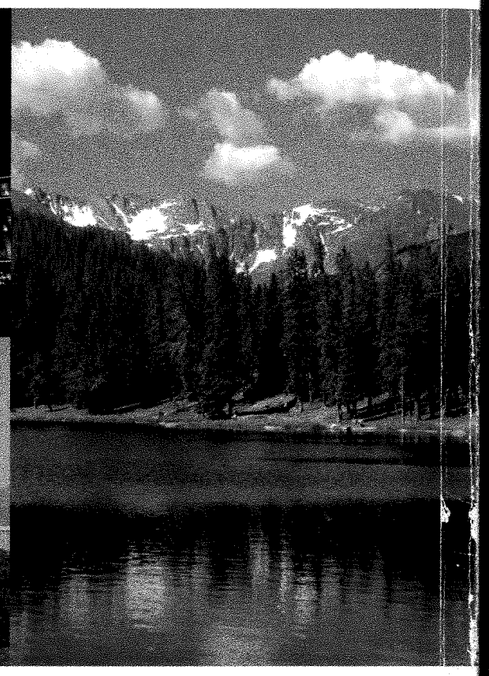
SAVE THE DATE FOR 2006



2006 AANS/CNS Section on Pediatric Neurological Surgery Annual Meeting

NOVEMBER 28–DECEMBER 1, 2006

MARRIOTT DENVER CITY CENTER

DENVER, COLORADO

American Association of Neurological Surgeons

JOINTLY SPONSORED BY THE AMERICAN ASSOCIATION OF NEUROLOGICAL SURGEONS

2005

PROGRAM BOOK

THE 34TH ANNUAL MEETING OF THE AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY

NOVEMBER 29 – DECEMBER 2 | CHAMPIONSGATE, FLORIDA (ORLANDO) | OMNI ORLANDO RESORT AT CHAMPIONSGATE

The program book was made possible, in part, by an educational grant provided by

Codman a Johnson & Johnson company

Jointly Sponsored by the American Association of Neurological Surgeons

American Association of Neurological Surgeons

AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY

November 29 – December 1, 2005
ChampionsGate, Florida (Orlando)

CONTINUING MEDICAL EDUCATION CREDIT (CME)

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the American Association of Neurological Surgeons and the AANS/CNS Section on Pediatric Neurological Surgery. The American Association of Neurological Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

The AANS designates this educational activity for a maximum of 18 hours in Category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours that he or she actually spends in the educational activity.

DISCLAIMER

The material presented at the 2005 AANS/CNS Section on Pediatric Neurological Surgery Annual Meeting has been made available by the AANS/CNS Section on Pediatric Neurological Surgery and the American Association of Neurological Surgeons for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method or procedure appropriate for the medical situations discussed, but rather it is intended to present an approach, view, statement, or opinion of the faculty, which may be helpful to others who face similar situations.

All drugs and medical devices used in the United States are administered in accordance with the 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, and jointly sponsored by the American Association of Neurological Surgeons have 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 the applicable law.

Neither the content (whether written or oral) of any course, seminar or other presentation in the program, nor the use of specific product in conjunction therewith, nor the exhibition of any materials by any parties coincident with the program, should be construed as indicating endorsement or approval of the views presented, the products used, or the materials exhibited by the AANS/CNS Section on Pediatric Neurological Surgery and jointly sponsored by the American Association of Neurological Surgeons, or its Committees, Commissions, or Affiliates.

ANNUAL MEETING SITES

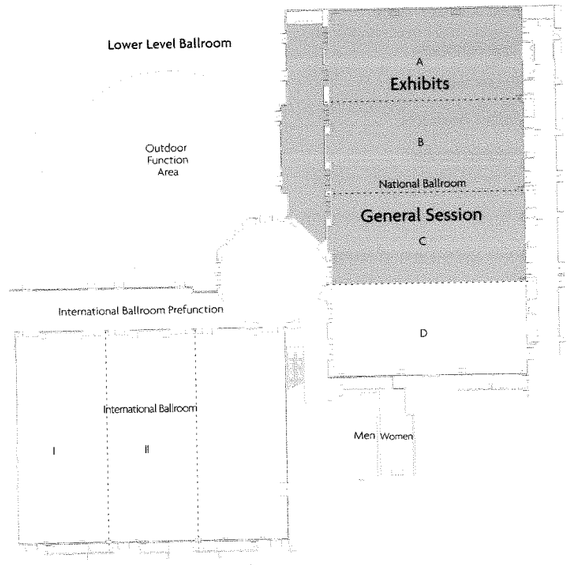
1972 Cincinnati
1973 Columbus
1974 Los Angeles
1975 Philadelphia
1976 Toronto
1977 Cleveland
1978 Philadelphia
1979 New York
1980 New York
1981 Dallas
1982 San Francisco
1983 Toronto
1984 Salt Lake City
1985 Houston
1986 Pittsburgh
1987 Chicago
1988 Scottsdale
1989 District of Columbia
1990 San Diego/Pebble 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
2004 San Francisco
2005 ChampionsGate (Orlando)

FUTURE MEETING SITES

2006 Denver
2007 South Beach (Miami)

Continuing Medical Education Credit 2
Disclaimer 2
Annual Meeting Sites 3
Hotel Floor Plan 4
Pediatric Section Chairs 5
Officers and Standing Committees of the AANS/CNS Section on Pediatric Neurological Surgery 5
Ad Hoc Committees 5
2005 Raimondi Lecturer 6
Past Raimondi Lecturers 6
Matson Memorial Lecturers 7
Kenneth Shulman Award Recipients 7
Hydrocephalus Association Award Recipients 8
Program Schedule 9–15
Exhibit Hall Floor Plan 16
Exhibitor Listing 17
Acknowledgements 18
Disclosure Information 19–20
Scientific Program Oral Abstract Index 21–24
Scientific Program Oral Abstracts 25–49
Scientific Program Poster Index 50–51
Scientific Program Poster Abstracts 52–64
2005 Section Membership Roster 65–72
Evaluation Forms 73–84

HOTEL FLOOR PLAN



Registration	National Foyer
Speaker Ready Room	Royal Melbourne
Continental Breakfast	National Foyer
General Session	National Ballroom C
Exhibit Hall	National Ballroom A-B
Lunch with Exhibitors	National Ballroom A-B
Nurses Seminar	Colonial A

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
2005–07 Rick Abbott

OFFICERS

Chair	Rick Abbott, MD, FAAP (2005–2007)
Chair-Elect	Jeffrey H. Wisoff, MD (2005–2007)
Secretary	Ann-Christine Duhaime, MD (2005-2007)
Treasurer	Alan R. Cohen, MD, FACS (2005 – 2007)
Past Chair	Andrew D. Parent, MD (2003–2005)

EXECUTIVE COMMITTEE

Members at Large (two-year term)	Bruce A. Kaufman, MD, FACS Nalin Gupta, MD, PhD Sarah J. Gaskill, MD, FACS Michael David Partington, MD, FACS, FA

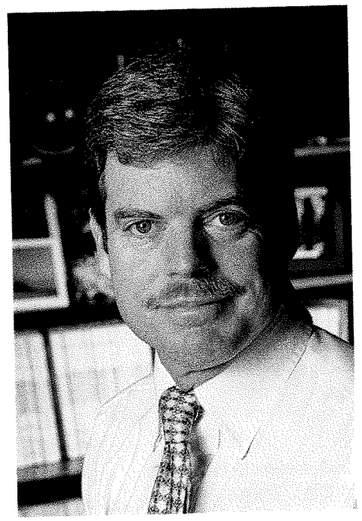
STANDING COMMITTEES

Nominating Committee	Chair: Andrew D. Parent, MD Marion L. Walker, MD Thomas G. Luerssen, MD
Rules and Regulations Committee	Chair: Cheryl A. Muszynski, MD, FACS
Membership Committee	Chair: John R.W. Kestle, MD, MSc
Program and Continuing Education Committee	Chair: Joseph R. Madsen, MD Ex Officios: W. Jerry Oakes, MD Rick Abbott, MD, FAAP Alan R. Cohen, MD
Annual Meeting	Chair: W. Jerry Oakes, MD
Future Annual Meeting	Chair: Michael H. Handler, MD (2006) John Ragheb, MD (2007)

AD HOC COMMITTEES

Traveling Fellowship Committee	Chair: R. Michael Scott, MD Ken R. Winston, MD Alan R. Cohen, MD, FACS
Lifetime Achievement Award	Chair: Andrew D. Parent, MD
NEUROSURGERY://ON-CALL® Web site	Chair: Douglas L. Brockmeyer, MD
Publications Committee	Chair: Sarah J. Gaskill, MD, FACS
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 the Quality Assurance Committee	Paul A. Grabb, MD Sarah J. Gaskill, MD, FACS James M. Drake, MD
Representative to the Washington Committee	Thomas G. Luerssen, MD
Education and Practice Management Committee, AANS	David P. Gruber, MD
Devices And Technology Committee, AANS	Mark R. Proctor, MD
Representative to ISPN	Cheryl A. Muszynski, MD, FACS

2005 RAIMONDI LECTURER



JAMES B. MCCLINTOCK, PHD

James McClintock was born in Ann Arbor, Michigan. He is an Endowed Professor of Polar and Marine Biology, as well as Interim Dean of the Graduate School at University of Alabama Birmingham. He is an invertebrate zoologist and marine chemical ecologist who received his MA and PhD at the University of South Florida.

His research interests are in the areas of reproductive and nutritional biology of marine and aquatic invertebrates, especially echinoderms, crustaceans and mollusks; physiological and chemical ecology; and hard and soft-bottom ecology.

Currently he is continuing with his studies of the chemical ecology of marine invertebrates, with an emphasis on those found in Antarctic environments. These studies are focused on understanding the role of marine invertebrate secondary metabolites in mediating patterns of fouling, overgrowth and predation. He plans to continue with and expand upon all of the work described above, taking advantage of the rich diversity of freshwater, estuarine and marine environments of the southeastern United States.

Dr. McClintock is a member of several associations including the Society of Integrative and Comparative Biology, American Association for the Advancement of Science and International Society of Chemical Ecology. He has received numerous awards for his teaching and research. He is extensively published and aspects of his scientific research have been covered by the national media including *National Geographic Magazine*, *NPR Radio*, *Discover Magazine*, *Chronicle of Higher Education*, and *Smithsonian Magazine*.

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 Huntsman
2004 J. Michael Bishop
2005 James. B. McClintock

AWARD RECIPIENTS

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
2004 A. Leland Albright
2005 Joan L. Venes

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

2004 JOSHUA E. MEDOW The Permiable Proximal Catheter Project: A Novel Approach to Preventing Shunt Obstruction

2005 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 MARTIN U. SCHUHMANN Serum and CSF C-Reactive Protein in Shunt Infection Management

2004 JEFF PUGH Can the Skull Diploic Space Be Utilized for Absorption of Cerebrospinal Fluid?

AND

JAY K. RIVA-CAMBRIN Pediatric Posterior Fossa Tumors: Pre-operative Predictors of Chronic Hydrocephalus.

TUESDAY, NOVEMBER 29

NOON – 5:00 PM
PRE-MEETING NURSES SEMINAR
Colonial A

The nursing seminar will include presentations on the topics of Chiari Malformations/Syrinx, Quick Imaging Techniques for the Pediatric Neurosurgery Patient, Shunts – Programmable vs. Non-programmable, Penetrating CNS Injuries, Moya Moya Disease, Pediatric Headache: Sign or Symptom, and Craniopharyngioma Treatment with Bleomycin, and will include American Association on Neurosurgical Nurses and National Institutes of Health updates and segments on patient education, nursing issues, and networking.

Faculty: Rick Abbott, MD, FAAP; Patti Batchelder, RN, MSN, PNP-C; Karen Belcher, RN, CPN; Shona Lenss, RN, MS, CFNP; Bernadette Makar, NP-C; Tina Popov, CNS/NP; Patricia Rowe, RN, MN, CSN/NP; Mary Smellie-Decker, RN, MSN, PNP; R. Shane Tubbs, MS, PA-C, PhD; Donna Wallace, RN, MS, CPNP; Herta Yu, RN, MN-ACNP, CNN.

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

1. Identify types of Chiari.
2. Identify indications for MRI scans.
3. Describe pathology of hydrocephalus.
4. Identify common causes of penetrating CNS injuries.

2:00 – 7:00 PM
REGISTRATION
National Ballroom C Foyer

5:00 – 6:00 PM
POSTER SETUP FOR MEDICAL REGISTRANTS
National Ballroom A-B

6:30 – 8:00 PM
OPENING RECEPTION
Outside Pool Area

WEDNESDAY, NOVEMBER 30

7:00 – 8:00 AM
CONTINENTAL BREAKFAST
National Ballroom A-B Foyer

7:00 AM – 5:30 PM
REGISTRATION
National Ballroom C Foyer

7:50 – 7:55 AM
WELCOME AND OPENING REMARKS
National Ballroom C
Rick Abbott, MD, FAAP

7:55 – 8:00 AM
MEETING OVERVIEW
W. Jerry Oakes, MD

8:00 – 8:48 AM
SCIENTIFIC SESSION I

Craniosynostosis
National Ballroom C

Moderators: Jeffrey P. Blount, MD, FACS; Rick Abbott, MD, FAAP

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

- Appraise new proposed craniosynostosis procedures, including late vault remodeling and minimally invasive procedures.
- Describe technical and methodological challenges in evaluating late effects of craniosynostosis surgery.

8:00 – 8:12 AM

1. "Clamshell" Craniotomy: a Technique for Previously Uncorrected Sagittal Craniosynostosis
Matthew D. Smyth, MD; Christian Kaufman, MD; Alex A. Kane, MD (St. Louis, MO)

8:12 – 8:24 AM

2. A Comparison of Open and Minimally Invasive Procedures for Craniosynostosis
Laura Hollinger E. Hollinger, BS; James E. Baumgartner, MD; John F. Teichgraeber, MD (Houston, TX)

8:24 – 8:36 AM

3. Multiple Revolution Spiral Osteotomy and Additional Techniques for Cranial Vault Remodeling and Expansion
Elizabeth M. Trinidad, MD; Micam W. Tullous, MD; Lisa Zerda, RN, MSN; Andrew E. Auber, MD; Patricia A. Mancuso (San Antonio, TX)

8:36 – 9:48 AM
SCIENTIFIC SESSION II

Congenital Anomolies
National Ballroom C

Moderators: Jeffrey P. Blount, MD, FACS; Rick Abbott, MD, FAAP

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

- Appraise new observations in the pathophysiology of Chiari malformations and tethered spinal cord.
- Compare observations in animal models of congenital CNS anomalies with the human syndromes.
- Discuss advances in radiographic and electrophysiological guidance in tethered spinal cord surgery.

