experience

Jean-Pierre Farmer, MD, FRCS(C); Abdulrahman J. Sabbagh, MD (Montreal, PQ, Canada); Ayman Albanyan, MD, FRCS(C) (Riyadh, Saudi Arabia); Jose Montes, MD (Montreal, PQ, Canada)

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

methods A retrospective 20-years 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–18 years). 73.1% of patients developed intracranial hemorrhage including a patient with spinal AVM. 30% had seizures. 73.9% had headaches. 13% of patients presented with steel symptomatology. 10% were asymptomatic. Eight patients (16.7%) had associated pre-existing congenital or acquired syndromes. Location: 37 (80%) of AVMs were supratentorial, and 8 (17%) were infratentoreal. One patient had a spinal AVM. 3 patients had associated aneurysms. Management: patients had different combinations of the following modalities. 31 (63%) required surgery. Eleven patients (24%) had endovascular embolization, thirteen patients (38%) had stereotactic radiosurgery. Outcome: In as many as 61% of patients who had surgery it resulted in a complete resection. Engle seizure outcome score was I in 11 (79%), II in 2 (14%), and III in one patient. Glasgow outcome score (GOS) was good (4 or 5) in 36 (83%) patients. Three patients died (9%).

conclusion AVM presenting at a pediatric age, has a higher chance of being infratentoreal than in adults. (2) Hemorrhage is the main cause of mortality and morbidity. (3) When surgery is decided, complete resection is achievable in two thirds of patients. (4) Seizure outcome is very satisfactory.

17. Thermal Imaging in Pediatric AVM Surgery

Hal S. Meltzer, MD; Burak M. Ozgur, MD; Kevin Yu, MD; Henry Aryan, MD; Rahul Jandial, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

introduction Prior studies have documented the use of Quantum Well Infrared Photo detection for the treatment of AVM's 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 AVM's.

methods A prospective evaluation of nine patients utilizing infrared technologies.

results There were 5 males in the series (mean age = 9.7 + 4.5 yrs). 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 frontal, 3 temporal, 1 occipital, 1 parietal and 1 frontoparietal AVM in the series. Six patients underwent QWIP imaging. All had intraoperative angiography. Analysis tools included signal averaging, 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 post resection. Residual AVM on intraoperative angiography correlated with continued temperature increase in the surgical bed.

conclusion MID has a resolution of .00018oC and 81,920 pixels/frame and improves image perception. Data acquisition rates did not correlate with image quality or specificity. Noise Equivalent Temperature Differences (NEDeltaT) further enhance image resolution. Intraoperative MID imaging can be a useful, noninvasive adjunct to surgery in children which may supplant the use of intraoperative angiography in the near future. We found benefit in the use of the 3–5u spectrum as opposed to the 8–10 um spectrum used by QWIP.

18. Functional Hemispherectomy for Epilepsy in Childhood—Institutional Experience

Prithvi Narayan, MD; Ugur Isik, MD; Edwin Trevathan, MD, MPH; Robert T. Fitzgerald, MD, MPH; Susan T. Arnold, MD; Matthew D. Smyth, MD; Jeffrey R. Leonard, MD (St. Louis, MO)

introduction The proposed advantages of functional over anatomical 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 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 22.3 months (range 2 months to 6 years). The underlying pathology included hemimegalencephaly (2), porencephalic cyst (1), 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 greater than 90% reduction in seizure frequency. One patient developed new-onset seizure from the opposite hemisphere. Hemiparesis improved in 3 patients, was unchanged in 10 and worse in 1. Immediate complications included subgaleal collection (1), aseptic meningitis (1) and fever (3). Two patients developed hydrocephalus. One patient underwent shunt placement and the other was lost to follow-up. Delayed complications included scalp erosions (2) requiring plate removal. Mean operative time was 5.6 hours (range 3.5–8.25). Mean hospital stay was 7.25 days (range 4–13).

conclusion Functional hemispherectomy reduces seizure frequency with acceptable postoperative complication rates in selected patients.

19. Complications of Hemispherectomy in Pediatric Epilepsy Surgery

Sanjiv Bhatia, MD; John Ragheb, MD; Glen Morrison, MD; Michael Duchowny, MD; Trevor Resnick, MD; Prasanna Jayakar, 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 hemispheric 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 Childrens' Hospital. In this clinical database, 67 patients were identified who underwent hemispherectomy of patients with at least follow up of one year. The complications included: postoperative hemorrhage, hydrocephalus, aseptic meningitis, electrolyte disturbances, infections, need for reoperation and death.

results About one third of the patients were less than 3 years. More than 90% seizure control was achieved in about 80% of patients. Twenty-seven patients –40%–suffered complications after surgery that included: 5 infections, 7 hydrocephalus requiring placement of shunts, 4 had edema or infarction of the disconnected hemisphere, 3 developed major electrolyte disturbances. Twelve patients required reoperation and three patients died.

conclusion Hemispherectomy remains an important surgical technique to treat intractable epilepsy with good results in selected patients. The complication rate has necessitated modification 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.

20. Posterior Cervical Approach for Intrathecal Baclofen Pump Insertion in Children with Previous Spinal Fusions

James K. Liu, MD; Marion L. Walker, MD (Salt Lake City, UT)

introduction Intrathecal baclofen pumps for the management of severe spasticity is increasingly being used in children with cerebral palsy. The intrathecal catheter is traditionally introduced dorsally in the lumbar region. In some children who have had previous thoracolumbar fusions, the fusion mass obviates the introduction of the lumbar catheter. The authors describe their experience using a posterior cervical approach for intrathecal baclofen 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 intrathecal baclofen pump insertion. In two cases, an initial lumbar incision was made and several attempts to access with thecal sac under fluoroscopy were unsuccessful due to obstruction by the bony fusion mass. A cervical incision was subsequently made and a T1 laminectomy was performed. In one case, a C1 laminectomy was performed. A small durotomy was created for insertion of the intrathecal catheter down to T3 to T6. The catheter was then tunneled down to the lumbar incision (2 cases) or abdominal incision (1 case) where it was ligated to the remainder of the baclofen pump system.

results All three patients had successful insertion of an intrathecal baclofen pump through the posterior cervical approach. There were no complications of catheter disconnection, catheter dislodgement, or CSF leak. Follow-up ranged from 4–22 months postoperatively.

conclusion The posterior cervical approach for intrathecal baclofen pump insertion is a safe and effective alternative for patients who have had spinal fusions which may prohibit the traditional approach.

21. Low Incidence of Subdural Electrode Grid Related Complications in Prolonged Pediatric EEG Monitoring

Wael Musleh, MD, PhD; Kurt Hecox; Michael Kohrman; Maria Chico; 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 incidence of epidural bacterial contamination, 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 32 to >128 with a range of 4–11 electrode wires piercing the skin > 1 cm from the primary incision. Of the 33 implantations (66 craniotomies), 4 were for re-implantation.

results There were no permanent complications related to grid implantation. Transient complications included 1 case of prolonged Prothrombin time and 1 patient with unexplained fever, both of which resolved on removal of the grids. There were two culture positive infections, one epidural and one superficial both in patients undergoing re-implantation. There was no percutaneous CSF

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.

22. Surgical Strategies to Approach Hypothalamic Hamartomas Causing Gelastic Seizures. Transventricular versus Skull Base Approaches

Iman Feiz-Erfan, MD; Harold L. Rekate, MD; Robert F. Spetzler, MD; Eric M. Horn, MD; Mauro A. T. Ferreira, MD; G. Michael Lemole, 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 (range 3–16 years) who were surgically treated for hypothalamic hamartomas causing refractory gelastic seizures were reviewed retrospectively. In three cases, an orbitozygomatic approach was used. In six cases, an interhemispheric interforniceal 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 interforniceal 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 interforniceal approach.

23. Reducing the Incidence of Abusive Head Injuries: The Shaken Baby Syndrome Parent Education Program

Mark S. Dias, MD (Hershey, PA); Kim Smith, RN; Kathy deGuehery, RN; Veetai Li, MD (Buffalo, NY)

introduction The Upstate New York SBS Education Program began in December 1998 to educate both parents (mothers and, whenever possible, 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 abusive head trauma.

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 abusive head trauma during the program was compared with historical control incidence rates from WNY during the 6 preceding years, and with incidence 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 abusive head injuries declined 48% from 39.7 cases per 100,000 births per year during the control period to 20.6 cases per year (range 1–8) during the study period ($p<0.05$); no comparable decline was seen in Pennsylvania.

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

24. A Simple and Rapid Assessment Tool for Concussive Injury in Children and Adolescents

Rebecca M. Bennett, CPNP; Robert Granville, BS; Hal S. Meltzer, 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 equipment, rules and playing technique over the years. A more significant problem is the ability of those present at the competitions to adequately assess the athletes 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 level, we developed an instrument to allow for the rapid and reproducible evaluation of potentially concussed athletes. The index was derived from the Concussion Grading Systems of Cantu, the Colorado Medical Society, the AAN and McGill University. It was found to be easily utilized and 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 was long-term follow-up of the athlete. When coupled with the Standard Sideline Assessment of Concussion, the tool becomes 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.

25. Getting Better After Traumatic Brain Injury: Age-Dependent Repair and Recovery Processes

Ann-Christine Duhaime, MD; Andrew Saykin, PhD; Brenna McDonald, PhD; Gregory Holmes, MD; Brent Harris, MD; Carter Dodge, MD; Paul Tomashosky, BA (Lebanon, NH)

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

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

results In the youngest subjects, 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 outcome measures in this species, fMRI enables tracking of cortical recovery over time as a function of age at injury, as cortical functions relocate 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.

26. The Impact of Helmets on Head Injury in Sport

Rahul Jandial, MD; Henry Aryan, MD; Kevin Yu, MD; Burak M. Ozgur, MD; Hal S. Meltzer, 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 1999. 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 0.68/100,000.