8:36 – 8:48 AM

4. Spinal Cutaneous Tethering Tracts in Spina Bifida Occulta: Reclassification
Sharad Rajpal, MD (Madison, WI); R. Shane Tubbs, PhD (Birmingham, AL); Shahriar Salamat, MD, PhD (Madison, WI); W. Jerry Oakes, MD (Birmingham, AL); Bermans J. Iskandar, MD (Madison, WI)

8:48 – 9:00 AM

5. A Novel Spontaneous Sheep Mutant of Spinal Neural Tube Defects
Timothy M. George, MD; Thomas J. Cummings, MD; Yohannes G. Asfaw, DVM; Marcy C. Speer, PhD; James D. Reynolds, PhD (Durham, NC)

9:00 – 9:12 AM

6. The Symptomatic Post Lipomyelomeningocele Resection Patient: Do Increases in the Lumbosacral Angle Indicate a Tethered Spinal Cord?
R. Shane Tubbs, PhD, PA-C; William C. Rice, MD; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

9:12 – 9:24 AM

7. Electrophysiologically-guided Untethering of Secondary Tethered Spinal Cords Following Myelomeningocele Repair
Nader Pouratian, MD, PhD; John A. Jane, Jr., MD; Tracey L. Owensby, BS; W. J. Elias, MD; Lawrence A. Phillips, MD; John A. Jane, Sr., MD, PhD, FRC (Charlottesville, VA)

9:24 – 9:36 AM

8. Posterior Fossa Volume in the Myelomeningocele Population: a Novel Observation
Keyne K. Thomas; Isaac O. Karikari; Dave S. Enterline; Herbert E. Fuchs; Timothy M. George (Durham, NC)

9:36 – 9:48 AM

9. Enhancement of Re-closure Capacity by the Intra-amniotic Injection of Human Embryonic Stem Cells in Surgically Induced Spinal Open Neural Tube Defects in Chick Embryos
Kyu-Chang Wang, MD, PhD; Do-Hun Lee, MS; Sepill Park, PhD; Seung-Ki Kim, MD, PhD; Jinho Lim, MD, PhD; Byung-Kyu Cho, MD, PhD (Seoul, Republic of Korea)

9:00 AM – 5:30 PM
EXHIBIT & POSTER VIEWING IN EXHIBIT HALL
National Ballroom A-B

9:50 – 10:30 AM
BEVERAGE BREAK IN EXHIBIT HALL
National Ballroom A-B

10:30 AM – 12:00 PM
SCIENTIFIC SESSION III

Tumors
National Ballroom C

Moderator: Mark M. Souweidane, MD; Jeffrey H. Wisoff, MD

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

- Describe new proposed methods of delivery of chemotherapeutic agents to CNS tumors.
- Relate preoperative radiographic findings of pediatric brain tumors to long term outcome.
- Review techniques of novel gene discovery in pediatric brain tumors.
- Formulate the role of preresection chemotherapy in selected brain tumors.

10:30 – 10:42 AM

10. Neural Stem Cells Target and Deliver Pro-drug Gene to Experimental Intracranial Medulloblastomas
Seung-Ki Kim, MD (Boston, MA); Seung U. Kim, MD (Suwon, Republic of Korea); Karen S. Aboody, MD (Duarte, CA); Kyu-Chang Wang; Byung-Kyu Cho (Seoul, Republic of Korea); Peter M. Black, MD; Rona S. Carroll, PhD (Boston, MA)

10:42 – 10:54 AM

11. Digital Karyotyping Identifies a Novel Retinoblastoma Oncogene
D. Cory Adamson, MD, PhD; Timothy M. George, MD (Durham, NC)

10:54 – 11:06 AM

12. Effects of Hydrocephalus on IQ in Children with Infratentorial Ependymoma Before and After Conformal Radiation Therapy
Robert A. Sanford, MD (Memphis, TN); Thomas C. Merchant, DO, PhD; Frederick A. Boop, MD; Naina Gross, MD

11:06 – 11:18 AM

13. The Role of Diffusion-weighted MR Imaging in Pediatric Brain Tumors
Peter Kan, MD; James Liu, MD; Gary Hedlund; Douglas Brockmeyer, MD; Marion Walker, MD; John Kestle, MD (Salt Lake City, UT)

11:18 – 11:30AM

14. Neurocognitive Outcome in Pediatric Craniopharyngioma: the Impact of Surgical Resection and Conformal Radiation Therapy
Erin N. Kiehna, MS; Frederick A. Boop, MD; Robert A. Sanford, MD; Larry E. Kun, MD; Raymond K. Mulhern, PhD; Chenghong Li, MS; Xiaoping Xiong, PhD; Kathleen J. Helton, MD; Thomas E. Merchant, DO, PhD (Memphis, TN)

11:30 – 11:42 AM

15. Local Delivery of M4N in a Brainstem Tumor Model Using a Cannulated Guide Screw
George I. Jallo, MD; Andrey Volkov, BA; Margaret Penno, PhD; Cyrus Wong, BS; Ru Chin Huang, PhD (Baltimore, MD)

11:42 – 11:54 AM

16. Optical Characterization of Pediatric Brain Tumors and Epileptogenic Lesions
David I. Sandberg, MD; Glenn Morrison, MD, FACS; Sanjiv Bhatia, MD; Greg Olavarria, MD; John Ragheb, MD, FACS; Michael Duchowny, MD; Prasanna Jayakar, MD, PhD; Wei-Chiang Lin, PhD (Miami, FL)

12:10 – 1:00 PM
LUNCH AND POSTER VIEWING IN THE EXHIBIT HALL
National A-B Ballroom

1:00 – 2:36 PM
SCIENTIFIC SESSION IV

Tumors
National Ballroom C

Moderators: David W. Pincus, MD, PhD; Frederick A. Boop, MD, FACS

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

- Estimate the value of intraoperative MRI and new techniques of functional mapping on pediatric brain tumor therapy.
- Contrast interstitial delivery of monoclonal antibodies into tumors with polymer release of molecular constituents.
- Discuss the major morbidities of craniopharyngioma resection in long term follow-up.

1:00 – 1:12 PM

17. Intratumoral Interstitial Delivery of Anti-glioma Monoclonal Antibody 8H9
Neal Luther, MD; Mark A. Edgar, MD; Naikong V. Cheung, MD, PhD; Philip H. Gutin, MD; Mark M. Souweidane, MD (New York, NY)

1:12 – 1:24 PM

18. Noninvasive Diagnosis of Pediatric Pilocytic Astrocytomas by Advanced Magnetic Resonance Spectroscopy
Mark D. Krieger, MD; Ashok Panigrahy, MD; J. Gordon McComb, MD; Marvin D. Nelson, MD; Ignacio Gonzalez-Gomex, MD; Floyd Gilles, MD; Stefan Bluml, PhD (Los Angeles, CA)

1:24 – 1:36 PM

19. Aggressive Clinical Behaviour of Histologically Benign Tectal Gliomas
Jeffrey Pugh, MD, MSc; Vivek Mehta, MD, FRCS(C); Keith Aronyk, MD, FRCS(C) (Edmonton, AB, Canada)

1:36 – 1:48 PM

20. Extraoperative Functional Mapping via Staged Resection of Supratentorial Tumors in Children
Robert J. Bollo, MD; Chad Carlson, MD; Catherine Schevon, MD; Jeffrey Wisoff, MD; Orinn Devinsky, MD; Howard Weiner, MD (New York, NY)

1:48 – 2:00 PM

21. Efficacy of Local Delivery 3-bromo-pyruvate in the Treatment of a Brainstem Tumor
George I. Jallo, MD (Baltimore, MD); Cyrus Wong, BS; Margaret Penno, PhD; Andrey Volkov, BA; Young Ko, PhD

2:00 – 2:12 PM

22. Immunotherapy for Medulloblastoma
Alfred T. Ogden, MD (Columbia, New York, NY)

2:12 – 2:24 PM

23. Myxopapillary Ependymoma: Long-term Outcome and Treatment
Carrie N. Stair, BA (Reno, NV); Mark D. Krieger, MD; Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

2:24 – 2:36 PM

24. Intraoperative MRI and the Pediatric Patient: Are We There Yet?
Robert F. Keating, MD; John S. Myseros, MD; Amanda L. Yaun, MD; Derek A. Bruce, MD (Washington, DC)

2:36 – 3:00 PM
BEVERAGE BREAK IN EXHIBIT HALL
National Ballroom A-B

3:00 – 4:36 PM
SCIENTIFIC SESSION V

Various Technical topics
National Ballroom C

Moderators: Alan R. Cohen, MD: Bruce A. Kaufman, MD, FACS

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

- Discuss criteria for diagnosis and technical advances in tethered cord syndrome surgery.
- Quantify the value of incidental tumor discovery after trauma in predicting outcome
- Review the value of vagal nerve stimulation in autism.
- List pros and cons of early surgery for leptomeningeal cysts.

3:00 – 3:12 PM

25. Development of a Long-lasting Silicone Catheter Impregnated with Rifampicin.
James P. McAllister, PhD; Xuemei Liang, PhD; Anfeng Wang, PhD; Haiying Tang, BS; Ting Cao, BS; Steven O. Salley, PhD; Kelley Brabant, BS; Carolyn Black; Jie Li,MD; KY Simon Ng, PhD (Detroit, MI)

3:12 – 3:24 PM

26. Diagnosis and Management of Growing Skull Fractures: the Memphis Experience
John S. Winestone, MD; Frederick A. Boop, MD; Naina L. Gross, MD; Michael S. Muhlbauer, MD; Stephanie L. Einhaus, MD; Robert A. Sanford, MD; The University of Tennessee-Memphis; Semmes–Murphey Neurologic and Spine Institute; LeBonheur Children's Medical Center (Memphis, TN)

3:24 – 3:36 PM

27. Ventricular-subgaleal Shunts at Columbus Children's Hospital
Chris S. Karas, MD; Scott W. Elton, MD (Columbus, OH)

3:36 – 3:48 PM

28. Vagus Nerve Stimulation Therapy in Patients with Autism Spectrum Disorder: Results from the Vagus Nerve Stimulation Therapy Patient Outcome Registry
Andrew D. Nguyen, MD, PhD; Samuel A. Hughes ,MD, PhD; Lissa C. Baird, MD; Hal S. Meltzer, MD (San Diego, CA); Arun P. Amar, MD (New Haven, CT); Michael L.J. Apuzzo, MD (Los Angeles, CA); Karen M. Levy, BSN, RN; Michael L. Levy, MD, PhD (San Diego, CA)

3:48 – 4:00 PM

29. Do Completely Resected Ependymomas in the Very Young Require Adjuvant Therapy?
Mark D. Krieger, MD; Jonathan L. Finlay, MD; Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

4:00 – 4:12 PM

30. Children with CNS Tumors Discovered Incidentally after Trauma
Gwyneth Hughes, BA; Alan R. Cohen, MD; Shenandoah Robinson, MD (Cleveland, OH)

4:12 – 4:24 PM

31. Use of Minimally Invasive Techniques for Tethered Cord Release: Technical Note
Jonathan E. Martin, MD; Daniel J. Donovan, MD (Honolulu, HI)

4:24 – 4:36 PM

32. Essential Factors of Tethered Cord Syndrome
Shokei Yamada, MD, PhD (Loma Linda, CA); Daniel J. Won, MD (Fontana, CA); David B. Knierim, MD (Madeira, CA); Javed Siddiqi, MD, PhD (Colton, CA)

4:36 PM – 5:30 PM
WINE & CHEESE RECEPTION IN EXHIBIT HALL
National Ballroom A-B

THURSDAY, DECEMBER 1

7:00 – 8:00 AM
CONTINENTAL BREAKFAST
National Ballroom A-B Foyer

7:00 AM – 5:30 PM
REGISTRATION
National Ballroom C Foyer

8:00 – 10:12 AM
SCIENTIFIC SESSION VI

Trauma
National Ballroom C

Moderators: Ann-Christine Duhaime, MD; Michael H. Handler, MD, FACS

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

- Discuss technical challenges in producing new devices or algorithms for management of intracranial pressure in children.
- State the technical problems in gene therapy in pediatric central nervous system disease.
- Appraise the role of surgery of the brachial plexus after birth injury in children.
- List advances in basic understanding of regeneration which may impact pediatric neurosurgical care.

8:00 – 8:12 AM

33. Decompressive Craniectomy for Treatment of Intractable Intracranial Pressure in Severely Head Injured Pediatric Patients
Matthew A. Adamo, MD; Daniel L. Friedlich; Eric M. Deshaies; John Dalfino; Walter Edge; John B. Waldman (Albany, NY)

8:12 – 8:24 AM

34. Perinatal Brain Injury Impairs Cerebellar Development in Children and Rats
Jason D. Hill, BA; Shenandoah Robinson, MD (Cleveland, OH)

8:24 – 8:36 AM

35. Transcutaneous Inductive Pressure (TIP) Monitor: Prototype for a Permanently Implanted ICP Device
Joshua E. Medow, MD; Bermans J. Iskandar, MD (Madison, WI)

8:36 – 8:48 AM

36. Variation in the Notch Filter Response of the ICP to Arterial Pulse Pressure
Joseph R. Madsen, MD; Rui Zou, PhD (Boston, MA); Michael R. Egnor, MD (Stonybrook, NY); Mark Luciano, MD; Stephen Dombrowski, PhD (Cleveland, OH); Erin J. McCormack, MS; Mark Wagshul, PhD (Stonybrook, NY); Dong Kim, MD (Boston, MA)

8:48 – 9:00 AM

37. Use of Controlled Hyperosmolality with Hypertonic Saline Solutions in Traumatic Brain Injury: Case Study of 16 Pediatric Patients
Stephen A. Fletcher, DO; James E. Baumgartner, MD; Sean T. Meiner, BS; Len Tanaka, MD; Giuseppe Colasurdo, MD; Beatrice Cua, MD; Nathan Strobel, MD; Lindsay Sharp, BS (Houston, TX)

9:00 – 9:12 AM

38. Gene Therapy for Late Infantile Neuronal Ceroid Lipofuscinosis: Surgical Considerations
Mark M. Souweidane, MD (New York, NY); Lisa M. Arkin, BA (Philadelphia, PA); Dolan Sondhi, PhD; Neil R. Hackett, PhD; Stephen M. Kaminsky, PhD; Ronald G. Crystal, MD; Michael G. Kaplitt, MD, PhD (New York, NY)

9:12 – 9:24 AM

39. Scoliosis and Chiari I Malformations in Children
Mark D. Krieger, MD; Yuri Falkinstein, MD; Ira Bowen, BA; Vernon Tolo, MD; J. Gordon McComb, MD (Los Angeles, CA)

9:24 – 9:36 AM

40. Professionalism: A Proposed Curriculum for Neurosurgery
Sudesh Ebenezer, MD; Joseph R. Madsen, MD; Arthur Day, MD (Boston, MA)

9:36 – 9:48 AM

41. Dural Inversion Procedure for Moyamoya Disease: Experience with Twenty One Cases
Robert C. Dauser, MD; Hatem S. Megahed, MD; Charles W. McCluggage, MD (Houston, TX)

9:48 – 10:00 AM

42. The Role of DNA Methylation in CNS Regeneration
Elias Rizk, MD; Kate Simon; Nithya Hariharan, MD; David Jarrard, MD; Bermans J. Iskandar, MD (Madison, WI)

10:00 – 10:12 AM

43. Long-term Motor Outcome Analysis Following Surgical Brachial Plexus Repair Using a Motor Score Composite
William W. Ashley, MD, PhD, MBA; T. S. Park, MD; Jeffrey R. Leonard, MD; Matthew D. Smyth, MD; Michael Noetzel, MD; Trisha Weatherly, PA-C (St. Louis, MO)

9:00 AM – 4:00 PM
EXHIBIT & POSTER VIEWING IN EXHIBIT HALL
National Ballroom A-B

10:15 – 10:45 AM
BEVERAGE BREAK IN EXHIBIT HALL
National Ballroom A-B

10:45 – 10:50 AM
INTRODUCTION OF THE RAIMONDI LECTURER
Jeffrey P. Blount, MD, FACS

10:50 – 11:45 AM
RAIMONDI LECTURE

Antarctica
National Ballroom C

James B. McClintock, PhD

On his 11 expeditions to the subantarctic islands and the continent of Antarctica, Dr. McClintock has developed a keen sense of the importance of Antarctica as a key scientific resource for humankind. This image-based presentation will feature an introduction to the flora and fauna of the French sub-antarctic islands of Crozet and Kerguelen, followed by a more detailed overview of the marine biology of the nutrient-rich waters surrounding the antarctic continent. In addition to insights into the early history of Antarctic exploration and the logistical challenges of conducting underwater science in such an extreme environment, Dr. McClintock provides a synopsis of his research program in polar marine chemical ecology and drug discovery, a program that has been funded for almost two decades by the National Science Foundation.

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

- Enumerate the leadership and scientific approach characteristics which accelerated early exploration of Antarctica.
- Discuss aspects of the Arctic ecosystem suggesting an importance for biodiversity in the discovery of future pharmaceutical agents.

11:45 AM – 12:45 PM
LUNCH AND POSTER VIEWING IN THE EXHIBIT HALL

National A-B Ballroom

12:45 – 2:45 PM
SCIENTIFIC SESSION VII

Functional/Miscellaneous
National Ballroom C

Moderator: Joseph R. Madsen, MD

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

- Compare outcomes in surgical resection of temporal seizure foci, corpus callosotomy, and vagal nerve stimulation.
- Relate the advantages of navigation techniques in seizure surgery.
- Indicate potential roles of nanotechnology, including quantum dots, in neurosurgery.

12:45 – 12:57 PM

44. Cervical Selective Dorsal Rhizotomy in the not only Spasticity Treatment in 21 Children with Cerebal Palsy
Boris Zivny, MD; Stanislav Severa, MD (Czech Republic)

12:57 – 1:09 PM

45. Dynamical Evolution of Seizures in Children
Steven J. Schiff, MD, PhD; Tim Sauer, PhD; Rohit Kumar (Fairfax, VA); Steven L. Weinstein, MD (Washington, DC)

1:09 – 1:21 PM

46. MSI Guided Frameless Navigation for Placement of Subdural Grid Arrays Confirms Accuracy of MEG Dipoles in Predicting Ictal Onset in Pediatric Patients
Jeffrey P. Blount, MD (Birmingham, AL)

1:21 – 1:33 PM

47. Seizure Control Following Temporal Lobectomy in Children: Experience at Memorial Hermann Children's Hospital, Houston
James E. Baumgartner, MD; Joshua Baker, BSN, RN; Stephen A. Fletcher, DO (Houston, TX)

1:33 – 1:45 PM

48. Temporal Lobectomy for Epilepsy in Children- Long Term Follow up
Mony Benifla, MD; Hiroshi Otsubo, MD; Carter Snead, MD; Khoshyomn Sami, MD; Sheila Weiss, MD; James Rutka, MD, PhD (Toronto, ON, Canada)

1:45 – 1:57 PM

49. Corpus Callosotomy: A Six Year Experience of Clinical Outcomes for Patients with Intractable Epileptic Seizures
Lindsay L. Sharp, BS; James E. Baumgartner, MD; Stephen A. Fletcher, DO; David Clarke, MD; Sean T. Meiner, BS (Houston, TX)

1:57 – 2:09 PM

50. Vagus Nerve Stimulation in Children Less Than Five-Years-Old
R. Shane Tubbs, PhD; Jeffrey P. Blount, MD; Pongkiat Kankirawatana, MD; Sarah Kiel, RN, CPNP; Robert Knowlton, MD; Paul A. Grabb, MD; Martina Bebin, MD (Birmingham, AL)

2:09 – 2:21 PM

51. The Natural History of Arachnoid Cysts: Progression in Children Less Than 2 Years of Age
Nader Sanai, MD; Kurtis I. Auguste, MD (San Francisco, CA); Peter P. Sun, MD (Oakland, CA)

2:21 – 2:33 PM

52. Consequences of Removal of Oregon's Cap on Non-economic Damages on the Neurosurgical Workforce
Monica C. Wehby, MD (Portland, OR)

2:33 – 2:45 PM

53. In Vivo Quantum Dot Labeling of Stem Cells in the Developing Embryonic Nervous System
Jonathan R. Slotkin, MD (Boston, MA); Haining Dai, PhD; Ian Gallicano, PhD; Barbara Bregman, PhD; Joshua Corbin, PhD; Tarik Haydar, PhD (Washington, DC)

2:45 – 3:15 PM
BEVERAGE BREAK IN EXHIBIT HALL
National Ballroom A-B

3:15 – 4:51 PM
SCIENTIFIC SESSION VIII

Miscellaneous
National Ballroom C

Moderator: Bermans J. Iskandar, MD; John Ragheb, MD

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

- Discuss challenges of bringing new technologies such as coated shunts and scanning laser ophthalmoscopy to clinical use.
- Describe recent advances in surgery for stroke and ischemia in arterial and venous disease.

3:15 – 3:27 PM

54. Apoptosis Seems to be the Major Process While Surface and Neural Ectodermal Layers Detach During Neurulation
Mehmet Selcuki, MD, PhD (Izmir, Turkey)

3:27 – 3:39 PM

55. Cerebral Revascularization for the Medically Intractable Patient with Progressive Cerebral Artery Stenosis Caused by Sickle Cell Disease
Roger Hudgins, MD; Lynn Gilreath, RN; Beatrice Gee, MD; Beatrice Files, MD; William Boydston, MD; Andrew Reisner, MD; Kevin Stevenson, MD; Thomas Burns, PsyD (Atlanta, GA)

3:39 – 3:51 PM

56. Incidence of Venous Infarction after Sacrificing Mid Sagittal Sinus Bridging Veins
Ivan J. Sosa, MD; J. Gordon McComb, MD, FACS; Sean McNatt, MD; Mark Krieger, MD (Los Angeles, CA)

3:51 – 4:03 PM

57. Microsurgical Resection Improves Hind-limb Function Until Onset of Paresis in an Experimental Intramedullary Spinal Cord Tumor
Justin M. Caplan, BA; Alia Hdeib, BS; Gustavo Pradilla, MD; Betty Tyler, BA; Federico Legnani, MD; William Pennant; Andrey Volkov, BA; Henry Brem, MD; George Jallo, MD (Baltimore, MD)

4:03 – 4:15 PM

58. Astrocyte and Choroid Plexus Growth on Silicone Coated with Polymers and Self-Assembled Monolayers.
James P. McAllister, PhD; Kruti Patel, MS; William E. Grever, PhD; Haiying Tang, BS (Detroit, MI); Jianming Xiang; Richard F. Keep, PhD (Ann Arbor, MI); Kelley E. Brabant, BS; Carolyn A. Black; K.Y. S. Ng, PhD (Detroit, MI)

4:15 – 4:27 PM

59. The Na/K ATPase Pump is Essential to Regeneration of the Adult CNS
Bermans J. Iskandar, MD; Elias Rizk, MD; Dandan Sun, PhD; Raghu Vemuganti, PhD; Nithya Hariharan, MD (Madison, WI)

4:27 – 4:39 PM

60. Use of the Far Lateral Transcondylar Approach in Children
David W. Pincus, MD, PhD; Stephen B. Lewis, MD, FRACS (Gainesvillle, FL)

4:39 – 4:51 PM

61. Laser Image Evaluation of Papilledema and Intracranial Pressure
Jeffrey E. Catrambone, MD (Newark, NJ); Dennis Roberts, BA, BS, PhD; Gordon Thomas, BA, BS, PhD; Sandra Kosinski, BA, BS, PhD; Wenzhaun He, MD, MS

4:51 – 5:00 PM
ANNUAL BUSINESS MEETING
National Ballroom C

OPEN EVENING

FRIDAY, DECEMBER 2

7:00 – 8:00 AM
CONTINENTAL BREAKFAST
National Ballroom A-B Foyer

7:00 – 10:00 AM
REGISTRATION
National Ballroom C Foyer

8:00 – 9:30 AM
HYDROCEPHALUS SYMPOSIUM
National Ballroom C

Benjamin Warf, MD; Joseph H. Piatt, Jr., MD; David Douglas Cochrane, MD

9:00 – 11:00 AM
EXHIBIT & POSTER VIEWING IN EXHIBIT HALL
National Ballroom A-B

9:30 – 9:54 AM
SCIENTIFIC SESSION IX

Hydrocephalus
National Ballroom C

Moderators: David Douglas Cochrane, MD; John C. Wellons, III, MD

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

- Describe the pitfalls of large scale outcomes studies in hydrocephalus.
- Identify several questionable assumptions made by clinicians in routine care of patients with hydrocephalus.
- Contrast the impetus for innovation in impoverished areas of the world with wealthy industrialized states.

9:30 – 9:42 AM

62. Intraoperative Assessment of Third Ventriculostomy Success
Jeffrey P. Greenfield, MD, PhD; Mark M. Souweidane, MD (New York, NY)

9:42 – 9:54 AM

63. Has Regulation Improved the CSF Shunt?
Stephen J. Haines, MD (Minneapolis, MN); Jeffrey P. Blount, MD (Birmingham, AL)

9:54 – 10:30 AM
BEVERAGE BREAK IN EXHIBIT HALL
National Ballroom A-B

10:30 AM – 12:46 PM
SCIENTIFIC SESSION X

Hydrocephalus
National Ballroom C

Moderator: Joseph H. Piatt, Jr., MD; Roger J. Hudgins, MD

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

- Classify potential drug-impregnated catheter devices in shunt function.
- Identify a growth factor whose overexpression may cause hydrocephalus.
- Appraise the effect of endoscopic ventriculoscopy and adjustable valves on the clinical treatment of hydrocephalus.

10:30 – 10:42 AM

64. Utility of Antibiotic Impregnated Extraventricular Drains
R. Shane Tubbs, PhD; James Custis, MD; R. Scott Hammock, MD; Elizabeth Blackburn, RN; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

10:42 – 10:54 AM

65. Polymerase Chain Reaction for the Detection of Cerebrospinal Fluid Shunt Infections: A Prospective Study
R. Shane Tubbs, PhD, PA-C; James Custis, MD; Suman Bharara, PhD; Yancey Gillispie, PhD; John C. Wellons, III, MD; W. Jerry Oakes, MD; Jeffrey P. Blount, MD (Birmingham, AL)

10:54 – 11:06 AM

66. Hydrocephalus in the HB-EGF Transgenic Model of Communicating Hydrocephalus is Stable Over Time
Bart A. MacDonald, MD; Joseph R. Madsen, MD; Yanping Sun, PhD; Michael Klagsbrun, PhD (Boston, MA)

11:06 – 11:18 AM

67. Comparison of Infection Rates with Antibiotic and Non-antibiotic Impregnated Shunt Systems in a Large Series of Pediatric Patients
Greg Olavarria, MD; Pediatric Neurosurgery Group, University of Miami and Miami Children's Hospital (Miami, FL);

11:18 – 11:30 AM

68. The Strata Programmable Valve for Shunt-Dependent Hydrocephalus: The Pediatric Experience at a Single Institution
Edward S. Ahn, MD; Markus Bookland, MD; Benjamin S. Carson, MD; Jon D. Weingart, MD; George I. Jallo, MD (Baltimore, MD)

11:30 – 11:42 AM

69. Late Failure of Endoscopic Third Ventriculostomy in Children
Brian T. Jankowitz, MD; Paul Gardner, MD; P. D. Adelson, MD, FACS; A. L. Albright, MD; Ian F. Pollack, MD, FACS (Pittsburgh, PA)

11:42 – 11:58 AM

70. Pathophysiology of Communicating Hydrocephalus in Clinically-Relevant Experimental Models
James P. McAllister, PhD; Jie Li, MD; Janet M. Miller, PhD; Parthasarathy K. Saranath, BS (Detroit, MI); Michael R. Egnor, MD; Mark Wagshul, PhD (Stony Brook, NY); Curt Stewart, MBA (Carefree, AZ); E. Mark Haacke, PhD (Detroit, MI); Marion E. Walker, MD (Salt Lake City, UT)

11:58 AM – 12:10 PM

71. Effects of Silicone Surface Coatings on Staphylococcus Epidermidis Adhesion and Colonization
James P. McAllister, PhD; Haiying Tang, BS; Xuemei Liang, PhD; Ting Cao, BS; Steven O. Salley, PhD; K.Y. Simon Ng, PhD (Detroit, MI)