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. Durham, 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 (0–18y) 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 interval changes.

results 182 patients (111 male, 71 female) were studied. The mean age was 10.5 yrs (range 2d–18yrs). In 147 patients, the initial CT scan demonstrated intracranial pathology. On repeat imaging, 35 (19.2%) showed progression of known intracranial injury. The injuries were epidural hematoma (100%), parenchymal contusion (96%), diffuse axonal injury (50%), subdural hematoma (44%), cerebral edema (40%), intraventricular hemorrhage (20%) and subarachnoid hemorrhage (7.7%). Five patients underwent neurosurgical intervention after the second CT; however, in only one patient was the decision for surgery based solely on radiographic findings. 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 unnecessary radiation.

28. Skiing and Snowboarding Head Injury: Why are Head Injuries More Common in Snowboarders?

Matthew A. Hunt, MD; Nathan R. Selden, 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 consequence of any sport with this combination of elements. To date, limited information is available regarding the relative incidence of head injury from skiing and snowboarding. We retrospectively analyzed the epidemiologic data from several larger series.

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 this data.

results Head injury occurs with an incidence of 0.44/100,000 skier-days and 1.04/100,000 snowboarder-days. The incidence of death from head injury is 0.079/1,000,000 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 account 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 reasons: mechanics, age, sex, risk-taking behavior, and/or underestimation of the number of snowboarders. With 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.

29. Pineoblastoma: The St. Jude Experience (1990–2002)

Michael D. Taylor, MD, PhD; Frederick A. Boop, MD; Robert A. Sanford, MD; Amar Gajjar, MD; Miriam Fouladi, MD; Tom E. Merchant, 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.

methods A retrospective chart review of all children with pineal region neoplasms was conducted, and children with pineoblastoma were identified.

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 dead of disease (DOD), as opposed to 4/8 older children). The median number of operations was 2 (range 1-5). Children who underwent resection, as opposed to biopsy alone had a trend towards better outcome (biopsy alone 3/4 DOD, resection 5/10 DOD). Children >3 years of age were treated with radiotherapy and chemotherapy. 4/6 children diagnosed under the age of 3 did not receive radiotherapy, but did receive chemotherapy. Of those 4 children, 3 are DOD and one has stable disease. Three children received Gamma Knife radiotherapy; all three are alive with no evidence of disease. No child presenting with a metastasis survived.

conclusion Ineoblastoma remains a devastating disease with a >50% mortality rate, particularly 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 of value in patients with pineoblastoma.

30. The Diagnostic Value of Preoperative Radiologic and Serologic Testing in Pineal Region Tumors in Children

Mark D. Krieger, MD; J. Gordon McComb, 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, pinealcytomas, pineal primitive neurectodermal tumors (pnet), and astrocytomas is more controversial, although surgical resection plays a large role.

methods 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 10 years.

results This series consists of 19 germinomas, 12 non-germinomatous germ cell tumors (teratomas, embryonal carcinomas, choriocarcinomas, or germ cell tumors of mixed histology), 15 PNETs (pinealblastomas), 3 astrocytomas, and 1 pinealoma. Patients included 34 boys and 16 girls, with an age range of 6 months to 16 years (mean 9.5 years). The preoperative MRI report included the correct histological diagnosis in the differential in 46 cases (92%). In 6 of the cases, the report incorrectly indicated the tumor was "likely germinoma"; however, the correct histology was mixed germ cell tumor in 3 cases, PNET in 2, and astrocytoma in 1. Serological markers (BHCG and AFP) were obtained in 44 patients (88%). These tests were normal or mildly elevated in all of the patients with germinoma, PNET, astrocytoma, or pinealoma. However, they were elevated in only 5 of the 12 (42%) non-germinomatous germ cell tumors.

conclusion Preoperative serological and radiological evaluation of pineal region tumors is not conclusive in making a histological 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 the lesion, the treatment of craniophryngioma remains both controversial and problematic. Treatment options include surgical resection, external beam irradiation, stereotaxic 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 may be complicated by post-operative pan-hypopituitarism, hypothalamic dysfunction and tumor recurrence. We present 5 patients treated with stereotaxically guided instillation of intracystic colloidal radioactive phosphorus. Three patients were female. Age ranged from 5 years to 46 years (mean of 21.8 years) at the time of intracystic treatment. Two patients were treated at initial presentation and 3 at recurrence (two at first recurrence and 1 after 2 recurrences). Patients were treated using framed stereotaxy. After application of the head frame, an MR scan was obtained, cyst volume calculated, target chosen, and radioactive phosphorus injected into the cyst. The dose calculation will be described. All patients experienced both symptomatic and radiographic improvement within weeks of injection. With mean follow-up of 23.8 months, no patient has evidence of tumor growth. These results suggest that intracystic injection of colloidal radioactive phosphorus is an effective treatment for cystic craniopharyngioma, both at presentation and at recurrence. 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. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

introduction The management of cystic craniopharyngiomas in children continues to evoke considerable controversy. This study evaluates our practice of maximal tumor resection, rather than solely addressing the cystic component.

methods 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 pterional craniotomy in 9 patients, subfrontal in 7, orbitozygomatic in 3, and transsphenoidal in 2. Follow-up ranged from 1 to 9 years (median 2.5 years), and included at least one post-operative MRI.

results 15 patients (71%) had gross total resections, 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 (95%), panhypopituitarism in 16 (76%), visual deficits 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

Chan Roonprapunt, MD, PhD; Rick Abbott, MD; Karl Kothbauer, MD; Fred Epstein, MD; George Jallo, MD (New York, NY)

introduction We reviewed our experience with intrinsic gliomas of the tectal plate 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 intra-axial 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 signs of increased intracranial pressure caused by obstructive hydrocephalus at the level of the tectum. All patients underwent a CSF diversionary procedure: fourteen (45%) had indwelling ventricular catheters alone; eight (26%) had endoscopic third venticulostomies; and six (29%) had a combination of both procedures. All histological samples obtained from the biopsied patients (7/31) revealed low grade astrocytomas. There were no mortalities within the complete follow up (mean 10.7 years) group of 24 patients. Patients with radiographic gadolinium enhancement more often experienced progression in their disease.

conclusion Clinical follow up has revealed that the natural history of these tumors is primarily a slow relatively benign and indolent course. 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.

34. Recovery of Cranial Nerve Function Following Surgery for Medullary Brainstem Tumors

George I. Jallo, MD (Baltimore, MD); Tania Shiminski-Maher, NP; Linda Velasquez, MS; Karl Kothbauer, MD; Rick Abbott, MD (New York, NY)

introduction Although the optimal treatment for intrinsic focal tumors of the medulla remains controversial, many surgeons advocate radical surgery for these tumors. The postoperative surgical morbidity include 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 medulla 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 intrinsic medullary 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; Ralph Jandial, MD; Burak M. Ozgur, MD; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

introduction The approach to pineal tumors extending into the third ventricle is controversial. In infratentorial or interhemispheric +/- transtentorial approaches the anterior/anterolateral region is difficult given the angle of the approach, anatomic and vascular restrictions. We suggest the use of the trans-choroidal approach to allow for aggressive resection of these tumors while diminishing potential complications.

methods A retrospective review of a series of 14 patients undergoing trans-choroidal approaches.

results Mean age was 43.4 months (14–98 mo.). There were 9 males. Transchoroidal approaches represented 13% of all approaches to this region. The lateral decubitus position was used in all cases. Pathology included astrocytoma in 2, ependymoma in 2, PNET in 7 and malignant germ cell tumors in 2 cases. Mean follow-up was 4 years. Patients were extubated at a mean of 0.6 hours (range=0–25 hours). EBL was 200.2 cc. ICU stay averaged 2.6 days and hospitalization 12.0 days. A cortical vein was sacrificed in 1 patient without compromise. Transient post-operative hemiparesis occurred in 3 patients. One patient had permanent compromise of his EOM's. Seven patients required CSF diversion following surgery. No patients had seizure activity. There was one wound infection and one ventriculitis, both treated with antibiotics. Wound compromise included a CSF leak in 2. CSW occurred in two.

conclusion The transchoroidal approach is well tolerated in children with low post-operative and long-term morbidity. It allows for a more extensive approach to pineal tumors while minimizing potential complications especially related to venous compromise.

36. The Malignancy of Atypical Teratoid Rhabdoid Tumors

Michael L. Chen, BA; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

introduction Atypical teratoid rhabdoid tumors (ATRT) represent a relatively newly-categorized neoplastic entity. They 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 ATRT. The median age was 61 months, and ranged from 40 to 80 months. Presenting signs and symptoms began, on average just over a month before diagnosis and included: headache (46%), nausea/vomiting (55%), lethargy (27%), seizures (27%), cranial nerve findings (46%), ataxia (18%), and long tract findings (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 brain irradiation in 5, and chemotherapy and craniospinal irradiation in 3. Five patients are alive, three have died, and three were lost to follow-up. The average time to death was 31 months and ranged from 16 months to 46 months. Among the surviving patients, the average length of follow-up is 32 months and ranges from 24 months to 40 months.

conclusion ATRT represents a malignant tumor, with rapid progression. Further study is necessary to determine efficacy of therapy.

37. Endoscopic Surgery for Intraventricular Brain Tumors in Patients without Hydrocephalus

Mark M. Souweidane, MD, FACS (New York, NY)

introduction Endoscopic surgery for patients with an intraventricular brain tumor, but without hydrocephalus is usually avoided due a relative inability to access the ventricular compartment, difficulty with intraventricular navigation, and risk of postoperative hydrocephalus. The experience of sixteen such patients who underwent endoscopic management of their brain tumor is reviewed.

methods Since December of 1995, 59 endoscopic neurosurgical procedures were performed for an intraventricular brain tumor. Of these patients, 16 had an intraventricular tumor without concomitant hydrocephalus and underwent either endoscopic tumor biopsy or resection. The medical records, the surgical technique, and the patient outcome are reviewed.

results Tumor location was categorized as third ventricular in 11 and lateral ventricular in 5. Stereotactic image guidance was used in 12 patients for ventricular cannulation while in 4 a free-hand technique was utilized. Ventricular insufflation 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 16; 13 had successful diagnostic sampling and 3 had complete resection of a colloid 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 intraventricular brain tumors in patients without hydrocephalus can be safely performed using a technique which includes stereotactic guidance, ventricular insufflation, and continuous intraventricular irrigation. The aforementioned technique satisfied the intended surgical goal in all cases, was uniformly safe and did not lead toward the development of hydrocephalus.