12:10 – 12:22 PM

72. Inhibitory Effects of Minocycline on Gliosis in the Hydrocephalic H-Tx Rat
Janet M. Miller, PhD; Alexander G. Shanku; Steven D. Ham, DO; James P. McAllister, PhD (Detroit, MI)

12:22 – 12:34 PM

73. Endoscopic Third Ventriculostomy in the Management of Patients with Diffuse Pontine Gliomas
Liliana C. Goumnerova, MD, FRCS(C); Paul Klimo, MD (Boston, MA)

12:34 – 12:46 PM

74. Gray Zone Hydrocephalus and "The 30 Centimeter Syndrome"
Khaled B. Aly, MD (Giza, Egypt);

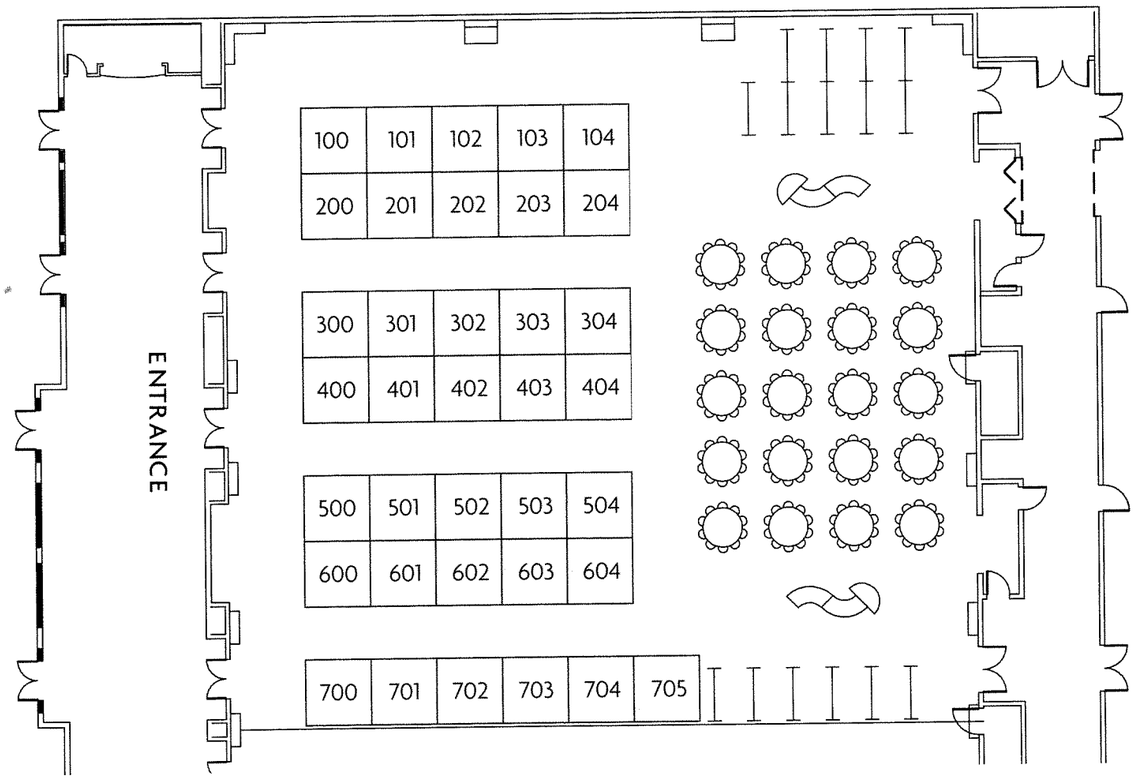
PRESENTATION OF THE HYDROCEPHALUS ASSOCIATION AWARD

12:46 – 1:00 PM
CLOSING REMARKS

W. Jerry Oakes, MD

AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY 2005 ANNUAL MEETING

EXHIBIT HALL—NATIONAL BALLROOM A–B



The AANS/CNS Section on Pediatric Neurological Surgery gratefully recognizes the support of these exhibitors. (Current as of 11/7/05)

Aesculap Inc.
3733 Corporate Parkway
Center Valley PA 18034
(610) 797-9300
Booth 600

American Association of Neurological Surgeons
5550 Meadowbrook Drive
Rolling Meadows, IL 60008-3852
(847) 378-0500
www.AANS.org
Booth 104

Codman, a Johnson & Johnson company
325 Paramount Drive
Raynham, MA 02767
(508) 828-3143
www.codman.com
Booth 500

Ellman Innovations
3333 Royal Ave.
Oceanside, NY 11572
(516) 267-6582
www.ellman.com
Booth 705

Hydrocephalus Association
870 Market Street, Suite 705
San Francisco, CA 94102
(415) 732-7040
www.hydroassoc.org
Booth 301

IMRIS
100-78 Innovation Drive
Winnipeg, MB R3T 6C2
Canada
(204) 480 7070
www.imris.com
Booth 602

Integra
311 Enterprise Drive
Plainsboro, NJ 08536
(609) 275-0500
www.integra-ls.com
Booth 204

Journal of Neurosurgery
1224 Jefferson Park Ave., Suite 450
Charlottesville, VA 22903
(434) 924-5503
www.thejns-net.org
Booth 303

Karl Storz Endoscopy-America, Inc.
600 Corporate Pointe
Culver City, CA 90230
(310) 338-8100
www.karlstorz.com
Booth 404

KLS – Martin , LP
P.O. Box 50249
Jacksonville, FL 32250
(904) 641-7746
www.klsmartin.com
Booth 400

Leica Microsystems
90 Boroline Rd.
Allendale, NJ 07401
(800) 526-0355
www.surgicalscopes.com
Booth 300

Lippincott Williams & Wilkins
10537 East Park Woods Drive
Orlando, FL 32832
(407) 625-6375
www.lww.com
Booth 304

Market Access Partners
3236 Meadowview Road
Evergreen, CO 80439
(303) 526-1900
www.marketaccesspartners.com
Booth 504

Medtronic Navigation
826 Coal Creek Circle
Louisville, CO 80027
(720) 890-3200
www.stealthstation.com
Booth 700

Medtronic Neurologic Technologies
4620 N. Beach St.
Fort Worth, TX 76137
(817) 788-6400
www.medtronic.com
Booth 701

Medtronic Neurological
710 Medtronic Parkway
Minneapolis, MN 55432
(763) 505-0028
www.medtronic.com
Booth 704

Mizuho America, Inc.
133 Brimbal Avenue
Beverly, MA 01915
(800) 699-2547
www.mizuho.com
Booth 604

Ortho Development Corporation
12187 S. Business Park Drive
Draper, UT 84094
(801) 553-9991
www.orthodevelopmet.com
Booth 201

Osteomed
3885 Arapaho Road
Addison, TX 75001
(972) 677-4600
www.osteomedcorp.com
Booth 302

PhotoMedex, Inc.
147 Keystone Drive
Montgomeryville, PA 18936
(215) 619-3600
www.photomedex.com
Booth 401

Red Sea Management, Ltd.
8345 NW 66th Street, #6508
Miami, FL 33166
(800) 498-5052
www.redseamanagement.com
Booth 502

Scanlan International, Inc.
One Scanlan Plaza
Saint Paul, MN 55107
(651) 298-0997
www.scanlaninternational.com
Booth 200

Synergetics, Inc.
3845 Corporate Centre Drive
O'Fallon, MO 63368
(636) 939-5100
Booth 601

Synthes CMF
1301 Goshen Parkway
West Chester, PA 19380
(610) 719-6873
www.synthes.com
Booth 100

Vygon Neuro
2495 General Armistead
Norristown, PA 19403
(610) 539-9300
www.vygonusa.com
Booth 403

W. Lorenz Surgical
1520 Tradeport Drive
Jacksonville, FL 32218
(904) 741-9440
www.lorenzsurgical.com
Booth 402

ACKNOWLEDGEMENTS

The American Association of Neurological Surgeons and Congress of Neurological Surgeons Section on Pediatric Neurological Surgery thank the following companies for their educational grants in support of the Annual Meeting:

DIAMOND SPONSORS $20,000+

CODMAN, A JOHNSON & JOHNSON COMPANY

Codman
a Johnson & Johnson company

Program Book
General Session

MEDTRONIC NEUROLOGIC TECHNOLOGIES

Medtronic
NEUROLOGIC TECHNOLOGIES

Opening Reception
Speaker Sponsor

DISCLOSURE INFORMATION

The AANS/CNS Section on Pediatric Neurological Surgery and the American Association of Neurological Surgeons (AANS) control the content and production of this CME activity, and attempt to assure the presentation of balanced, objective information. In accordance with the Standards for Commercial Support established by the Accreditation Council for Continuing Medical Education, Speakers and paper presenters are asked to disclose any relationship they or their co-authors have with commercial companies which may be related to the content of their lecture.

Speakers and paper presenters/authors who have disclosed a relationship with commercial companies, whose products may have a relevance to their presentation, are listed below.

Stephen J. Haines, MD	Grants/Research Support Medtronic PS Medical
James P. McAllister, PhD	Grants/Research Support Brain Child Foundation
	Grants/Research Support STARS Support Group
Eliaz Rizk, MD	Funding from Howard Hughes and the American College of Surgeons

NON-DISCLOSURE INFORMATION

Speakers and paper presenters who have reported they do not have relationships with commercial companies are listed.

Rick Abbott, MD

Matthew Adamo, MD

D. Cory Adamson, MD, PhD

Edward S. Ahn, MD

Khaled B. Aly, MD

Juan Alzate, MD

William Wallace Ashley, MD, PhD, MBA

Kurtis Ian Auguste, MD

Mirza N. Baig, MD, PhD

James E. Baumgartner, MD

Mony Benifla, MD

Erica F. Bisson, MD

Jeffrey P. Blount, MD, FACS

Robert John Bollo, MD

Frederick A. Boop, MD, FACS

Samuel R. Browd, MD, PhD

Jeffrey E. Catrambone, MD

Justin Michael Caplan, BA

David Douglas Cochrane, MD

Alan R. Cohen, MD, FACS

Robert C. Dauser, MD

Ann-Christine Duhaime, MD

Kristine Dziurzynski, MD

Sudesh Ebenezer, MD

Foad Elahi, MD

James Bradley Elder, MD

Ann Marie Flannery, MD, FACS, FA

Christopher A. Gegg, MD

Timothy M. George, MD

Holly S. Gilmer-Hill, MD

Liliana C. Goumnerova, MD, FRCS(C)

Jeffrey Peter Greenfield, MD, PhD

Michael Hillel Handler, MD, FACS

Ashraf Meghad Hassan, MD

Daniel Jin Hoh, MD

Roger J. Hudgins, MD

Bermans J. Iskandar, MD

Susumu Ito, MD

George I. Jallo, MD

Brian Thomas Jankowitz, MD

Peter Kan, MD

Chris S. Karas, MD

Bruce A. Kaufman, MD, FACS

Robert F. Keating, MD

Erin Nicole Kiehna, BS

Seung-ki Kim, MD

Mark D. Krieger, MD

Cornelius H. Lam, MD

Roger A. Lichtenbaum, MD

Neal Luther, MD

Bart A. MacDonald, MD

Joseph R. Madsen, MD

Suresh N. Magge, MD

Jonathan E. Martin, MD

Joshua Eric Medow, MD

Roham Moftakhar, MD

Jae Gon Moon, MD DMSc

Andrew Do Nguyen, MD, PhD

Alfred T. Ogden, MD

Greg Olavarria, MD

Jogi Venkata Pattisapu, MD

Joseph H. Piatt Jr., MD

David W. Pincus, MD, PhD

Nader Pouratian, MD, PhD

Jeffrey Pugh, MD

Patricia B. Quebada, MD

John Ragheb, MD

Ali I. Raja, MD, MS

Sharad Rajpal, MD

Patrick Julian Reid, MD

Shenandoah Robinson, MD

Curtis J. Rozzelle, MD

Nader Sanai, MD

David I. Sandberg, MD

Robert A. Sanford, MD

Steven J. Schiff, MD, PhD

Mehmet Selcuki, MD, PhD

Jonathan R. Slotkin, MD

Jodi L. Smith, MD, PhD

Matthew D. Smyth, MD

Deepa Soni, MD, MPH

Ivan J. Sosa, MD

Mark M. Souweidane, MD

Keyne K. Thomas, MD

Elizabeth M. Trinidad, MD, PharmD

R. Shane Tubbs, PA

Kyu-Chang Wang, MD, PhD

Benjamin C. Warf, MD

Monica C. Wehby, MD

John C. Wellons III, MD

William E. Whitehead, MD

John S. Winestone, MD

Jeffrey H. Wisoff, MD

Shokei Yamada, MD

Boris Zivny, MD

ORAL ABSTRACT INDEX

1. "Clamshell" Craniotomy: a Technique for Previously Uncorrected Sagittal Craniosynostosis
Matthew D. Smyth, MD; Christian Kaufman, MD; Alex A. Kane, MD (St. Louis, MO)

2. A Comparison of Open and Minimally Invasive Procedures for Craniosynostosis
Laura Hollinger E. Hollinger, BS; James E. Baumgartner, MD; John F. Teichgraeber, MD (Houston, TX)

3. Multiple Revolution Spiral Osteotomy and Additional Techniques for Cranial Vault Remodeling and Expansion
Elizabeth M. Trinidad, MD; Micam W. Tullous, MD; Lisa Zerda, RN, MSN; Andrew E. Auber, MD; Patricia A. Mancuso (San Antonio, TX)

4. Spinal Cutaneous Tethering Tracts in Spina Bifida Occulta: Reclassification.
Kenneth Shulman Award Candidate
Sharad Rajpal, MD (Madison, WI); R. Shane Tubbs, PhD (Birmingham, AL); Shahriar Salamat, MD, PhD (Madison, WI); W. Jerry Oakes, MD (Birmingham, AL); Bermans J. Iskandar, MD (Madison, WI)

5. A Novel Spontaneous Sheep Mutant of Spinal Neural Tube Defects
Timothy M. George, MD; Thomas J. Cummings, MD; Yohannes G. Asfaw, DVM; Marcy C. Speer, PhD; James D. Reynolds, PhD (Durham, NC)

6. The Symptomatic Post Lipomyelomeningocele Resection Patient: Do increases in the Lumbosacral Angle Indicate a Tethered Spinal Cord?
R. Shane Tubbs, PhD, PA-C; William C. Rice, MD; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

7. Electrophysiologically-guided Untethering of Secondary Tethered Spinal Cords Following Myelomeningocele Repair
Kenneth Shulman Award Candidate
Nader Pouratian, MD, PhD; John A. Jane, Jr., MD; Tracey L. Owensby, BS; W. J. Elias, MD; Lawrence A. Phillips, MD; John A. Jane, Sr., MD, PhD, FRC (Charlottesville, VA)

8. Posterior Fossa Volume in the Myelomeningocele Population: a Novel Observation
Kenneth Shulman Award Candidate
Keyne K. Thomas; Isaac O. Karikari; Dave S. Enterline; Herbert E. Fuchs; Timothy M. George (Durham, NC)

9. Enhancement of Re-closure Capacity by the Intra-amniotic Injection of Human Embryonic Stem Cells in Surgically Induced Spinal Open Neural Tube Defects in Chick Embryos
Kyu-Chang Wang, MD, PhD; Do-Hun Lee, MS; Sepill Park, PhD; Seung-Ki Kim, MD, PhD; Jinho Lim, MD, PhD; Byung-Kyu Cho, MD, PhD (Seoul, Republic of Korea)

10. Neural Stem Cells Target and Deliver Pro-drug Gene to Experimental Intracranial Medulloblastomas
Seung-Ki Kim, MD (Boston, MA); Seung U. Kim, MD (Suwon, Republic of Korea); Karen S. Aboody, MD (Duarte, CA); Kyu-Chang Wang; Byung-Kyu Cho (Seoul, Republic of Korea); Peter M. Black, MD; Rona S. Carroll, PhD (Boston, MA)

11. Digital Karyotyping Identifies a Novel Retinoblastoma Oncogene
Kenneth Shulman Award Candidate
D. Cory Adamson, MD, PhD; Timothy M. George, MD (Durham, NC)

12. Effects of Hydrocephalus on IQ in Children with Infratentorial Ependymoma Before and After Conformal Radiation Therapy
Hydrocephalus Award Candidate
Robert A. Sanford, MD; Thomas C. Merchant, DO, PhD; Frederick A. Boop, MD; Naina Gross, MD (Memphis, TN)

13. The Role of Diffusion-weighted MR Imaging in Pediatric Brain Tumors
Kenneth Shulman Award Candidate
Peter Kan, MD; James Liu, MD; Gary Hedlund; Douglas Brockmeyer, MD; Marion Walker, MD; John Kestle, MD (Salt Lake City, UT)

14. Neurocognitive Outcome in Pediatric Craniopharyngioma: the Impact of Surgical Resection and Conformal Radiation Therapy
Erin N. Kiehna, MS; Frederick A. Boop, MD; Robert A. Sanford, MD; Larry E. Kun, MD; Raymond K. Mulhern, PhD; Chenghong Li, MS; Xiaoping Xiong, PhD; Kathleen J. Helton, MD; Thomas E. Merchant, DO, PhD (Memphis, TN)

15. Local Delivery of M4N in a Brainstem Tumor Model Using a Cannulated Guide Screw
George I. Jallo, MD; Andrey Volkov, BA; Margaret Penno, PhD; Cyrus Wong, BS; Ru Chin Huang, PhD (Baltimore, MD)

16. Optical Characterization of Pediatric Brain Tumors and Epileptogenic Lesions
David I. Sandberg, MD; Glenn Morrison, MD, FACS; Sanjiv Bhatia, MD; Greg Olavarria, MD; John Ragheb, MD, FACS; Michael Duchowny, MD; Prasanna Jayakar, MD, PhD; Wei-Chiang Lin, PhD (Miami, FL)

17. Intratumoral Interstitial Delivery of Anti-glioma Monoclonal Antibody 8H9
Kenneth Shulman Award Candidate
Neal Luther, MD; Mark A. Edgar, MD; Nai-kong V. Cheung, MD, PhD; Philip H. Gutin, MD; Mark M. Souweidane, MD (New York, NY)

18. Noninvasive Diagnosis of Pediatric Pilocytic Astrocytomas by Advanced Magnetic Resonance Spectroscopy
Mark D. Krieger, MD; Ashok Panigrahy, MD; J. Gordon McComb, MD; Marvin D. Nelson, MD; Ignacio Gonzalez-Gomex, MD; Floyd Gilles, MD; Stefan Bluml, PhD (Los Angeles, CA)

19. Aggressive Clinical Behaviour of Histologically Benign Tectal Gliomas
Kenneth Shulman Award Candidate
Jeffrey Pugh, MD, MSc; Vivek Mehta, MD, FRCS(C); Keith Aronyk, MD, FRCS(C) (Edmonton, AB, Canada)

20. Extraoperative Functional Mapping via Staged Resection of Supratentorial Tumors in Children
Robert J. Bollo, MD; Chad Carlson, MD; Catherine Schevon, MD; Jeffrey Wisoff, MD; Orinn Devinsky, MD; Howard Weiner, MD (New York, NY)

21. Efficacy of Local Delivery 3-bromopyruvate in the Treatment of a Brainstem Tumor
George I. Jallo, MD; Cyrus Wong, BS; Margaret Penno, PhD; Andrey Volkov, BA; Young Ko, PhD (Baltimore, MD)

22. Immunotherapy for Medulloblastoma
Alfred T. Ogden, MD (Columbia, New York, NY)

23. Myxopapillary Ependymoma: Long-term Outcome and Treatment
Carrie N. Stair, BA (Reno, NV); Mark D. Krieger, MD; Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

24. Intraoperative MRI and the Pediatric Patient: Are We There Yet?
Robert F. Keating, MD; John S. Myseros, MD; Amanda L. Yaun, MD; Derek A. Bruce, MD (Washington, DC)

25. Development of a Long-lasting Silicone Catheter Impregnated with Rifampicin

Hydrocephalus Award Candidate
James P. McAllister, PhD; Xuemei Liang, PhD; Anfeng Wang, PhD; Haiying Tang, BS; Ting Cao, BS; Steven O. Salley, PhD; Kelley Brabant, BS; Carolyn Black; Jie Li,MD; KY Simon Ng, PhD (Detroit, MI)

26. Diagnosis and Management of Growing Skull Fractures: the Memphis Experience
John S. Winestone, MD; Frederick A. Boop, MD; Naina L. Gross, MD; Michael S. Muhlbauer, MD; Stephanie L. Einhaus, MD; Robert A. Sanford, MD; The University of Tennessee-Memphis; Semmes–Murphey Neurologic and Spine Institute; LeBonheur Children's Medical Center (Memphis, TN)

27. Ventricular-subgaleal Shunts at Columbus Children's Hospital

Hydrocephalus Award Candidate
Chris S. Karas, MD; Scott W. Elton, MD (Columbus, OH)

28. Vagus Nerve Stimulation Therapy in Patients with Autism Spectrum Disorder: Results from the Vagus Nerve Stimulation Therapy Patient Outcome Registry
Andrew D. Nguyen, MD, PhD; Samuel A. Hughes ,MD, PhD; Lissa C. Baird, MD; Hal S. Meltzer, MD (San Diego, CA); Arun P. Amar, MD (New Haven, CT); Michael L.J. Apuzzo, MD (Los Angeles, CA); Karen M. Levy, BSN, RN; Michael L. Levy, MD, PhD (San Diego, CA)

29. Do Completely Resected Ependymomas in the Very Young Require Adjuvant Therapy?
Mark D. Krieger, MD; Jonathan L. Finlay, MD; Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

30. Children with CNS Tumors Discovered Incidentally after Trauma
Gwyneth Hughes, BA; Alan R. Cohen, MD; Shenandoah Robinson, MD (Cleveland, OH)

31. Use of Minimally Invasive Techniques for Tethered Cord Release: Technical Note
Jonathan E. Martin, MD; Daniel J. Donovan, MD (Honolulu, HI)

32. Essential Factors of Tethered Cord Syndrome
Shokei Yamada, MD, PhD (Loma Linda, CA); Daniel J. Won, MD (Fontana, CA); David B. Knierim, MD (Madeira, CA); Javed Siddiqi, MD, PhD (Colton, CA)

33. Decompressive Craniectomy for Treatment of Intractable Intracranial Pressure in Severely Head Injured Pediatric Patients

Kenneth Shulman Award Candidate
Matthew A. Adamo, MD; Daniel L. Friedlich; Eric M. Deshaies; John Dalfino; Walter Edge; John B. Waldman (Albany, NY)

34. Perinatal Brain Injury Impairs Cerebellar Development in Children and Rats
Jason D. Hill, BA; Shenandoah Robinson, MD (Cleveland, OH)

35. Transcutaneous Inductive Pressure (TIP) Monitor: Prototype for a Permanently Implanted ICP Device

Kenneth Shulman Award Candidate
Joshua E. Medow, MD; Bermans J. Iskandar, MD (Madison, WI)

36. Variation in the Notch Filter Response of the ICP to Arterial Pulse Pressure
Joseph R. Madsen, MD; Rui Zou, PhD (Boston, MA); Michael R. Egnor, MD (Stonybrook, NY); Mark Luciano, MD; Stephen Dombrowski, PhD (Cleveland, OH); Erin J. McCormack, MS; Mark Wagshul, PhD (Stonybrook, NY); Dong Kim, MD (Boston, MA)

37. Use of Controlled Hyperosmolality with Hypertonic Saline Solutions in Traumatic Brain Injury: Case Study of 16 Pediatric Patients
Stephen A. Fletcher, DO; James E. Baumgartner, MD; Sean T. Meiner, BS; Len Tanaka, MD; Giuseppe Colasurdo, MD; Beatrice Cua, MD; Nathan Strobel, MD; Lindsay Sharp, BS (Houston, TX)

38. Gene Therapy for Late Infantile Neuronal Ceroid Lipofuscinosis: Surgical Considerations
Mark M. Souweidane, MD (New York, NY); Lisa M. Arkin, BA (Philadelphia, PA); Dolan Sondhi, PhD; Neil R. Hackett, PhD; Stephen M. Kaminsky, PhD; Ronald G. Crystal, MD; Michael G. Kaplitt, MD, PhD (New York, NY)

39. Scoliosis and Chiari I Malformations in Children
Mark D. Krieger, MD; Yuri Falkinstein, MD; Ira Bowen, BA; Vernon Tolo, MD; J. Gordon McComb, MD (Los Angeles, CA)

40. Professionalism: A Proposed Curriculum for Neurosurgery

Kenneth Shulman Award Candidate
Sudesh Ebenezer, MD; Joseph R. Madsen, MD; Arthur Day, MD (Boston, MA)

41. Dural Inversion Procedure for Moyamoya Disease: Experience with Twenty One Cases
Robert C. Dauser, MD; Hatem S. Megahed, MD; Charles W. McCluggage, MD (Houston, TX)

42. The Role of DNA Methylation in CNS Regeneration

Kenneth Shulman Award Candidate
Elias Rizk, MD; Kate Simon; Nithya Hariharan, MD; David Jarrard, MD; Bermans J. Iskandar, MD (Madison, WI)

43. Long-term Motor Outcome Analysis Following Surgical Brachial Plexus Repair Using a Motor Score Composite

Kenneth Shulman Award Candidate
William W. Ashley, MD, PhD, MBA; T. S. Park, MD; Jeffrey R. Leonard, MD; Matthew D. Smyth, MD; Michael Noetzel, MD; Trisha Weatherly, PA-C (St. Louis, MO)

44. Cervical Selective Dorsal Rhizotomy in the not only Spasticity Treatment in 21 Children with Cerebal Palsy
Boris Zivny, MD; Stanislav Severa, MD (Czech Republic)

45. Dynamical Evolution of Seizures in Children
Steven J. Schiff, MD, PhD; Tim Sauer, PhD; Rohit Kumar (Fairfax, VA); Steven L. Weinstein, MD (Washington, DC)

46. MSI Guided Frameless Navigation for Placement of Subdural Grid Arrays Confirms Accuracy of MEG Dipoles in Predicting Ictal Onset in Pediatric Patients
Jeffrey P. Blount, MD (Birmingham, AL)

47. Seizure Control Following Temporal Lobectomy in Children: Experience at Memorial Hermann Children's Hospital, Houston
James E. Baumgartner, MD; Joshua Baker, BSN, RN; Stephen A. Fletcher, DO (Houston, TX)

48. Temporal Lobectomy for Epilepsy in Children- Long Term Follow up
Mony Benifla, MD; Hiroshi Otsubo, MD; Carter Snead, MD; Khoshyomn Sami, MD; Sheila Weiss, MD; James Rutka, MD, PhD (Toronto, ON, Canada)

49. Corpus Callosotomy: A Six Year Experience of Clinical Outcomes for Patients with Intractable Epileptic Seizures
Lindsay L. Sharp, BS; James E. Baumgartner, MD; Stephen A. Fletcher, DO; David Clarke, MD; Sean T. Meiner, BS (Houston, TX)

50. Vagus Nerve Stimulation in Children Less Than Five-Years-Old
R. Shane Tubbs, PhD; Jeffrey P. Blount, MD; Pongkiat Kankirawatana, MD; Sarah Kiel, RN, CPNP; Robert Knowlton, MD; Paul A. Grabb, MD; Martina Bebin, MD (Birmingham, AL)

51. The Natural History of Arachnoid Cysts: Progression in Children Less Than 2 Years of Age

Kenneth Shulman Award Candidate
Nader Sanai, MD; Kurtis I. Auguste, MD (San Francisco, CA); Peter P. Sun, MD (Oakland, CA)

52. Consequences of Removal of Oregon's Cap on Non-economic Damages on the Neurosurgical Workforce
Monica C. Wehby, MD (Portland, OR)

53. In Vivo Quantum Dot Labeling of Stem Cells in the Developing Embryonic Nervous System

Kenneth Shulman Award Candidate
Jonathan R. Slotkin, MD (Boston, MA); Haining Dai, PhD; Ian Gallicano, PhD; Barbara Bregman, PhD; Joshua Corbin, PhD; Tarik Haydar, PhD (Washington, DC)

54. Apoptosis Seems to be the Major Process While Surface and Neural Ectodermal Layers Detach During Neurulation
Mehmet Selcuki, MD, PhD (Izmir, Turkey)

55. Cerebral Revascularization for the Medically Intractable Patient with Progressive Cerebral Artery Stenosis Caused by Sickle Cell Disease
Roger Hudgins, MD; Lynn Gilreath, RN; Beatrice Gee, MD; Beatrice Files, MD; William Boydston, MD; Andrew Reisner, MD; Kevin Stevenson, MD; Thomas Burns, PsyD (Atlanta, GA)