38. Atlanto-occipital Dislocation in Children: A Retrospective Study of Stabilization Techniques and Outcomes

Said Elshihabi, MD; George T. Burson, MD; Glenn T. Pait, MD (Little Rock, AR)

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 more readily and expeditiously with advanced neuroimaging 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 18 months to 17 years. All patients had a complete pre-operative neuro-diagnostic work-up (plain x-rays, CT, MRI). Each patient underwent an occipital-cervical fusion procedure using the inside/outside technique along with autologous bone graft (rib) as described by the senior author.

results All patients tolerated the procedure well. No patient required halo-fixation; only a cervical collar was used following surgery. Mean follow-up was 15 months (range 3 months–2.5 years). Outcome measures included appearance of graft healing on diagnostic imaging and functional performance. Four patients were independently ambulatory at 18 months, one patient died from pneumonia, two patients had complete quadriplegic injuries at presentation, and one patient had a residual hemiparesis.

conclusion We present a retrospective analysis on a particular treatment option for patients that 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 Findings

Scott Soleau, MD; R.Shane Tubbs, PhD, PA-C; Daniel B. Webb, BS; W. Jerry Oakes, MD (Birmingham, AL)

introduction 10.6% of our surgical series of patients with both Chiari I malformation and syringomyelia continued to have a significant syrinx following their first decompressive procedure. All but one of these had resolution of their syrinx after a second operation. We have analyzed this cohort to discern for possible radiologic or surgical findings that may aid in predicting which patients were less 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 syrinx following a second operation. Reoperatively, three had ventriculocisternal stents placed, one patient in whom the dura was not opened at first operation, a second operation revealed an arachnoid veil, one patient had scarring between the left and right PICA thus occluding the fourth ventricular outlet, and four patients underwent unilateral tonsillar coagulation. Two patients had small fourth ventricles. Four patients had grade III odontoid retroflexion and one of these failed to improve following their second operation. Two patients were noted to have caudal decent of the brain stem.

conclusion No one radiologic measurement 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 reoperative confirmation of a patent foramen of Magendie was made had resolution of their syringomyelia.

40. Scoliosis and Chiari I Malformations in Children

Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

introduction The identification of Chiari I malformations has increased in recent years, commonly during evaluation for scoliosis Treatment, however, remains controversial, and the expected success determinants unclear.

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 ages from 6 months to 18 years (median 12 years). Included were 39 girls (54%) and 34 boys (46%). All had hydrosyringomyelia 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 (70%) patients had total or near total resolution of the syrinx and 65 (89%) had a significant reduction in the syrinx with ascent of the cerebellar tonsils. Persistantly 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 mr imaging even in the absence of neurological signs and symptoms.

41. Posterior Fossa Decompression Without a Durotomy for Treatment of Chiari II Malformation

Prithvi Narayan, MD; Sarah Jost, MD; Jeffrey R. Leonard, MD; Matthew D. Smith, MD; Jeffrey G. Ojemann, MD; Tae Sung Park (St. Louis, MO)

introduction Hindbrain compression in Chiari II patients may be from bone and the atlantooccipital membrane rather than the dura. Furthermore, the dura mater in young children may be more distensible compared to adults. Posterior fossa decompression without a durotomy may be sufficient to relieve symptoms. Leaving the dura intact also decreases the risk of catastrophic hemorrhage from sinuses/lakes.

methods Over a 13 year period, 11 patients with symptomatic Chiari II malformations underwent decompression without a durotomy. The age range was 1 month to 5.5 years (mean 17.9 months). All patients had functioning shunts prior to surgery. Cervical laminectomy and division of the dural band was performed on all patients based on findings on pre-operative magnetic resonance imaging (MRI) and intraoperative ultrasound (US). 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 1. One patient had worsening of symptoms, despite initial improvement, due to bony regrowth and an enlarging syrinx, requiring a second decompression and duraplasty. There was no operative morbidity or mortality.

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

42. Dural Splitting Craniocervical Decompression: Reduced Operative Time, Hospital Stay and Cost with Equivalent Early Outcome

Nathan R. Selden, PhD, MD; Farhad M. Limonadi, MD; Susan R. Durham, MD (Portland, OR)

introduction Traditional practice for decompression of Chiari I malformations includes duraplasty, although good preliminary outcomes have been reported 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 craniocervical decompression. In patients with syringomyelia, an allograft duraplasty was utilized. In patients without syringomyelia, intraoperative ultrasonography confirmed adequate tonsillar decompression by lysis of periosteal bands at the foramen magnum and 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 12.4 months. Dural splitting decompression required significantly shorter average procedure time (99 vs. 169 minutes, P<.001), total operating room time (166 vs. 249 minutes, P<.001), length of hospitalization (3.0 vs. 3.8 days, p<.05), peri-operative charges (3,615 vs. 5,538 dollars, P<.001) and total hospital charges (7,705 vs. 9,759 dollars, p<.001) compared with the duraplasty group. 83% of dural splitting decompression patients and 89% of duraplasty patients experienced complete or significant resolution of all symptoms (p=NS). One duraplasty patient suffered from aseptic meningitis after hospital discharge. There were no complications in the dural splitting decompression group.

conclusion Dural splitting craniocervical decompression in pediatric Chiari I malformation without syringomyelia is safe, 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 craniocervical decompression is justified.

43. Withdrawn

44. Craniopagus Twins: Surgical Anatomy and Strategies for Separation

Samuel R. Browd, MD, PhD; Marion L. Walker, MD (Salt Lake City, UT)

introduction The separation of craniopagus twins is a complex undertaking which requires the reconstruction of many structures including neurovascular, dural, calvarial and cutaneous entities. The reproducible finding of a shared superior sagittal sinus (SSS) is amongst the most technically challenging issues faced during separation.

methods Various 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 SSS. Forced deep venous drainage allows one twin to receive the shared SSS and negates the need to reconstruct a SSS de novo 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-narcotic Analgesics in Children after Suboccipital Craniectomy

Matthew D. Smyth, MD (St Louis, MO); Jason T. Banks, MD; R. Shane Tubbs, PhD, PA-C; John C. Wellons, III, MD; W. Jerry Oakes, MD (Birmingham, AL)

introduction To evaluate the efficacy of a regimen of scheduled minor analgesics in managing postoperative pain in children undergoing intracranial procedures.

methods Postoperative pain scores were analyzed in two groups of children undergoing Chiari decompression, one group (A) receiving a scheduled regimen of minor oral analgesics (standing doses of acetominophen (10 mg/kg) and ibuprofen (10 mg/kg) alternating every 2 hours) and the other (B) receiving analgesics when requested.

results A total of 50 children underwent a standard occipital craniectomy: 25 receiving analgesics when requested (Group B), and 25 with a scheduled regimen of standing doses of analgesics (Group A). The pain scores were significantly lower in Group A for most of the postoperative period. Length of stay was shorter (2.2 vs 2.8 days), and narcotic and anti-emetic requirements were also decreased in this group. Patients diagnosed with spinal cord syringes had similar postoperative courses and also responded to scheduled minor analgesic dosing with improved pain scores.

conclusion A regimen of minor analgesics, given in alternating doses every two hours immediately after craniotomy and throughout hospitalization significantly reduced post-operative pain scores and length of stay in children undergoing suboccipital craniotomy. Narcotic and anti-emetic requirements were also decreased with this regimen. Application of this method of postoperative analgesia may benefit children and adults undergoing a number of similar neurosurgical procedures.

46. Complications of the Interhemispheric Transcallosal Approach in Children

Kevin Yu, MD; Burak M. Ozgur, MD; Henry Aryan, MD; Ralph Jandial, MD; Henry S. Meltzer, MD; Michael L. Levy, MD, PhD, FAC (San Diego, CA)

introduction Though complications related to the interhemispheric approach including hemiparesis, memory loss, and mutism 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 variables and Seizure, Hemiparesis and CSF diversion.

results There were 49 females (mean= 100.7 mos). Mean follow-up was 3.8 years. Patients were extubated at a mean of 0.6 hours. EBL was 278.2 cc. Patients spent an average of 3.7 days in the ICU and 19.0 days (1–221) in the hospital. Bridging veins were sacrificed in 38 patients (25 single, 13 multiple). Transient hemiparesis was documented in 33 patients (four permanent). A significant relationship between Operative Duration and Vein Ligation and Paresis–Short Term and Paresis–Long Term was found (p<0.01). 18 patients required CSF diversion. All had ventriculomegaly on presentation, as did 84% of the series. Age <4 years was strongly correlated with the postoperative hydrocephalus (p>0.01). 18 patients (17%) had seizures in the immediate post-operative period. The occurrence of seizures in the immediate post-operative period (24 hours) was significantly correlated to Amount of Irrigant or the combination Operative Duration/ Amount of Irrigant (p<0.01). There were 4 wound infections and 1 ventriculitis, all treated with antibiotics. There were 2 CSF leaks and 1 wound necrosis. Disorders of sodium balance occurred in 18%.

conclusion The interhemispheric transcallosal approach is well tolerated in children with a relatively low post-operative morbidity and lower long-term morbidity.

47. Treatment of Intraoperative Air Embolism in Posterior Fossa Surgery in Children by Central Line Placement—A Risk/Benefit Analysis

Kelly Scrantz, MD; Michael D. Taylor, MD; Fredrick A. Boop, MD; Robert A. Sanford, MD (Memphis, TN)

introduction Placement of central venous catheters for the treatment of air embolism has become widely accepted in pediatric anesthesia, with some authors suggesting that it is malpractice to perform a posterior fossa craniotomy without a central venous line. Our experience with routine placement 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 between 1985–2003 was performed at a single institution. From 1985–2000, all children were 1) operated upon in the prone position 2) had routine placement

of central venous/right atrial catheter and 3) were monitored for air embolus by precordial Doppler. In no instance was there clinical evidence of an air embolus, nor was one detected by precordial Doppler.

results During that time four major complications were attributable to central line placement. This included two pneumothoraces and two hemopneumothoraces, all requiring thoracostomy. From 2000–2003 central line placement has only been utilized in special circumstances.

conclusion Based upon this experience, the authors suggest that the risks of routine central venous line placement for posterior fossa craniotomy in the prone position outway the benefits. Specific instances in which we still advocate central venous access in children will be presented.

48. Transsphenoidal Transpalatal Myelomeningoencephalocystocoele Repair in a Newborn via a Transoral Approach

Luis F. Rodriguez, MD; Emun Abdu; Douglas J. Quint, MD; Steven R. Buchman, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

introduction Transsphenoidal encephalocoeles present in 1/700,000 live births, representing less than 5% of all basal encephalocoeles. Patients present with visual problems, endocrine dysfunction and/or CSF rhinorrhea. Surgical treatment carries a high degree of morbidity and mortality. We report a case of a transsphenoidal transpalatal myelomeningoencephalocystocoele treated via a transoral approach.

methods A newborn male with an in-utero diagnosis of a cleft lip was found to have a large mass in his oral cavity at birth. CT and MRI scans showed the optic tracts, pituitary stalk and gland, and part of the third ventricle and hypothalamus to be within the oral cavity. He underwent transoral approach for repair of the myelomeningoencephalocystocoelecoele.

results The child underwent transoral repair of the lesion at 6 days of life. All the structures within the myelomeningoencephalocystocoelecoele were elevated upwards into the anterior intracranial space, and the bony palate was reconstructed using the vomer. The patient had a transient episode of diabetes insipidous in the immediate post-op period which subsequently resolved. He is being evaluated for Growth Hormone deficiency but has no other endocrine abnormalities. His opthalmological exam is normal.

conclusion Transsphenoidal myelomeningoencephalocystocoelecoeles are very rare entities and there are few reports in the literature of lesions extending through the palate into the oral cavity. Attempted repair via a subfrontal approach carries a significant risk of morbidity and mortality. The transoral route provided a safe approach for repair of this lesion.

49. Use of a Compact Intraoperative Low-field Magnetic Imager in Pediatric Neurosurgery

Amer F. Samdani, MD (Baltimore, MD); Michael Schulder, MD; Jeffrey Catrambone, MD; Peter Carmel (Newark, NJ)

introduction The majority of investigations on the utility and indications of intraoperative magnetic resonance (iMR) imaging have been on adult patients. We report our initial experience with the mobile 0.12-Tesla PoleStar N-10 iMR imaging system in pediatric patients.

methods This system is easily moved in to position and attaches to a regular operating room table. We performed 21 procedures on 20 patients aged 2 months–18 years (mean 9 years). Treated lesions included low grade astrocytoma (5), craniopharyngioma (3), cortical dysplasia (3), hydrocephalus (2), and other (8).

results The procedures included 15 craniotomies, 2 shunts, and one each of the following surgeries: transsphenoidal, craniotomy/transsphenoidal, cranioplasty, and endoscopic biopsy and fenestration. The number of scans ranged from 2–5 with a mean of 3.2. T1-weighted images with contrast were acquired most often. Time added to the procedure was a combination of positioning and image acquisition. For the first ten patients, this additional time averaged 138 minutes, whereas in the last ten this decreased to 84 minutes. Preoperative and intraoperative images were adequate in all cases except one in which the signal-to-noise ratio was too high. Intraoperative imaging and navigation provided valuable information on the extent of resection and catheter placement. In eight patients it influenced the surgical strategy. No untoward events attributable to the system were encountered.

conclusion The low-field PoleStar N-10 iMR imaging system can safely assist pediatric neurosurgeons treating a variety of diseases. In addition to neuronavigation it provides information on extent of resection, real-time guided catheter placement, and avoidance of complications.

50. Intraoperative Neurophysiological Monitoring for Tethered Cord Surgery

Karl F. Kothbauer, MD (New York, NY)

introduction Neurophysiological monitoring of the functional integrity of axonal pathways and synaptic circuits during surgery for tethered cord release has made significant progress in the last decade.

methods Electrophysiological mapping of nerve roots is combined with continuous monitoring of motor, sensory and reflex pathways. Direct stimulation is used to identify nerve roots. Muscle responses are obtained from segmental target muscles and the external anal sphincter. Motor potentials (MEPs) are evoked by transcranial electrical motor cortex stimulation and recorded from the same target muscles. Responses are repeated once per second yielding real-time feedback of the integrity of the upper AND lower motor neurons. The bulbocavernosus reflex (BCR) is recorded from the external anal sphincter bilaterally after electrical stimulation of the penile/clitoral nerve. Interpretation of MEPs and BCR follows an all-or-none rule: present responses indicate intact functional integrity, absence or loss indicate decrease of motor function in the corresponding segment. Somatosensory evoked potentials (SEPs) from the tibial and the pudendal nerves are used as continuous monitoring of the afferent pathways. Interpretation is based on amplitude decrease or latency prolongation of cortical responses.

results The comprehensive neurophysiological monitoring was used in 60 patients during tethered cord release. Monitoring was feasible in all patients. There were no monitoring-related complications and no false-negative recordings.

conclusion Neurophysiological monitoring of the functional integrity of motor and sensory pathways, and local neural circuitry of the conus, together with direct neurophysiological mapping of neural structures provides complete, real-time and effective protection against surgery-induced neural injury during tethered cord surgery.

51. Experience Using the Neodynium: Yttrium-Aluminum-Garnet (Nd:YAG) Laser in Pediatric Neurosurgery

James K. Liu, MD; John R.W. Kestle, MD, MSc; Douglas L. Brockmeyer, MD; Carolyn M. Carey, MD; Marion L. Walker, MD (Salt Lake City, UT)

introduction The authors present their 14-year experience with the Nd:YAG laser and discuss its surgical applications in pediatric neurosurgery.

methods A review of the Primary Children's Medical Center Laser Log from 1989 to 2003 revealed 318 pediatric neurosurgical cases in which the Nd:YAG laser was used. The patient charts and laser log data sheets of these 318 cases were retrospectively reviewed.

results The Nd:YAG laser was used in 318 operative procedures: 201 tethered cord releases, 41 endoscopic ventricular procedures for cyst or septum pellucidum fenestration, 14 syringo-subarachnoid shunts, 26 brain tumor resections, 14 spinal tumor resections, 21 lipomyelomeningocele repairs, and 1 myelomeningocele repair. The age of the patients ranged from 0 days to 26 years (mean: 8.4 years). The laser offered precise cutting and dissection with minimal damage to adjacent tissue, which was suitable for removing tumors of the brain and spinal cord. Fiberoptic delivery of the laser was useful for endoscopic procedures. The ability to coagulate tissue in a fluid-filled environment was ideal for intraventricular procedures. There were no complications of hemorrhage, thermal damage, worsening neurological function, or death related to laser use.

conclusion The Nd:YAG laser is a safe and effective operative tool in the armamentarium of the pediatric neurosurgeon in managing a variety of surgical pathologies. In our experience, it has been particularly useful in performing tethered cord releases, brain and spinal tumor removal, and endoscopic intraventricular surgery. The precautions necessary for safe application of the Nd:YAG laser will be described.

52. Surgical Experience: Did it Affect the Results of the Endoscopic Shunt Insertion Trial?

Paul Klimo, MD, MPH; John R.W. Kestle, MD, MSc (Salt Lake City, UT); James M. Drake, MD (Toronto, ON, Canada)

introduction A recent prospective multicenter randomized trial found no advantage to endoscopic ventricular catheter placement compared to non-endoscopic placement. Since neuro-endoscopy is a learned skill, the negative result might have been the result of inexperience on the part of the participants.

methods Children less than 18 years old undergoing their first shunt placement were randomized to endoscopic or non-endoscopic shunt insertion. The primary outcome was shunt failure (including obstruction, overdrainage, loculation and infection). Eligibility and outcome were blindly adjudicated. Shunt survival and catheter position were evaluated as a function of case volume.

results Sixteen pediatric neurosurgical centers contributed 393 patients between September 1996 and November 1999. One-year shunt survival was 58% in the endoscope group and 66% in the non-endoscope group (log rank=2.92, p=0.09). Ventricular catheters, which at surgery were thought to be away from the choroid plexus, were confirmed to be there on imaging in 67% of endoscopic and 61% of non-endoscopic shunt placements. There did not appear to be a strong relationship between shunt survival or catheter position and center volume overall or in either study group.

conclusion The lack of benefit of endoscopic insertion of the initial ventriculoperitoneal shunt in hydrocephalic children cannot be attributed to a lack of surgical experience at the time of the trial.

53. Posture Independent Piston Valve: A Practical Solution to Maintaining Stable Intracranial Pressure in Shunted Hydrocephalus

Joshua E. Medow, MD; Christopher C. Luzzio, MD (Madison, WI)

introduction Shunt valves are intended to maintain physiologic intracranial pressure (ICP). A variety of mechanisms have been designed to accomplish this goal but have had limited success. Siphoning in particular has been a problem not effectively solved in proposed or manufactured valves. Poor control of ICP results in headache/neurologic disturbances, decreased cognition, shunt malfunction, slit ventricles, subdural hematomas, decreased cranial volume, and maldevelopment. We describe a prototype valve that we have machined and tested ex-vivo that actuates based on ICP alone regardless of the presence of a siphon.

methods The PIPV was anchored to a graduated reservoir. Opening pressure was measured by noting the fluid level in the reservoir when the piston moved. Measurements were made with a

40cm and a 120cm fluid filled siphon tube (1.3mm standard distal catheter) to simulate upright posture. Recumbent posture was simulated without the presence of a siphon.

Results: Opening Pressure+Siphon: 14cmH2O

Opening Pressure+40cm Siphon: 14cmH2O

Opening Pressure+120cm Siphon: 14cmH2O

conclusion The PIPV was triggered only by the pressure head demonstrating proof of principle of the actuating mechanism. When downsized, resistance within the valve should decrease the leak rate to <8ml/hr. The PIPV is a purely mechanical device that has practical application in the treatment of hydrocephalus.