56. Incidence of Venous Infarction after Sacrificing Mid Sagittal Sinus Bridging Veins
Ivan J. Sosa, MD; J. Gordon McComb, MD, FACS; Sean McNatt, MD; Mark Krieger, MD (Los Angeles, CA)

57. Microsurgical Resection Improves Hind-limb Function until onset of Paresis in an Experimental Intramedullary Spinal Cord Tumor
Justin M. Caplan, BA; Alia Hdeib, BS; Gustavo Pradilla, MD; Betty Tyler, BA; Federico Legnani, MD; William Pennant; Andrey Volkov, BA; Henry Brem, MD; George Jallo, MD (Baltimore, MD)

58. Astrocyte and Choroid Plexus Growth on Silicone Coated with Polymers and Self-Assembled Monolayers

Hydrocephalus Award Candidate
James P. McAllister, PhD; Kruti Patel, MS; William E. Grever, PhD; Haiying Tang, BS (Detroit, MI); Jianming Xiang; Richard F. Keep, PhD (Ann Arbor, MI); Kelley E. Brabant, BS; Carolyn A. Black; K.Y. S. Ng, PhD (Detroit, MI)

59. The Na/K ATPase Pump is Essential to Regeneration of the Adult CNS

Kenneth Shulman Award Candidate
Bermans J. Iskandar, MD; Elias Rizk, MD; Dandan Sun, PhD; Raghu Vemuganti, PhD; Nithya Hariharan, MD (Madison, WI)

60. Use of the Far Lateral Transcondylar Approach in Children
David W. Pincus, MD, PhD; Stephen B. Lewis, MD, FRACS (Gainesvillle, FL)

61. Laser Image Evaluation of Papilledema and Intracranial Pressure
Jeffrey E. Catrambone, MD; Dennis Roberts, BA, BS, PhD; Gordon Thomas, BA, BS, PhD; Sandra Kosinski, BA, BS, PhD; Wenzhaun He, MD, MS (Newark, NJ)

62. Intraoperative Assessment of Third Ventriculostomy Success

Hydrocephalus Award Candidate
Jeffrey P. Greenfield, MD, PhD; Mark M. Souweidane, MD (New York, NY)

63. Has Regulation Improved the CSF Shunt?
Stephen J. Haines, MD (Minneapolis, MN); Jeffrey P. Blount, MD (Birmingham, AL)

64. Utility of Antibiotic Impregnated Extraventricular Drains

Hydrocephalus Award Candidate

R. Shane Tubbs, PhD; James Custis, MD; R. Scott Hammock, MD; Elizabeth Blackburn, RN; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

65. Polymerase Chain Reaction for the Detection of Cerebrospinal Fluid Shunt Infections: A Prospective Study

Kenneth Shulman Award Candidate

R. Shane Tubbs, PhD, PA-C; James Custis, MD; Suman Bharara, PhD; Yancey Gillispie, PhD; John C. Wellons, III, MD; W. Jerry Oakes, MD; Jeffrey P. Blount, MD (Birmingham, AL)

66. Hydrocephalus in the HB-EGF Transgenic Model of Communicating Hydrocephalus is Stable Over Time

Hydrocephalus Award Candidate

Bart A. MacDonald, MD; Joseph R. Madsen, MD; Yanping Sun, PhD; Michael Klagsbrun, PhD (Boston, MA)

67. Comparison of Infection Rates with Antibiotic and Non-antibiotic Impregnated Shunt Systems in a Large Series of Pediatric Patients

Greg Olavarria, MD; Pediatric Neurosurgery Group, University of Miami and Miami Children's Hospital (Miami, FL);

68. The Strata Programmable Valve for Shunt-Dependent Hydrocephalus: The Pediatric Experience at a Single Institution

Hydrocephalus Award Candidate

Edward S. Ahn, MD; Markus Bookland, MD; Benjamin S. Carson, MD; Jon D. Weingart, MD; George I. Jallo, MD (Baltimore, MD)

69. Late Failure of Endoscopic Third Ventriculostomy in Children

Hydrocephalus Award Candidate

Brian T. Jankowitz, MD; Paul Gardner, MD; P. D. Adelson, MD, FACS; A. L. Albright, MD; Ian F. Pollack, MD, FACS (Pittsburgh, PA)

70. Pathophysiology of Communicating Hydrocephalus in Clinically-Relevant Experimental Models

Hydrocephalus Award Candidate

James P. McAllister, PhD; Jie Li, MD; Janet M. Miller, PhD; Parthasarathy K. Saranath, BS (Detroit, MI); Michael R. Egnor, MD; Mark Wagshul, PhD (Stony Brook, NY); Curt Stewart, MBA (Carefree, AZ); E. Mark Haacke, PhD (Detroit, MI); Marion E. Walker, MD (Salt Lake City, UT)

71. Effects of Silicone Surface Coatings on Staphylococcus Epidermidis Adhesion and Colonization

Hydrocephalus Award Candidate

James P. McAllister, PhD; Haiying Tang, BS; Xuemei Liang, PhD; Ting Cao, BS; Steven O. Salley, PhD; K.Y. Simon Ng, PhD (Detroit, MI)

72. Inhibitory Effects of Minocycline on Gliosis in the Hydrocephalic H-Tx Rat

Hydrocephalus Award Candidate

Janet M. Miller, PhD; Alexander G. Shanku; Steven D. Ham, DO; James P. McAllister, PhD (Detroit, MI)

73. Endoscopic Third Ventriculostomy in the Management of Patients with Diffuse Pontine Gliomas

Hydrocephalus Award Candidate

Liliana C. Goumnerova, MD, FRCS(C); Paul Klimo, MD (Boston, MA)

74. Gray Zone Hydrocephalus and "The 30 Centimeter Syndrome".

Khaled B. Aly, MD (Giza, Egypt)

1. "Clamshell" Craniotomy: a Technique for Previously Uncorrected Sagittal Craniosynostosis

Matthew D. Smyth, MD; Christian Kaufman, MD; Alex A. Kane, MD (St. Louis, MO)

Introduction: While most sagittal craniosynostosis is recognized and treated in infancy, some children are not brought to the attention of craniofacial centers until early childhood. We describe our operative technique for calvarial reconstruction in older children with previously untreated sagittal craniosynostosis.

Methods: We describe eight patients treated with a novel single-stage calvarial reconstruction using the supine position. The procedure consists of a coronal incision, bifrontal craniotomy without orbital osteotomy, and multiple interlocking midline parieto-occipital osteotomies and recontouring. Fixation is achieved with a bioabsorbable plating system. Pre-, intra-, and post-operative photographs and 3D CT scans will be presented for review.

Results: Between November 2003 and April 2005 we treated seven patients with uncorrected sagittal craniosynostosis and one with pansynostosis using this technique. All were boys with ages ranging from 1 to 9 years, mean 4.2 y. Average operating time was 5.1 hours (4.3 to 8h), with an average blood loss of 425 cc (200 to 800 cc). As a percentage of estimated circulating blood volume, mean operative blood loss was 33.6% (17% to 56%). Average hospital stay was 4.9 days. Cranial index improved from a mean of 65.6 to 71.3%. No acute or delayed complications have been recognized. Follow-up at an average of 6 mo (1 to 15 months) confirms excellent early patient and family satisfaction.

Conclusions: An approach of aggressive calvarial reconstruction with multiple interleaving osteostomies crossing the midline achieves excellent improvements in biparietal narrowing. Combined with a bifrontal reconstruction, early outcomes are excellent, with acceptable intraoperative blood loss and no significant complications.

2. A Comparison of Open and Minimally Invasive Procedures for Craniosynostosis

Laura Hollinger E. Hollinger, BS; James E. Baumgartner, MD; John F. Teichgraeber, MD (Houston, TX)

Introduction: The authors have developed and performed a new microsurgical approach to craniosynostosis designed to minimize the risks of traditional open repair. Results from the microscopic approach were compared to those of the open approach for sagittal, metopic and coronal synostoses.

Methods: From January 2001 to May 2005, the authors performed 35 microscopic and 55 open procedures for sagittal, coronal, metopic, and lambdoid synostoses. The authors' approach places a small incision over the prematurely fused suture, and using the operative microscope, a 5 mm diamond drill performs a 5 mm synostectomy. Bilateral parieto-occipital craniotomies are also employed for sagittal synostoses. Postoperatively, all patients require molding therapy. This retrospective chart review compares operative times, hospital stays, blood transfusion rates, and pre- and post-operative head measurements for both the open and microscopic approaches.

Results: Patients treated microscopically averaged 3.4 months of age. The impact of surgery on patients was greatly minimized with the microscopic approach, which cut surgical time by 75 minutes, hospital stays by more than one day, and blood loss by 150cc. Anthropometric head measurements for patients with sagittal synostoses demonstrate correction of cephalic indices to normal, shifting from 68 pre-operatively to 79 post-operatively. Patients with coronal synostoses show improvement in cephalic indices from 91 pre-operatively to 86 post-operatively.

Conclusions: The microscopic approach offers a safe and beneficial alternative to the traditional synostectomy procedure with outstanding aesthetic results.

3. Multiple Revolution Spiral Osteotomy and Additional Techniques for Cranial Vault Remodeling and Expansion

Elizabeth M. Trinidad, MD; Micam W. Tullous, MD; Lisa Zerda, RN, MSN; Andrew E. Auber, MD; Patricia A. Mancuso (San Antonio, TX)

Introduction: The authors present their experience in performing three different cranial vault remodeling and expansion.

Methods: A total of 70 patients underwent cranial vault remodeling and expansion utilizing three different surgical techniques. In addition, to providing immediate correction of their deformities these techniques also increased intracranial volume which allowed for immediate relief of existing intracranial hypertension and reduces the possibility of its future development. Multiple revolution spiral osteotomy was utilized in 55 patients to correct cranial deformities and relieve intracranial hypertension, including 5 cases of "slit ventricle" syndrome. We present the outcome, benefits and complications in this series of patients. The multi-concentric osteotomy technique was used to correct specific deformities in 12 patients. We describe this technique as well as its advantages and early results. We also introduce another promising new technique, the Omega procedure. We provide a description of this technique which has now been utilized in three patients (3-6 months of age) to treat scaphocephaly secondary to premature sagittal suture synostosis while providing cranial expansion for this younger age group.

Conclusions: The availability of three different cranial vault remodeling and expansion techniques, multiple revolution spiral osteotomy, multi-concentric osteotomies and Omega procedure promises great versatility for all age groups in the ability to correct various cranial deformities while also producing an increase in intracranial volume.

4. Spinal Cutaneous Tethering Tracts in Spina Bifida Occulta: Reclassification

Kenneth Shulman Award Candidate

Sharad Rajpal, MD (Madison, WI); R. Shane Tubbs, PhD (Birmingham, AL); Shahriar Salamat, MD, PhD (Madison, WI); W. Jerry Oakes, MD (Birmingham, AL); Bermans J. Iskandar, MD (Madison, WI)

Introduction: Since the seminal publication "Spina Bifida Occulta" by James and Lassman in the 1970s, various tethering tracts or bands have been recognized as part of the spectrum of occult spinal dysraphic lesions. These tracts were named according to their assumed histological composition: meningocele manqué, dermal sinus tracts, and fibrous ventral or dorsal bands. Such a classification system has not been systematically confirmed or redefined in any subsequent study.

Methods: In this study, we have examined the histological composition of tracts resected from patients with spina bifida occulta at two academic institutions. We have then classified these based on their clinical, histological, and anatomical characteristics.

Results: 21 SBO patients were identified (12: Univ. of Wisconsin; 9: Univ. of Alabama) with tracts arising in the spinal cord. 60% had cutaneous anomalies. The majority of tracts inserted in the skin (8) or dura (8). Some ended in fascia or bone. The majority of tracts that ended either in a cutaneous sinus opening and/or ones that arose in an intradural dermoid tumor had epithelial lining. The presence of meningeal elements or EMA positivity in tethering tracts was rare, and such tracts were not associated with cutaneous anomalies. Split cord malformations tended to be associated with spinal tracts that inserted in the dura rather than skin. CNS and adipose tissue was present in 20% and 33% of tracts, respectively.

Conclusions: We propose a new classification system of spinal cutaneous tethering tracts in spina bifida occulta based on clinical, anatomical, and histological criteria.

5. A Novel Spontaneous Sheep Mutant of Spinal Neural Tube Defects

Timothy M. George, MD; Thomas J. Cummings, MD; Yohannes G. Asfaw, DVM; Marcy C. Speer, PhD; James D. Reynolds, PhD (Durham, NC)

Introduction: We describe a novel large animal model that closely mimics the pathology and associated anomalies seen in human spinal neural tube defects.

Methods: A herd of sheep from the Bayliss Sheep Farm in Ohio was studied over a two year period.

From 38 ewes, a total of 92 lambs were born with 11 (12%) having spina bifida. The eleven lambs with spina bifida were from 9 different ewes. There were 6 ram and 5 ewes. Six of the affected lambs were products of twin gestation and one was a quadruplet pregnancy, and the remaining 4 were single fetus pregnancies. None of the siblings had spina bifida. None of the mother ewes with a spina bifida lamb had another pregnancy with a spina bifida fetus. The ewe flock was made up of 4 crossbred strains and was originated from commercial sources. The same ram impregnated all of the ewes. Viral studies revealed only the presence of Cache Valley Virus in some of the lambs.

Necropsy revealed that all of the sheep had open lumbosacral defects associated with varying degrees of hindbrain herniation (Chiari malformation), hydrocephalus, and one had a cervical meningocele. All had abnormally short tails.

Histology and immunohistochemical analysis of the brain and spinal cord was performed.

Conclusions: The sheep model described here has the potential to be the closest model of human spina bifida to date. It will allow for the study of prevention and novel treatment strategies of children afflicted with NTD.

6. The Symptomatic Post Lipomyelomeningocele Resection Patient: Do Increases in the Lumbosacral Angle Indicate a Tethered Spinal Cord?

R. Shane Tubbs, PhD, PA-C; William C. Rice, MD; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

Introduction: The angulation of the sacrum is easily measured. We have reported symptomatic myelomeningocele patients who were found to have increases in their lumbosacral angle (LSA) corresponding to the onset of symptoms from a tethered spinal cord. The present study seeks to verify this same cause and effect in a group of patients with occult spinal dysraphism.

Methods: Retrospective analysis of 50 consecutive lipomyelomeningocele repairs was performed. Thirty age-matched controls were also analyzed. Measurements were made of the LSA over time in all patients.