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

Stephen L. Huhn, MD; Yun Yung, BS; David Juan, BS; Samuel Cheshier, MD, PhD; Victor Tse, MD, PhD (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 may therefore have stem-like properties.

methods Tumor tissues were collected from the operating room with an approved IRB. Cells were dissociated and labeled with fluorochrome-coupled antibodies against a panel of markers: anti-CD133-PE, anti-CD24-FITC, anti-CD34-APC, anti-CD45-APC-Cy7, and anti-MHC class I. Cells were sorted and analyzed with fluorescence-activated cell sorting technique. Cells with putative neural stem cell phenotype (CD133+/ CD24-/CD34-/ CD45-) were selected and propagated in stem cell or serum enriched media. The cellular growth patterns and morphology were recorded in addition to the degree of glial and neuronal marker expression (glial fibrillary acid protein and beta-tubulin III) by confocal microscopy.

results Two out of the five pediatric brain tumors collected contained populations of CD133 positive cells. The CD 133+ cells were identified in an astroblastoma and a malignant teratoma. Neither the germinoma nor the two pilocytic astrocytoma specimens were found to have CD 133+ cells. The majority of the CD133+ cells carried the putative phenotypic marker profile of neural stem cells: CD133+/CD24-/CD34-/CD45-. When isolated and placed in culture, these cells formed cytospheres 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 significance of neural stem cells within pediatric brain tumors may have important overlap with developmental biology and neuro-oncogenesis.

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

Erika B. Mark, BS; Giuseppe Occhiogrosso, MD; Mark A. Edgar, MD; Ira J. Dunkel, MD; Mark M. Souweidane, MD (New York, NY)

introduction Interstitial infusion of Carmustine (BCNU) into the rat brain stem in conjunction with systemic administration of O6-Benzylguanine (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 a 24-h infusion of BCNU (Volume of infusion [Vi] 200 µl) at its maximal concentrated dose [3.3 mg/mL] in 5% dextrose water. Six additional rats underwent 24-h infusion of BCNU preceded by an intraperitoneal (I.P.) injection of O6-BG at a dose of 50mg/Kg. Serial neurological examinations were performed on all animals. Histologic 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 cavitary lesions (ranging from 20 to 250 µm) containing variable numbers of macrophages or neutrophils consistent with an inflammatory response. These finding were limited only to the cannula site and no changes beyond the region of the cannula tract were found. There were no other changes in the brain stem indicating any histological evidence of injury.

conclusion These findings indicate that interstitial infusion of BCNU into the brain stem in conjunction with systemic administration of O6-BG is safe in a small animal and may serve as a potential investigative strategy for children with diffuse pontine gliomas.

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

Janet M. Miller, BS; James P. McAllister, II, PhD (Detroit, MI)

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 ventriculo-subcutaneous shunts in 15 day old H-Tx rats with severe congenital hydrocephalus, sacrificed these animals 3 or 8 weeks later, and processed tissue from parietal (PC) and occipital (OC) cortices for glial fibrillary acidic protein (GFAP) levels and GFAP immunohistochemistry.

results Preliminary data indicate that, beginning at 12 days of age, GFAP protein levels rose 196% (PC) and 350% (OC) as untreated animals became severely hydrocephalic. All shunted animals exhibited markedly reduced ventriculomegaly and were normal neurologically with no malfunctions or infections. At 3 weeks post-shunt, GFAP protein decreased to 13% above (PC) and 37% below (OC) age-matched controls. At 8 weeks post-shunt, GFAP protein decreased to 13% below (PC) and 50% above (OC) age-matched controls. Immunohistochemistry revealed a similar pattern of GFAP changes, i.e. increases throughout the cortical mantle beginning at 12 days of age that returned to normal after shunting. In OC, the increase in GFAP-immunoreactivity after long-term recovery was generally localized to the remaining periventricular white matter, which was quite sparse, and superficial layers of the cortex.

conclusion These results suggest that reactive astrocytosis may be reduced initially after CSF drainage and can persist at near normal levels with protracted recovery periods.

57. Cytokines IGF-1, IGF-2, and TGF-B1 in a Congenital Hydrocephalus Rat Model

Frances W. Morgan, PhD; Jennifer A. Stewart, MS; Allison N. Smith, BS; Jogi V. Pattisapu, MD; Roy W. Tarnuzzer, PhD; Wade's Center for Hydrocephalus Research, ORHS; Pediatric Neurosurgery (Orlando, FL)

introduction Complex signaling mechanisms of growth factors and cytokines are tightly regulated. An imbalance of these critical biomolecules may cause an increase of CSF accumulation in hydrocephalic brains.

methods Protein levels for IGF-1, IGF-2 and TGFß-1 in H-Tx (hydrocephalus model) and Sprague Dawley rat whole brains were evaluated on prenatal (E16-E20) and postnatal (D1, D3, D5 and D10) matched time-points using indirect ELISA assay.

results IGF-1 in H-Tx whole brain were increased in H-Tx over SD on E17 but were less in H-Tx on E18 and remained lower than SD thru E20 and postnatally. IGF-2 was lower in H-Tx than SD on E16 and E17, but were approximately equal in H-Tx and SD whole brain until postnatal D3. Subsequently, significant decreases were found in H-Tx (normal) and HC (affected H-Tx) relative to SD. TGFß-1 increases were seen in H-Tx on E16-E18 with decreases found on E19 and E20. TGFß-1 in HC was lower postnatally relative to SD and H-Tx on all days.

conclusion IGF-1 and IGF-2 are expressed prenatally in the mammalian brain, and stimulate proliferation of neuronal and glial precursors and their phenotypic differentiation. IGF-2 is primarily expressed in tissues that contact CSF, such as the choroid plexus and meninges, and the ubiquitous cytokine, TGFß-1 is known to affect putative compensatory biological mechanisms in the postnatal H-Tx rats. Growth factor and cytokine alterations are involved in extracellular matrix (ECM) development and cellular maturation and migration. Identifying prenatal growth factor alterations will lead to a better understanding of the complex molecular mechanisms of hydrocephalus.

58. Death Receptor Ligands and Decoy Receptors in Pediatric Medulloblastomas

Richard C. E. Anderson, MD; Daniel W. Fults, MD; John R. W. Kestle, MD, MSc; Douglas L. Brockmeyer, MD; Marion L. Walker, MD (Salt Lake City, UT); David E. Anderson, PhD (Davis, CA)

introduction Numerous cytokines and death receptor ligands can arrest cell proliferation or induce apoptosis in a wide variety of tumors, including pediatric medulloblastomas (MEDs). We hypothesize that 1) the presence of decoy receptors or down-regulation of receptors implies that signaling through these receptors normally antagonizes tumor cell growth or survival and 2) modulation of these receptors is due to immune pressure created by tumor infiltrating lymphocytes (TILs).

methods CD4+ TILs were isolated from an ex vivo GBM tumor specimen using magnetic microbeads. Isolated T cells were expanded with PHA/allogeneic PBMC stimulation and subsequently with autologous tumor cells. T cell lines were divided and tested in duplicate against anti-CD3 mAb (1µg/ml) or left unstimulated. Culture supernatants were collected after 48 hours and tested for the presence of IFN-? and IL-13 using ELISA assays.

results The vast majority of T cell lines expanded from an ex vivo GBM specimen (11 of 12) produced IL-13 (3070 +/- 2818 pg/ml) after anti-CD3 mAb stimulation; fewer lines (6/12) secreted significant levels of IFN-? (2767 +/- 3426 pg/ml).

conclusion The overwhelming majority of GBMs uniquely up-regulate a non-signaling decoy IL-13 receptor. Our data strongly support our contention that factors secreted by TILs (IL-13) can force tumor cells to modulate cell surface receptors (decoy IL-13R). We are conducting investigations to determine if these mechanisms also influence pediatric MEDs, and we believe that a similar study will suggest novel immunotherapeutic strategies specifically for the treatment of pediatric MEDs.

59. Myelomeningocele: Characterization of a Surgically Induced Sheep Model and its Similarities and Differences to the Human Disease

Cornelia S. Von Koch, MD, PhD; Nathalie Compagnone, PhD; Shinjiro Hirose, MD; Suzanne Yoder, MD; Diana L. Farmer, MD (San Francisco, CA)

introduction To determine how closely the surgically induced sheep myelomeningocele (MMC) model resembles the human disease.

methods A MMC-like lesion was created surgically in 16 fetal sheep at 75 days' gestation. Five died, 7 underwent no fetal repair, and 4 were repaired at 100 days' gestation. Repairs included Bioglue (2), DuraGen™ and Bioglue (1), and a 2-layer surgical repair (1). Two controls underwent unrelated fetal surgery at 110 days' gestation. MMC sheep were delivered at term and allowed to survive for up to 17 days to analyze their mental status. Upon sacrifice, all lambs were analyzed for hindbrain herniation, hydrocephalus, and other aspects of myelomeningocele seen in humans.

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 fewer axons were seen in the fimbria-forniceal pathway in unrepaired MMC animals compared with controls, suggesting impaired fiber tract development. No animal developed split sutures, Lueckenschaedel, syringomyelia, quadrigeminal cyst, dysgenesis/agenesis of the corpus callosum, polymicrogyria, subependymal gray matter heterotopia, or an enlarged massa intermedia.

conclusion The sheep MMC 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, decrease in mental status, and cortical dysgenesis seen in humans. Supported by NRSA F32 HD42921-01 (CvK).

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

David McAuley, FRCS; Essam El Gamal, FRCS; Peter Richards, FRCS; Steve Wall, FRCS (Oxford, United Kingdom)

introduction Sagittal synostosis is often considered a cosmetic issue only. It is our belief that 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 subset of patients who have had ICP monitoring performed.

methods Patients with isolated non-syndromic primary sagittal synostosis were identified from the registry of the Oxford craniofacial 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 craniofacial team. All patients are monitored for 24–48 hours. For this study, retrospective 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 20mmHg, and on the sleep trace up to 4 'B-type' waves to 30mmHg 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 recordings 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.

61. Transcranial Doppler Evaluation of Middle Cerebral Artery Blood Flow During Pi Procedure in Children with Sagittal Synostosis

David J. Donahue, MD; Deepak Sobti (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 foreshortening. Anecdotal reports have even reported demonstration of flow-reversal during and after foreshortening. To address concerns regarding cerebral blood flow, we sought to determine whether flow reversal, as revealed by transcranial doppler (TCD), is a concomitant of cranial shortening during pi procedures performed in our institution.

methods Forty-five children with sagittal synostosis underwent intraoperative TCD (transcranial doppler) evaluation during their pi procedure. We attempted to record middle cerebral artery flow velocity bilaterally, employing standard insonation techniques at the following surgical stages: 1. After craniectomy ("baseline"); 2. Upon anterior-posterior cranial shortening ("acute"); and 3. Before closure ("delayed"). Values for pCO2 and mean systemic blood pressure were also measured and recorded.

results We were able to insonate 44 children aged 3.5 to 17 months (mean age 5.73 mos; median age 5 months). Calculated baseline RI was 0.743 +.096 (range 0.485–0.970); average acute RI was 0.789 +0.090 (range 0.570–.945); average delayed RI measured 0.751 + 0.082 (range: 0.545–0.915). Change of RI associated with anterior-posterior cranial shortening proved to be statistically insignificant, and flow-reversal (i.e. RI = 1.000) was not encountered. Similarly, BP 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 who are hemodynamically stable during surgery.

62. Management of Sagittal Craniosynostosis:nbsp; Seven Year Experience in 134 Patients Using Endoscopic Wide Vertex Craniectomies and Bilateral Barrel Stave Osteotomies

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

introduction Endoscopic techniques were introduced seven years ago for the management of patients with sagittal synostosis. Presented herein, are the results of treating 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 via two small incisions near the lambda and vertex. With endoscopic assisted visualization, a wide vertex craniectomy with bilateral temporal and parietal barrel stave 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 craniectomy width was 5.4 cm and the length 10 cm. Estimated blood loss mean was 29.5 cc with a range between 5 cc and 150 cc. The mean 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 fevers. 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 venous sinus injuries.

conclusion Our long term results indicate that patients who achieve normocephaly at 18 months of age, maintained their head shape longitudinally. Detail anthropometric measurements and CT scans will be presented. Excellent results, extremely low morbidity, 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 Slit Ventricle Syndrome

Albert E. Telfeian, MD; Juanita Celix, BS; Leslie N. Sutton, MD (Philadelphia, PA)

introduction Slit ventricle 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 2002 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 subtemporal 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 preceded by proximal shunt malfunction and failed revision, 7 were anterior expansions, 5 were posterior expansions, and 1 was a total expansion. Post-operative and follow-up imaging showed small non-collapsed ventricles in all patients. Cosmetic outcomes were considered excellent (no obvious deformity) in 6 patients and good (minimal deformity) in 3 patients.

conclusion In pediatric patients with SVS and acute intracranial hypertension in the setting of shunt malfunction with failed shunt revision, emergency cranial vault reconstruction can be utilized with good therapeutic and aesthetic outcomes.

64. Expanded Strip Craniectomy and Postoperative Molding Helmet for Scaphocephaly: Patient Selection Factors in Outcome

Howard J. Silberstein, MD, FACS; Jeffrey M. Tomlin, MD; Stephen J. Vega; Lan B. Hua (Rochester, NY); Joseph E. Losee (Pittsburgh, PA)

introduction This study represents a retrospective analysis to determine if Expanded Strip Craniectomy and Helmet Therapy (ESCHT) is more effective than Expanded Strip Craniectomy without Helmet Therapy (ESC) or Calavarial Vault Remodeling (CVR). We additionally examined patient factors which influenced outcome of ESCHT patients.

methods Patients met inclusion criteria with a diagnosis of Sagittal Synostosis (SS) and operative treatment with ESCHT. Eight patients were evaluated using institutional records and office charts. 3D computed tomography (CT) scans were reviewed by a neuroradiologist and a craniofacial surgeon, with Cranial Indices (CI) measured for all patients and compared to published cohorts of ESC and CVR patients. Helmet compliance, OR time, and age were also examined for their effect on postoperative CI.

results The mean age was 4.3 months, and preoperative CI for ESCHT was 69, improving to 75 (p=0.0078). Preoperative CI of ESC patients was 67 without statistical difference between cohorts, improving to 71 (p=0.0016). CI change was not statistically different between ESCHT and CVR (p=0.41). At one year, HT compliance showed no statistically significant increase in CI, but younger age did trend higher.

conclusion His study shows statistically significant improvement in CI for ESCHT patients with SS compared to ESC, but not for CVR. Given the blood loss, operative time and critical care requirements of CVR, ESCHT appears to be a safe alternative. Additionally, HT and age influenced CI for ESCHT patients, though not with statistical significance given our cohort size. Further research should be pursued to elucidate this trend.

65. Visual Field Testing in Deformational Plagiocephaly

Paul C. Francel, MD, PhD; Sterling L. Cannon, MD; Aaron Fortney, MD; Michael Siatkowski, MD (Oklahoma City, OK); William J. Feuer, MS (Miami, FL); Warda 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 perimetry in the horizontal plane was performed. Both hemifield asymmetry of >/= 20 degrees and a decrease in hemifield values of >/= 20 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 constriction 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 normative data (p=0.004). The data showed a trend toward delayed progression of visual field compared to the standard curve.

conclusion 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 sequelae and requires treatment for cosmetic purposes only.

notes

new for 2003!

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

Presenters will submit their posters in an electronic format, which will be viewed during the meeting on monitors in the exhibit hall.

This visually stimulating twist on the traditional form of poster presentations will be an exciting addition to the AANS/CNS 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. 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 electromagnetic fields (e.g., MRI), effects of small magnetic fields are not well known. We present a case where playing with commercially available 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 codman-medos anti-siphon programmable valve set at 70 cm H2O. He subsequently presented with 2 days of increasing headaches, nausea, and vomiting.

results Head CT demonstrated marginally increased ventricles and shunt 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 reprogrammed back to 70 cm H2O, but without clinical improvement. In the O.R., 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 codman-medos programmable valves with the magnets revealed significant alterations of pressure settings even after minimal exposure.

conclusion 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 Caudate-Putamen Nuclei of the Mouse Brain

Shinya Yamada, MD, (Kanagawa, Japan); Ignacio Gonzalez-Gomez, MD; J. Gordon McComb, MD; Walter Laug, MD, (Los Angeles, CA)

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

methods The sterotactic injection of 0.5 to 5 ul of indigo carmine over 5 to 40 minutes into the caudate/putamen nuclei of the mouse was done followed by sacrifice and examination of the brain injection site. 1 ul containing 105 U87MG glioma cells were stereotactically implanted into the caudate/putamen nuclei over 20 minutes. The animals were sacrificed from one hour to 63 days after implantation and the brain examined and tumor size measured.

results An injection of 1 ul of indigo carmine over 20 minutes produced a spherical deposit of dye within the caudate/putamen nuclei. Larger volumes of indigo carmine or shorter injection times resulted in dye spreading along the injection tract or into the ventricles or subarachnoid space. These obtained parameters were used to inject and confine the glioma cells to the caudate/putamen nuclei in 30 mice. The tumor cells appeared viable an hour after injection. However, by day three, considerable necrosis of tumor cells was noted, the effects of which resolved by day five. On day 6, the injection site was comparable to that of one hour. Tumor volume doubling time was 10 days for the first 5 weeks, subsequently decreasing to five days.

conclusion The technique described allows the accurate and reproducible introduction of tumor cells into the mouse brain. This should reduce the intragroup variability, allowing assessment of outcome with fewer number of mice.

103. Differential fMRI 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)

introduction Neurosurgical procedures involving dominant hemisphere frontal and temporal cortex can put language function at risk. In the present study, we adapted a recently-developed fMRI protocol for eliciting robust activity in anterior and posterior language regions of individual healthy young adults for studying a bilingual 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 left temporal lobe 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 infrontal and temporal regions for both the previously-established language protocol (in English) and a novel version (using Spanish materials). These areas are consistent with previously reported results in healthy controls. The English materials elicited enhanced activation posterior to the tumor for English relative to the Spanish materials.

conclusion 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 intra-operative 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 bilingual children who are fluent speakers of both English and Spanish.

104. Use of MRI for Routine Evaluation of Shunted Hydrocephalus in Children

William W. Ashley, MD, PhD, MBA; Robert McKinstry, MD, PhD; Jeffrey R. Leonard, MD; Matthew Smyth, MD; Prithvi Narayan, MD; Tae Sung Park, 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 been shown to rapidly provide 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 evaluated using rapid MRI. Radiologist reports were reviewed to assess the ability of a radiologist to visualize the shunt catheter. Two residents were asked to retrospectively localize the ventricular catheter and assess image quality.

results We included 22 patients with an average age of 5 years. All studies were performed without sedation. The average study duration was 25 minutes. The radiologist, an ER and neurosurgical resident could consistently localize the catheter. Image quality was good.

conclusion Rapid MRI yields reliable visualization of the ventricular catheter and offers superior anatomic detail while limiting radiation exposure. Our protocol is rapid and each image is acquired separately. Therefore motion artifact is reduced and the need for sedation is eliminated. We recommend the use of rapid sequence MRI for non-emergent evaluation of pediatric hydrocephalus.

105. Non-Communicating Spinal Extradural Arachnoid Cyst Causing Spinal Cord Compression in a Child

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

introduction Extradural arachnoid cysts in the spine are uncommon in the pediatric population. These lesions have been 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 cistern.

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 laminoplasty for an en bloc resection of the spinal extradural arachnoid cyst. Intraoperatively, the dura was intact and there was no evidence of communication intradurally into 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; Michael H. Handler, MD (Denver, CO); Cynthia Solomon, CEO (Sonoma, CA)

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 printable 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 wherever they find themselves ill with symptoms suggesting a shunt malfunction.