Results: Appropriate imaging was available for 25 lipomyelomeningocele cases. Roughly one half of patients were symptomatic at most recent follow up. Nine patients were found to have corresponding LSA measurements of greater than 70 degrees with seven of these presenting with signs of a tethered spinal cord (e.g. decreased lower extremity function, bladder incontinence). LSA measurements were statistically ($p < 0.05$) greater in our symptomatic patient population compared to controls.

Conclusions: Signs and symptoms indicative of a tethered spinal cord correspond to increases in the LSA. This radiological finding may prove useful to the clinician as an indication of the tethered spinal cord or as an adjunct in verifying symptomatology in patients with a lipomyelomeningocele.

7. Electrophysiologically-guided Untethering of Secondary Tethered Spinal Cords Following Myelomeningocele Repair

Kenneth Shulman Award Candidate

Nader Pouratian, MD, PhD; John A. Jane, Jr., MD; Tracey L. Owensby, BS; W. J. Elias, MD; Lawrence A. Phillips, MD; John A. Jane, Sr., MD, PhD, FRC (Charlottesville, VA)

Introduction: Myelomeningocele repair can be complicated by delayed spinal cord tethering by scar. Untethering in this situation can be difficult due to distorted anatomy and scar. We have developed, and describe here, an approach of using intraoperative electrophysiological mapping to guide re-operation for spinal cord tethering.

Methods: We identified patients who met three criteria: (1) perinatal myelomeningocele repair (2) re-operation for tethered cord release (3) age less than 20 years at re-operation. Thirty-eight patients were identified (0.5-19 years old) over 13 years. In all cases, we used electromyography (EMG) to both monitor for spontaneous muscle activity (due to intraoperative neural manipulation) and map peripheral responses to electrical stimulation of nerves. Proximity to viable nerves was determined by the stimulation threshold required to elicit a peripheral response.

Results: Presentations included motor deficits (71%), bowel and/or bladder dysfunction (63%), parasthesias (32%), and pain (32%). In 92% of cases, mapping helped identify neural tissue adjacent to the area of tethering that was not visually obvious. In 61% of cases, the operative plan was modified based on the intraoperative maps. In 9 cases, the placode was transected to achieve untethering. Postoperative functional deterioration was limited to 1 case each of motor deterioration and worse pain. Scar was the most commonly noted tethering element(68%). Overall, 35% of patients improved immediately from surgery, with those presenting with pain and weakness realizing the most benefit.

Conclusions: Electrophysiological mapping is an efficient, effective and reliable method for intraoperative guidance, limiting iatrogenic injury in surgical untethering of the spinal cord due to scar.

8. Posterior Fossa Volume in the Myelomeningocele Population: a Novel Observation

Kenneth Shulman Award Candidate

Keyne K. Thomas; Isaac O. Karikari; Dave S. Enterline; Herbert E. Fuchs; Timothy M. George (Durham, NC)

Introduction: It has been observed that the posterior fossa in children with Chiari II malformation is flattened, reduced in size and has a low tentorial position. In the myelomeningocele (MM) population, some have hypothesized that this malformation occurs as a result of constant leakage of CSF by way of the MM defect during gestation thus preventing distension of the posterior fossa. This consequently leads to a small posterior fossa with upward herniation into the supratentorial compartment and downward into the spinal canal. Our present study measures the posterior fossa volume in infants with a MM.

Methods: Twenty-four patients diagnosed as having a lumbosacral MM born between 2002-2005 were selected for review. All patients were noted to have a Chiari II malformation. Twenty-two of the patients had a ventriculoperitoneal shunt placed. Axial computed tomographic images were analyzed on all patients prior to shunting using the Cavalieri method to define posterior fossa volumes. Comparison was performed using age-matched controls without a MM but with hydrocephalus.

Results: Mean posterior fossa volumes of myelomenigocele patients with Chiari II malformation were greater than the mean volume of patients with hydrocephalus but no Chiari II.

Conclusions: Contrary to previous proposed theories indicating a small posterior fossa volume in myelomenigocele patients with a Chiari II malformation, we have found that the average posterior fossa volume is larger. This new information may change our former understanding and propose an alternative explanation regarding the pathophysiology of Chiari II malformation in the MM population.

9. Enhancement of Re-closure Capacity by the Intra-amniotic Injection of Human Embryonic Stem Cells in Surgically Induced Spinal Open Neural Tube Defects in Chick Embryos

Kyu-Chang Wang, MD, PhD; Do-Hun Lee, MS; Sepill Park, PhD; Seung-Ki Kim, MD, PhD; Jinho Lim, MD, PhD; Byung-Kyu Cho, MD, PhD (Seoul, Republic of Korea)

Introduction: To evaluate the role of embryonic stem cells as a method of prenatal management for human open neural tube defect (ONTD), human embryonic stem (hES) cells were injected into the amniotic cavities of chick embryos with surgically induced spinal ONTD and the presence of enhancement of re-closure capacity was tested.

Methods: The neural tubes of Hamburger and Hamilton (HH) stage 18 or 19 chick embryos were longitudinally incised open. In the experiment of hES cell injection on postoperative day (POD, operation = neural tube incision) 0, the embryos were divided into a control group (no injection), a vehicle group, and a hES cell group (injection of 20,000 hES cells immediately after neural tube incision). In the experiment of hES cell injection on POD 1, the embryos were divided into a control group (no injection) and hES cell group (injection of 40,000 hES cells one day after neural tube incision). The length of ONTDs was measured and the shape of neural tubes and the presence of hES cells in the neural tissue were investigated.

Conclusions: In both of the experiments on PODs 0 and 1, ONTDs were significantly more re-closed in the hES cell group than in the other groups 3, 5 and 7 days after injection. The hES cells were covering ONTDs in the process of re-closure, but were not found in the neural tissue at already re-closed area, suggesting indirect effects rather than cell replacement on the neural tissue.

10. Neural Stem Cells Target and Deliver Pro-drug Gene to Experimental Intracranial Medulloblastomas

Seung-Ki Kim, MD (Boston, MA); Seung U. Kim, MD (Suwon, Republic of Korea); Karen S. Aboody, MD (Duarte, CA); Kyu-Chang Wang; Byung-Kyu Cho (Seoul, Republic of Korea); Peter M. Black, MD; Rona S. Carroll, PhD (Boston, MA)

Introduction: Despite multimodality treatments, medulloblastomas are incurable in about one third of patients. In addition, the current therapies lead to long-term disabilities. Based on the extensive tropism of neural stem cells (NSCs) for malignant gliomas, we hypothesized that NSCs could also target medulloblastomas and be used as cellular delivery system for medulloblastoma therapy.

Methods: In the first set of studies, the migratory ability of HB1.F3 cells, human origin NSCs (hNSCs), to medulloblastomas was confirmed by an in vitro migration assay. In the second set of studies, the migration of HB1.F3 was confirmed in vivo; DiI labeled HB1.F3 cells were inoculated into the hemisphere contralateral to the established medulloblastomas in nude mice. In the third set of studies the potential of hNSCs to deliver a therapeutic gene, using HB1.F3 cells engineered to release cytosine deaminase (HB1.F3-CD) was examined. In vitro therapeutic efficacy of HB1.F3-CD was analyzed by co-culture experiments. For the in vivo therapeutic potential, animals bearing medulloblastomas were inoculated ipsilateral with HB1.F3-CD cells followed by systemic 5-fluorocytocine (FC) treatment. Histological analyses showed that DiI labeled hNSCs migrate at the tumor boundary leading to a 76% reduction of tumor volume in treatment group ($P<0.01$).

Conclusions: We demonstrate for the first time the potential of hNSCs as an effective delivery system to target and disseminate therapeutic agents to medulloblastomas.

11. Digital Karyotyping Identifies a Novel Retinoblastoma Oncogene

Kenneth Shulman Award Candidate

D. Cory Adamson, MD, PhD; Timothy M. George, MD (Durham, NC)

Introduction: Retinoblastoma is the most common malignant intraocular neoplasm of childhood and can be associated with an intracranial pineoblastoma. Retinoblastoma extension into the optic nerve or coexistence with a pineoblastoma is associated with a particularly poor outcome. Despite extensive research on the tumor suppressor gene, Rb1, there are still unknown contributory genetic factors. A better understanding of the signaling pathways for tumorigenesis can lead to therapeutic targets.

Methods: Digital karyotyping, a new state-of-the-art technique for performing genome-wide screens at high resolution was performed on PNET tumors to identify genetic alterations. FISH and real-time quantitative PCR were used to confirm potential oncogene amplifications; and immunohistochemistry was used to assess protein expression. siRNA-mediated gene knockdown and gene transfection were evaluated by proliferation, colony formation, and cell death assays to demonstrate oncogenic potential.

Digital karyotyping revealed amplification of the homeobox gene OTX2 in primary retinoblastoma tumors and cell lines. OTX2 amplification was confirmed by FISH and Q-PCR, and immunohistochemistry identified robust protein expression. Knockdown of OTX2 expression by siRNA inhibited pineoblastoma cell growth and colony formation in vitro, whereas, OTX2 overexpression induced a tumor phenotype. Importantly, pharmacologic doses of all-trans retinoic acid repressed OTX2 expression and induced apoptosis in retinoblastoma cell lines.

Conclusions: Through these genomic and expression analyses, we identified OTX2 as a novel oncogene in retinoblastoma that could be genetically and pharmacologically targeted. This investigation opens the door for study of additional novel signaling pathways in this malignant tumor and provides preclinical evidence for a potential clinical therapy.

12. Effects of Hydrocephalus on IQ in Children with Infratentorial Ependymoma Before and After Conformal Radiation Therapy

Robert A. Sanford, MD; Thomas C. Merchant, DO, PhD; Frederick A. Boop, MD; Naina Gross, MD (Memphis, TN)

Introduction: Our prospective study measured the influence of hydrocephalus on IQ in children with infratentorial ependymoma before and after focal radiation.

Methods: Careful measurements of ventricular size including Evans Index (EI), cella media index (CMI), frontal horn diameter (FHD), and ventricular angle were performed using MRI at the time of diagnosis and serially at 3 month intervals following radiation therapy. There were 59 children, median age of 4.1 years, enrolled in the study. 50 (85%) of whom had hydrocephalus and 23 (39%) required placement of a cerebrospinal shunt. Before and after treatment IQ was measured using age appropriate testing. Standard regression techniques were used to correlate multiple ventricular measurements and IQ utilizing a generalized linear model. Children with higher EI (0.04), CMI (0.001), and FHD (0.0002) at the time of diagnosis were more likely to have lower IQ scores before radiation therapy. Patients with higher CMI (0.04) and FHD (0.01) at the time of diagnosis were likely to demonstrate improved IQ score after radiotherapy. The rate of change in IQ after radiation was positively correlated with CMI intercept (0.015) and negatively correlated with rate of FHD (0.006).

Conclusions: Change in IQ score before and after radiation treatment are significantly influenced by the extent and treatment of hydrocephalus at the time of diagnosis. Patients who undergo repeat surgery are more likely to require placement of a CSF shunt (p=0.0001). The authors will discuss the clinical implications of this data and recommended changed in management strategy.

13. The Role of Diffusion-weighted MR Imaging in Pediatric Brain Tumors

Kenneth Shulman Award Candidate

Peter Kan, MD; James Liu, MD; Gary Hedlund; Douglas Brockmeyer, MD; Marion Walker, MD; John Kestle, MD (Salt Lake City, UT)

Introduction: Conventional MR imaging helps to characterize the location and extent of brain tumors but often provides limited information regarding their grades and types. Recent studies suggested that diffusion-weighted MR imaging (DWI) may enhance the radiographic diagnosis of brain tumors. The purpose of our study is to review the DWI properties of pediatric brain tumors at our institution and examine its relationship with tumor grade.

Methods: Since the institution of DWI in 2001, we identified 37 children with histologically verified brain tumors and preoperative DWI. On the basis of histology, tumors were separated into two groups: "low grade" and "high grade". The signal characteristics of each lesion on DWI and ADC maps were compared to the surrounding normal brain. The sensitivity, specificity, positive-predictive value, and negative predictive value of DWI as a test to differentiate between high grade and low grade tumors were calculated.

Results: Signal characteristics on DWI and ADC maps correlated well with tumor grades. High grade lesions appeared to be hyperintense with diffusion restriction on DWI and hypointense on ADC maps. Sensitivity, specificity, positive-predictive value, and negative predictive value were 78%, 100%, 100%, and 93% respectively. All primitive neuroectodermal tumors (PNETs) showed evidence of diffusion restriction whereas none of the ependymomas did.

Conclusion: The signal characteristics on DWI and ADC maps may predict tumor grade in pediatric brain tumors. Its routine use could be helpful to pediatric neurosurgeons preoperatively in differentiating fourth ventricular tumors, planning treatment, and predicting prognosis.

14. Neurocognitive Outcome in Pediatric Craniopharyngioma: the Impact of Surgical Resection and Conformal Radiation Therapy

Erin N. Kiehna, MS; Frederick A. Boop, MD; Robert A. Sanford, MD; Larry E. Kun, MD; Raymond K. Mulhern, PhD; Chenghong Li, MS; Xiaoping Xiong, PhD; Kathleen J. Helton, MD; Thomas E. Merchant, DO, PhD (Memphis, TN)

Introduction: Radical surgery for craniopharyngioma can be achieved without adversely impacting cognition in patients with small tumors that are completely resected. For more extensive tumors with hypothalamic involvement, the authors have advocated limited surgery and conformal radiotherapy (CRT). We conducted a prospective trial of CRT for craniopharyngioma to determine how irradiated volume, surgical and clinical variables impacted cognitive function.

Methods: Between July 1997 and January 2003, 28 pediatric patients (median age, 7.3 ffl 4.12 years) with craniopharyngiomas received CRT with a 1-cm margin. They were classified into three groups based on the extent of resection and post-operative neuroimaging. Neuropsychometrics were performed prior to CRT, at six months and annually thereafter. Statistical analyses were performed to determine the effect of radiation dosimetry as well as clinical and surgical variables on IQ.

Results: The median follow-up was 36.6 months (range 24.4-80 months). The estimated 3-year progression-free survival was 90.3%+7.3%. Three patients experienced local disease progression. Cognition was adversely affected by age<7.4 yrs, acute presentation, moderate or extensive surgery, multiple surgeries, diabetes insipidus, hydrocephalus, shunt placement/revision, and cyst aspirations. The percent volume of total brain, supratentorium or left temporal lobe receiving dose in excess of 45 Gy had a significant impact on longitudinal IQ.