107. Leptomeningeal Cyst Development After Endoscopic Craniosynostosis Repair

Henry E. Aryan, MD; Hal S. Meltzer, MD; Gregory G. Gerras, MD; Rahul Jandial, MD; Michael L. Levy, MD, PhD (San Diego, CA)

introduction Endoscopic craniosynostosis repair has been suggested 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

child who developed a leptomeningeal cyst after endoscopic craniosynostosis repair, presumably from iatrogenic dural laceration.

methods A 5-month-old female with sagittal synostosis underwent endoscopic repair. The procedure was uneventful and initial results were acceptable. The authors performed a chart review of their experience with both endoscopic and traditional repair. Furthermore, a literature review was performed.

results Five months after surgery, the child developed a pulsating forehead mass. Neuroimaging confirmed leptomeningeal cyst. At time of reoperation, a dural defect lying under a previous osteotomy site was identified. After uneventful repair and follow-up of over one year, the child has done well without the development of seizures or recurrence of her cyst.

conclusion Unrecognized dural injury combined with overlying osteotomy in an infant can result in development of leptomeningeal cyst. Care must be taken at time of endoscopic extradural surgery to recognize any inadvertent dural tears and perform direct repair at the time of initial occurrence. Facility with and use of an appropriate endoscope is essential to safe performance of minimally invasive craniosynostosis surgery. To prevent long-term sequelae such as development of a seizure disorder, knowledge of this potential complication and its expeditious repair is essential.

108. Multiple Cerebellar Pilocytic Astrocytomas in Neurofibromatosis Type I

Edward R. Smith, 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 the 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 pathophysiologic mechanism underlying the development of these lesions.

109. Withdrawn

110. Frameless, Pinless Stereotactic Neuroendoscopy in Children

John F. Reavey-Cantwell, MD; Frank J. Bova, PhD; David W. Pincus, MD, PhD (Gainesville, 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 beanbag device, for use with frameless neuronavigation. We have applied this technique to seven patients (2 females, 5 males; age range 2 months 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 unsuitable anatomy. The system provides good immobilization and is simple as well as inexpensive. 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 Disconnective Hemispherectomy in Pediatric Epilepsy

Sandrine N. de Ribaupierre; Roy T. Daniel (Lausanne, Switzerland); Giovanni Broggi, MD (Milano, Italy); Jean-Pierre Farmer, MD; Jose L. Montes, MD (Montreal, PQ ,Canada); Kathleen Meagher-Villemure, (Lausanne, Switzerland)

introduction Hemispherectomy has been performed for over 50 years and the complications have changed with introduction of newer surgical techniques. Disconnective 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 disconnective hemispherectomy performed at Montreal, Milano, Vellore and Lausanne. Classical functional hemispherectomy was performed in 17 while peri-insular hemispherotomy 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 (3.6%), hydrocephalus (5%), infection (1.8%), and remote hemorrhage (1.8%). 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 hydrocephalous 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 disconnective techniques of hemispherectomy, superficial cerebral haemosiderosis is no longer a complication and the rate of hydrocephalous has also significantly reduced following these functional techniques. We were not able to show a relation between etiology and complications.

notes

poster index

poster abstracts

112. Withdrawn

113. "Cookie Craniotomy" for Acute Subdural Empyema

Yoon S. Hahn, MD, FACS; Mary Ann Collins, MD; Tamir Hersonskey, MD; Laura Burokas, RN, MS, PNP (Chicago, IL)

introduction Despite recent advances in medical and surgical treatment for paranasal sinusitis, sinogenic intracranial suppuration remains a life-threatening problem and includes conditions such as subdural empyema (SE) cerebritis and meningitis. In spite of proper treatment, SE is a life-threatening infection with serious neurological consequences in 30% of patients and 20% mortality in most of the series. Because of cerebral edema that occurs with widespread infection, efficient drainage of the empyema is hampered. A variety of surgical interventions have been suggested. These include wide craniotomy/craniectomy, burr hole drainage or small sized craniotomy ("cookie craniotomy") and limited craniotomy/craniectomy with or without a bone flap.

methods "Cookie craniotomy" was prospectively performed in 12 children with SE. Ages ranged from 4 months to 16 years (average 9.4 years). All were treated for sinusitis with antibiotics prior to surgery. A craniotomy was performed to drain subdural pus. "Cookie Craniotomy" (3cm diameter) was performed emergently to evacuate SE and the lesion was thoroughly irrigated with saline solution. After thorough evacuation of pus, the dura was approximated and the bone flap was anchored in place with 2-0 vicryl sutures in all 12 patients. Five patients required a second "cookie craniotomy" at a different site 1–2 weeks later.

results 10 children improved completely without any neurological deficits, two children are receiving physical therapy for mild residual hemiparesis. There were no mortalities. All 17 bone flaps were replaced without any adverse consequences.

conclusion "Cookie Craniotomy" was found to be efficacious for the drainage of subdural pus and irrigation of suppurative debris.

114. Cranial Expansion Based on an Occipital Bandeau

Lenwood P. Smith, Jr., MD, FA; Jean-Francois Lefaivre, MD, FRCSC (Columbia, SC)

introduction Craniotomy for cranial expansion is an infrequent procedure in a craniofacial practice. We describe our experience with three children who underwent a cranial expansion based on occipital and sagittal bandeaux oriented at right angles.

methods Biparieto-occipital craniotomies are made leaving a mid sagittal strip. A three-centimeter wide occipital bandeau is cut from asterion to asterion. The bandeau is expanded in a transverse dimension by interposition of a bone graft. The remaining occipital bone is cut with barrel stave osteotomies and out fractured. 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 craniotomy bone flaps will be fixed.

results Three patients were treated. One male six years old had slit ventricle syndrome. A two year old female had Crouzon's syndrome and intracranial hypertension. Another two-year-old female had multiple suture synostosis and had anterior and posterior procedures at two sittings. 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 the largest expansion, carries the least cosmetic risk, is quantifiable preop, is rigid and allows removal of any posterior midsagittal keel that may be present. Our technique is similar to but different from procedures previously described by Salyer and another by Carson.

115. Cerebral Aqueductoplasty through a Foramen Magnum Trans-Fourth Ventricle Approach

Jason Sansone, BS; Bermans J. Iskandar, MD (Madison, WI)

introduction Advances in endoscopic technology have afforded the neurosurgeon new avenues in the treatment of hydrocephalus, rendering many patients shunt independent, and thus averting shunt complications and failure. Cerebral aqueductoplasty has been popularized as an effective treatment for membranous and short stenosis of the aqueduct of Sylvius. Traditionally, the procedure has been performed in a similar approach to third ventriculostomy, whereby the endoscope enters paramedially near the coronal suture, then descends through the lateral ventricle, foramen of Monro, 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 cerebral 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 cerebral aqueductoplasties. There were no surgical complications. At an average of 8.7 weeks post-operative follow-up, all patients demonstrated resolution of pre-operative symptoms, and two patients reported mild transient vertical diplopia. One patient developed recurrent stenosis of the aqueduct twice, requiring the placement of an aqueductal 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 stenosis of the cerebral aqueduct.

116. Endoscopic Management of Quadrigeminal Cistern Arachnoid Cysts

Sean M. Lew, MD; Rick Abbott, MD (New York, NY)

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 review the results of four patients treated endoscopically at our institution for symptomatic quadrigeminal plate arachnoid cysts associated with hydrocephalus.

results Patients ages ranged from 6 months to 19 years. All patients were treated endoscopically with both a third ventriculostomy and a ventriculo-cystostomy. The mean follow-up period is 5.0 years. Two of the four patients experienced both radiographic improvement and symptomatic resolution after surgery and remain shunt-free. One patient required a redo ventriculo-cystostomy 9 months after his initial surgery and subsequently has done well and remains symptom-free. One patient experienced closure of both her third ventriculostomy stoma as well as the ventriculo-cystostomy stoma, despite repeat attempts at both endoscopic and open fenestrations. She ultimately required a cystoperitoneal shunt and has done well with this management. There were no complications related to treatment.

conclusion Combined endoscopic third ventriculostomy and ventriculo-cystostomy is an acceptable treatment modality for quadrigeminal plate arachnoid cysts with associated hydrocephalus. Treatment in this manner can often avoid open surgery and shunt-dependency.

117. Intracellular and Extracellular Water Imaging of the Brain Using Magnetic Resonance Imaging

Shinya Yamada, MD (Kanagawa, Japan); Tsuyoshi Matsuda; Minoru Horii; Youuichirou Sugiyama (Tokyo, Japan); Stefan Bluml, PhD; J. Gordon McComb, MD (Los Angeles, CA)

introduction Previous studies indicate that the extra-cellular and intra-cellular spaces in the brain can be calculated by magnetic resonance imaging (MRI) using proton relaxation time sequences. Brain imaging of intra-cellular 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 Signa MR scanner with a head coil was used for all studies. A double-exponential T2 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 an intra-cellular component of water while the late phase of T2 decay was considered to be an extra-cellular component of water. Intra-cellular and extra-cellular images were created by T2 CALEPI soft ware (Tokai-GE Yokokawa Medical).

results Extra-cellular and intra-cellular spaces of the normal brain subjects were visualized by analyzing of 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. Extra-cellular 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 Quantitive Pupillometry in Children

Kostas N. Fountas, MD, PhD; Carlos H. Feltes, MD; Vassilios G. Dimopoulos, MD; Christopher E. Troup, MD (Macon, GA)

introduction The indirect monitoring of intracranial pressure by using non-invasive methods has become an increasingly utilized clinical modality. The recent employment of quantitive pupillometry in adult patients diagnosed with sub-aarachnoid hemorrhage or severe closed head injuries, confirmed the existence of a close relationship between the intracranial pressure and the pupillary constriction velocity. The purpose of this study was to define the normal variation of the pupillary reaction velocity in normal pediatric volunteers.

methods In a clinical prospective study, 240 healthy volunteers were examined under a wide 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 quantitive pupillometer (Forsite; NeurOptics; 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 the volunteers.

results In our series the minimum aperture ranged between 1.9 and 3.3 mm (mean 2.2 mm). The maximum aperture ranged between 3.7 and 4.8 mm (mean 4.4 mm). The reduction in size ranged between 32 and 43% (mean 36%). 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 secs (mean 0.21 secs).

conclusion The quantitive pupillometry appears to be a promising non-invasive indirect intra-cranial pressure monitoring modality, which is simple and easily applicable to pediatric patients. An extensive normal databank 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. Egnor, MD; Mark Wagshul, PhD; Lili Zheng, PhD; Raphael Davis, MD (Stony Brook, NY)

introduction Echoplanar Imaging (EPI) permits analysis of the spectral 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 heart rate, the reliability of spectral analysis has been questioned.

methods Seventeen healthy volunteers underwent EPI 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 produced in all subjects at the cardiac frequency, but some of this power was associated with the jndependent respiratory flow component and not with the modulation flow component. Both the asymmentry of the cardiac 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 major effect on CSF and blood flow patterns. Unfortunately, EPI produces coupling between all the components in the specturm, 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. Cheng, MD; Tiffany G. Johnson, BS; Ann M. Ritter, MD (Chapel Hill, NC)

introduction Intracranial hematomas in newborns are rare. Operative evacuation in this fragile population is fraught with difficulties, including exsanguination, hypothermia, hemodynamic instability and technically hallenging brain consistency. Few reports of percutaneous hematoma aspiration are available in past literature. With this report, we present needle aspiration to the general neurosurgical community as a first line treatment of intracranial hematomas in neonates. We also present the previously unreported aspiration of an intra-parenchymal hematoma via direct skull puncture. A rare entity, acute subdural hematoma associated with cerebral infarction, is also presented.

methods Percutaneous needle aspiration was performed 6 times in 4 consecutive neonates with intra-parenchymal 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 pierced.

results Liquid blood, not clot, was encountered even though CT scan showed high-density hemorrhage. Near complete aspiration of hematoma 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 high CT density, 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 Followed by Rapid Neurologic Deterioration: Case Report with Comparison Cases

Corbett Wilkinson, MD (Morgantown, WV); Robert F. Keating, MD (Washington, DC)

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 he underwent simple resection of his tail, with tethered cord release and lipoma resection planned for the future. Over the ensuing weeks he developed lower extremity weakness and sensory loss plus diminished rectal tone. He underwent resection of the lipoma with tethered cord release twice, at five weeks and four months, and is now neurologically improving. Three other 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 neurologic deterioration. We recommend that all patients with tails, spinal anomalies, and tethering undergo resection of the tail concurrently with exploration and tethered cord release.

122. Late Presenting Shunt Infections

Patti L. Batchelder, MSN, RN; John Lopez, MD; Ken R. Winston, MD; Michael H. Handler, MD (Denver, CO)

summary Shunt infections are generally considered to be the result of inoculation that occurs at the time of shunt insertion, with procedures in which the shunt may be exposed and contaminated, or bacteremia with vascular shunts. Infections typically present within one year of an operation or procedure. Secondary infection of extra-vascular shunts is rare, and often, a history that an operation was performed more than one year previously is used to exclude shunt infection form the differential diagnosis. We reviewed shunt infection data at our institution over an eight year period and identified twelve shunt infections that presented more than twelve months from an invasive procedure. The length of time from procedure to presentation with infection ranged from thirteen months to eight years. Infecting organisms varied, and included Staph. Aureus (2), Staph. Epidermidis (3), P. acnes (1), H. influenza (2), Alpha strep. (2), and E.coli (2). Two patients grew mixed enteric flora and the distal catheter was deeply stained, suggesting erosion of the distal catheter into the bowel. There were no instances of contamination from local skin infections and no evidence of skin erosion over the shunt hardware. A prolonged interval of time after shunt revision cannot be considered absolutely to rule out shunt infection.

123. Transverse-Sigmoid Sinus Flow Following Posterior Fossa Craniotomies

Julius Fernandez, MD (Memphis, TN); Julian Lin, MD (Peoria, IL); Fred Laningham, MD; Frederick Boop, MD; Robert Sanford, MD (Memphis, TN)

introduction Dural sinus thrombosis is a potential complication following posterior fossa craniotomies rarely described in the literature, especially in the pediatric population.

methods 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 recurrent or residual tumor resections.

results The mean age was 1.9 years. All were male. Three children had medulloblastomas while one child had CPA ependymoma. All four patients had VP shunts. Three of the four patients received Mannitol during surgery, but none were dehydrated 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 their ventriculomegaly. Slow flow in the sinus was suspected with MRI showing hyper-intensity on T1WI and absent of flow on MRV while CT failed to show acute clot in the sinus. One child with TSS thromboses was treated with aspirin but then developed thrombocytopenia and bilateral SDH while undergoing chemotherapy. One child with TSS thromboses was not treated due to rapid tumor progression that eventually led to his death two months after surgery.

conclusion Although very uncommon, slow flow in the TSS may lead to sinus thromboses following posterior fossa craniotomies. The pathophysiology of this entity is unknown but may be related to hypercoagulable states, intraoperative dehydration, bony exposure of the sinuses, and/or manipulation near venous structures.

124. Management of a Giant Varix Associated with an Arteriovenous Fistula in an Infant

Paul Klimo, MD, MPH; Richard Anderson, MD; Douglas Brockmeyer, MD (Salt Lake City, UT)

introduction Congenital arteriovenous fistulas 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 an 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 M2 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. Intrathecal Baclofen Pump Implantation in Children with Posterior Spinal Fusions with Rod Instrumentation

Albert E. Telfeian, MD; Juanita Celix (Philadelphia, PA)

introduction A retrospective study investigated 16 pediatric patients with spastic cerebral palsy to evaluate the effect of posterior spinal fusion with rod instrumentation on the implantation of an intrathecal baclofen pump.

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 quadriplegics and 2 diplegics. The mean age at surgery was 13.2 years. Of the 16 patients, 2 underwent posterior lumbar spinal fusion. Patient spasticity was evaluated by application of Ashworth scores. The most common procedural complications were seromas around the pump (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 fusions was done without an intrathecal trial injection, performed after a fine cut lumbar CT with sagital and coronal reconstructions, and performed with a paravertebral trajectory for the intrathecal implantation to avoid posterior instrumentation. A high-speed diamond 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 Vassilyadi, MD, FRCS(C) (Ottawa, ON, Canada)

introduction Dural arteriovenous fistulas 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 bruit was identified on regular follow-up six weeks later. Brain MRI/MRA and cerebral angiography showed a large high-flow dural-based 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 bruit.

conclusion Trauma can induce the formation of a dural arteriovenous fistula via sinus thrombosis. 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 fistulas. Arteriovenous fistulas 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. Wetjen, MD (Rochester, MN)

introduction Surgeons who perform pediatric craniofacial reconstruction have been searching for the ideal bone substitute for years. Methyl methacrylate has been used for over a decade but has a significant complication rate in the pediatric population. Autogenous tissue is an ideal local replacement but has possible donor site complications. Recently, the innovation of hydroxyapetite cements such as Norian CRS has opened new options in pediatric skull 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 a bony defect that resulted from a congenital condition (70%) or trauma (30%). Patients were followed up after their surgical procedure with clinical exams and CT scans to evaluate their functional and cosmetic outcomes. Follow up ranged from 11 months to 34 months (average 23 months).

conclusion Hydroxtapetite cements such as Norian CRS appears on early review to be useful in the treatment of pediatric craniofacial defects. Norian has the added advantages of 1) 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 host bone that resists dislodgement, 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.

128. Time Trends and Demographics of Deaths from Hydrocephalus in U.S. Children

John Chi, MD, MPH; Heather Fullerton, MD; Nalin Gupta, MD, PhD (San Francisco, CA)

introduction Congenital hydrocephalus (HCP) 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 HCP 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 HCP, spina bifida with HCP, and communicating HCP 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 analyzed for differences based on age, race, gender and year.

results From 1979 to 1998, mortality from congenital HCP declined 66%, spina bifida with HCP by 85%, and communicating HCP by 92%. Mortality rates were highest in infants. While mortality rates from congenital HCP and HCP with spina bifida were similar among infant girls, infant boys had higher mortality rates from congenital HCP compared to HCP with spina bifida (2.0 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 HCP and communicating HCP, but not for HCP with spina bifida (3.3 for blacks v. 1.8 white in congenital HCP, 0.6 for blacks v. 0.8 for whites in HCP with spina bifida).

conclusion Mortality from congenital HCP 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. Ventriculosubgaleal Shunting for Hydrocephalus: Where is it Useful?

Jeffrey M. Tomlin, MD; Howard J.S. Silberstein, MD, FACS (Rochester, NY)

introduction Ventriculosubgaleal (VSG) 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 HCP at our institution were initially managed with VSG shunting. Three cases were for HCP secondary to intraventricular hemorrhage, two were for HCP 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 VSG 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 Ventriculosubgaleal 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 prolong the need for ventriculoperitoneal shunting.

130. Surgical Management of Aneurysmal Bone Cysts in the Pediatric Spine

James K. Liu, MD; Marion L. Walker, MD; John R.W. Kestle, MD, MSc; 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 (66%), 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 cc). Spinal instability was managed in a stepwise fashion. One patient underwent intraoperative 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. Saggital Synostosis: Current Evaluation and Treatment

Paul T. Boulos, MD; John A. Jane, Jr. MD; John A. Jane, MD, PhD (Charlottesville, VA)

introduction Craniosynostosis occurs at a rate of 1 in 2500 live births. 40–60% are saggitial. A multitude of compensations occur resulting in scaphocephaly, frontal bossing, the occipital knob, the golf tee deformity, or Bathrocephaly. 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 saggital 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. Burr holes are made on each side or the saggital suture at the level of the coronal and lambdoid sutures. The dura is dissected free. The saggital 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 deformities, an occipital craniotomy to the level of the torcula 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 saggital synostosis. It is a good alternative to the simple strip craniectomy, and placement of a head molding device.

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~~RBG~~ RB	4	21	1
	6	23	1
	35	23	
	53	22	3
	43	22	3
NG	11	22	3
JM	# 6		1
	43		1
	53		1
AMF	#4	23	1
	#6	23	1
	35	19	3
	11	16	6
	43	19	3
	53	23	1
	52	19	3

Dawson 4/6

NG	11	17	2
	35	15	3
	43	14	4
	53	18	1

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4	6+1	4 4		15
6	1	11	—	7
11	3	6 2	—	13
35	1	3 3	—	11
43	3	1 3 4		11
53	3	1 11		6