Conclusions: Limited surgery and CRT results in tumor control equivalent to that achieved by aggressive surgery. However, the volume receiving dose in excess of 45 Gy continues to impact longitudinal IQ. In this series, surgical intervention maintaining hypothalamic integrity reduces surgical morbidity and mortality and preserves cognition.

15. Local Delivery of M4N in a Brainstem Tumor Model Using a Cannulated Guide Screw

George I. Jallo, MD; Andrey Volkov, BA; Margaret Penno, PhD; Cyrus Wong, BS; Ru Chin Huang, PhD (Baltimore, MD)

Introduction: Previous research has demonstrated that tetra-o-methyl nordihydroguaiaretic acid (M4N) exhibits tumoricidal activity by inhibiting CDC2 kinase activity, thus inducing G2 arrest in mammalian cells. This study examined the efficacy of M4N in treating the progression of F98 tumor cells in vitro and in the rat brainstem.

Methods: A previously established rat brainstem tumor model was used, in which 1x105 F98 glioma cells were injected into the pontine tegmentum. Doses of 0, 0.01, 0.1,1, 10, and 35 mM M4N were similarly injected 5 days later. A rotarod test was used to assess neurological deficits of the animals throughout progression of the tumor. Rodent brains for each dose were harvested for histological analysis at defined intervals. An additional study determined the in vitro efficacy of M4N.

Results: Rotarod performance and clinical observation of animals documented paresis 20 days post-tumor injection. A single dose of M4N (10mM) prolonged the onset of paresis by 1-2 day post-tumor injection. In vitro a single treatment with 3_L of M4N decreased cell viability by as much as 36% in 24 hours.

Conclusions: A single dose of M4N significantly decreases cell viability (36%) and prolongs the onset of paresis 1-2 days without toxicity. Further studies may be done to determine whether multiple doses or sustained release of M4N may prevent paresis in this model altogether, providing a possible treatment for pediatric brainstem tumors.

16. Optical Characterization of Pediatric Brain Tumors and Epileptogenic Lesions

David I. Sandberg, MD; Glenn Morrison, MD, FACS; Sanjiv Bhatia, MD; Greg Olavarria, MD; John Ragheb, MD, FACS; Michael Duchowny, MD; Prasanna Jayakar, MD, PhD; Wei-Chiang Lin, PhD (Miami, FL)

Introduction: The margins of brain tumors and non-neoplastic epileptogenic lesions are often difficult to define intraoperatively. We hypothesize that optical spectroscopy may offer a unique means of differentiating intraoperatively between various lesions and normal brain parenchyma. Our objective was to test this hypothesis by comparing the optical and fluorescence characteristics of resected lesions with those of normal brain.

Methods: Surgical specimens were collected from 17 pediatric brain tumors of various pathologies and 19 pediatric epilepsy surgery patients with cortical dysplasia, migration disorders, or other anomalies. Normal brain specimens were obtained from 4 epilepsy cases. Fluorescence emission spectra from each specimen were measured at 337, 360, and 440 nanometers excitation, and diffuse reflectance spectra were measured between 400 and 900 nanometers.

Results: Distinctive optical and fluorescence characteristics were observed in brain tumors and epilepsy specimens that differed from normal gray and white matter. Diffuse reflectance spectra between 400 nanometers and 850 nanometers are significantly different ($p < 0.001$) between white matter and all brain lesions examined. The most prominent differences between fluorescence spectra from normal and lesional brain tissue occur between 550 and 650 nanometers at all excitation wavelengths ($p < 0.01$).

Conclusions: Brain tumors and epileptogenic foci in pediatric patients have distinct optical and fluorescence profiles that differ from normal brain parenchyma. Further studies with larger groups of patients with distinct pathologic entities are indicated. Optical spectroscopy may ultimately be able to intraoperatively distinguish lesions from normal brain that is similar in appearance.

17. Intratumoral Interstitial Delivery of Anti-glioma Monoclonal Antibody 8H9

Kenneth Shulman Award Candidate

Neal Luther, MD; Mark A. Edgar, MD; Naikong V. Cheung, MD, PhD; Philip H. Gutin, MD; Mark M. Souweidane, MD (New York, NY)

Introduction: Monoclonal antibody (MAb)-mediated therapy has potential utility in targeting high-grade glioma. MAb 8H9 binds to >85% of gliomas without cross-reactivity to normal brain. Therapy of invasive gliomas can be greatly improved with a specific targeting agent that bypasses the BBB and achieves high concentration and uniform distribution in tumor and normal parenchyma. Large volumes of distribution (Vd) of 8H9 have been achieved in the naïve brain via interstitial infusion. We now validate these observations using human brain tumor xenografts.

Methods: 5.0 x 105 U87 tumor cells were harvested at 60-80% confluency and stereotactically implanted in the striatum of athymic rats. MRI was performed to confirm tumor growth. Stereotactically-guided interstitial infusion of biotinylated 8H9 into these solid tumor xenografts was performed at a rate of 0.1 microliters/minute. Control rats without tumor xenografts underwent interstitial treatment using identical infusion parameters. Animals were sacrificed 1 hour following infusion. Brains were sectioned and reacted with streptavidin-peroxidase. 8H9 Vd was then visualized and calculated after incubation in diamenobenzidine.

Interstitially-delivered 8H9 showed preferential binding to U87 xenografts in comparison to normal striatum. However, the presence of the 8H9 antigen did not significantly alter intratumoral dispersion of 8H9.

Conclusions: No study to date has specifically evaluated distribution of a glioma-targeting antibody using convection-enhanced delivery. This study shows interstitial infusion of 8H9 is an effective and specific mode of intratumoral MAb delivery. In addition, increased binding of 8H9 following delivery to an immunoreactive tumor in comparison to normal brain supports previous studies describing this antibody's specificity.

18. Noninvasive Diagnosis of Pediatric Pilocytic Astrocytomas by Advanced Magnetic Resonance Spectroscopy

Mark D. Krieger, MD; Ashok Panigrahy, MD; J. Gordon McComb, MD; Marvin D. Nelson, MD; Ignacio Gonzalez-Gomex, MD; Floyd Gilles, MD; Stefan Bluml, PhD (Los Angeles, CA)

Introduction: Treatment of pediatric CNS neoplasms is highly dependent on identifying tumor type and discerning tumor from other radiographic anomalies, including non-neoplastic postoperative changes. This may be particularly true in the case of pilocytic astrocytomas, whose management is different than other common posterior fossa tumors of childhood. The present study utilizes novel magnetic resonance spectroscopy (MRS) techniques to elucidate identifying biochemical features of pediatric pilocytic astrocytomas in vivo which may facilitate diagnosis and treatment.

Methods: Under an IRB approved protocol, 48 children were identified with newly diagnosed, untreated posterior fossa brain tumors seen over 5 years. This series included 17 pilocytic astrocytomas, 14 PNETs, 3 astrocytomas, 5 anaplastic astrocytomas, 5 ependymomas, and 4 anaplastic ependymomas. Single voxel 1H MRS spectra of the tumors were acquired. This technique allowed absolute quantification of N-acetyl-aspartate (NAA), creatine (Cr), choline (Cho), myo-inositol (mI) and taurine (Tau).

Results: Pilocytic astrocytomas were found to have strikingly lower levels of creatine when compared with the other tumor categories (1.0+/-.8 mmole/kg vs 5.3+/-2.7, $p<0.000001$). Myoinositol and taurine were also decreased ($p<.000001$ and $p<.00001$, respectively). Creatine is considered a marker of cellular metabolism. It is thus not surprising that pilocytic astrocytomas, with their low growth rate, would have suppressed creatine levels.

Conclusions: This study identifies biochemical constituents that uniquely identify pediatric pilocytic astrocytomas and can be used as a non-invasive means of diagnosis and disease follow-up. Current work examines the correlation of levels of these constituents with disease activity.

19. Aggressive Clinical Behaviour of Histologically Benign Tectal Gliomas

Kenneth Shulman Award Candidate

Jeffrey Pugh, MD, MSc; Vivek Mehta, MD, FRCS(C); Keith Aronyk, MD, FRCS(C) (Edmonton, AB, Canada)

Introduction: Tectal gliomas in children are uncommon, histologically benign tumors. Unlike other posterior fossa tumors, the natural history and optimal management of these lesions is not well described, and many patients require only cerebrospinal fluid (CSF) diversion. Surgery within the dorsal midbrain carries the risk of significant neural injury, while radiotherapy and chemotherapy remain of uncertain benefit.

Methods: Retrospective chart review of tectal gliomas managed at our institution between 1994 and 2005.

Results: Six cases of tectal gliomas with aggressive clinical or radiographic deterioration were selected. At the time of presentation, the patients ranged in age from 4 to 17 years (mean 11 years). Each of these patients was treated with CSF diversion (either ventriculoperitoneal shunt or endoscopic third ventriculostomy) and biopsy or resection of the tectal glioma. Biopsy results demonstrated pilocytic astrocytoma in all cases confirming the low-grade nature of these tumors. Three of these patients were observed with magnetic resonance imaging (MRI) following CSF diversion. After 0.5, 2.5 and 9 years of observation, there was clinical deterioration accompanied by an increase in tumor size in each of these cases, prompting surgical intervention. Two of four patients who underwent surgical resection of their tumor had significant neurologic impairment post-operatively.

Conclusions: Histologically benign tectal gliomas occasionally demonstrate aggressive clinical and radiologic progression. While gross total resection offers the chance for surgical cure there is potentially significant operative morbidity. Given the benign histology of these tumors and variable biologic behavior, consideration should be given to judicious subtotal removal or simple biopsy followed by ongoing observation.

20. Extraoperative Functional Mapping via Staged Resection of Supratentorial Tumors in Children

Robert J. Bollo, MD; Chad Carlson, MD; Catherine Schevon, MD; Jeffrey Wisoff, MD; Orinn Devinsky, MD; Howard Weiner, MD (New York, NY)

Introduction: 15-25% of pediatric brain tumors occupy are supratentorial. Half of these are low grade gliomas, for which gross total resection alone affords a 10-year survival approaching 100%. When located near eloquent cortex, the morbidity of reseaction is significantly increased. Seizures occur in 50% to 90% of cases.

Methods: We conducted a retrospective review of our experience using a staged resection of supratentorial tumors in childen, with a goal of maximizing resection, minimizing morbidity, and optimizing seizure control. First, subdural electrodes were implanted. This was followed by extraoperative functional and seizure focus mapping, and subsequently tumor resection.

Results: Between 1999 and 2005, ninety-five children less than 18 years-old underwent extraoperative functional mapping via an implanted subdural grid. Ten patients (mean age 12 years) underwent mapping as part of a staged tumor resection, with a mean follow-up of 14 months. The mean extraoperative monitoring period was 3.4 days. Eight patients (80%) presented with seizures. Whenever possible, preoperative WADA testing, MEG and functional MRI were obtained. In three patients, intraoperative direct cortical stimulation was conducted. Intraoperative electrocorticography was also performed in three patients.

A gross-total resection was achieved in nine patients (90%). One patient suffered a new post-operative neurologic deficit. All patients have been managed with surgery alone. Half of all patients with seizures remain seizure-free post-operatively.

Conclusions: Multistage resection of supratentorial tumors in children allows awake functional and seizure focus mapping. This approach provides precise mapping of eloquent and epileptogenic cortex, permitting maximal tumor resection with minimal morbidity and optimal seizure contol.

21. Efficacy of Local Delivery 3-bromopyruvate in the Treatment of a Brainstem Tumor

George I. Jallo, MD; Cyrus Wong, BS; Margaret Penno, PhD; Andrey Volkov, BA; Young Ko, PhD (Baltimore, MD)

Introduction: Previous research has demonstrated that 3-bromopyruvate, a lactate/pyruvate analog, eradicates advanced tumors through inhibition of glycolytic ATP production. This study examined the toxicity of 3-bromopyruvate in the rat brainstem and efficacy of cell killing in vitro.

Methods: A previously established rat brainstem tumor model was used to deliver 3 _L of 3-bromopyruvate (0, 0.375, 0.75, 1.5, and 3 mM) to F98 glioma tumors growing in the pons. Neurological deficits were followed by rotarod performance and clinical observation. The histopathological profile of each dose was documented in brains harvested at 1, 7, and 14 days after drug administration. In an in vitro analysis of 3-bromopyruvate efficacy, F98 cells (100K) were established in culture dishes for 5 days then treated with the 5 doses of 3-bromopyruvate. Cell number and viability were determined by automated Vicell analysis.

Results: Rotarod performance and clinical observation of animals treated with 0, 0.375 and 0.75 mM 3-bromopyruvate documented paresis 12 days after tumor injection that was associated with an 18% drop in bodyweight. At a higher dose (3 mM) 3-bromopyruvate was associated with a delay in paresis onset and a smaller change in body weight (9%). At 1.5 mM, 3-bromopyruvate was associated with a significant delay in paresis (17%) associated with a 1.2% bodyweight increase.

Conclusions: 3-bromopyruvate may delay the induction of paresis, the hallmark of brainstem tumors. A dose of 1.5 mM was associated with the maximal protective effect. Future studies may examine the effect of multiple doses of 3BP and other doses close to 1.5 mM, for treatment for pediatric brainstem tumors.

22. Immunotherapy for Medulloblastoma

Alfred T. Ogden, MD (Columbia, New York, NY)

Introduction: Recent advances in the field of immunotherapy are rekindling interest in the treatment of medulloblastoma using immunologic approaches. Along with a comprehensive discussion of the background and rational regarding immunotherapy for pediatric medulloblastoma, we present initial findings from analyses of tumor infiltrating lymphocytes and screenings of potential antigenic targets.

Methods: Tumor infiltrating lymphocytes were analyzed after ex vivo preparation of fresh tumor specimens using flow cytometry. A panel of potential tumor specific antigens from the cancer testis antigen family was assayed by RT-PCR of RNA isolated from tumor specimens.

Results: Ex vivo tumor specimens demonstrated a high proportion of B cells in medulloblastomas compared to other kinds of brain tumors. RT-PCR analysis showed 3/6 tumor specimens expressed both MAGE-4 and SCP-1, but were negative for a range of others including MAGE-1 and MAGE-3.

Conclusions: MAGE-4 and SCP-1 are two potential antigenic targets for immunotherapy. The presence of a marked B cell infiltrate could be explained by a local clonal expansion. Analysis of variable regions in B cell receptors could support or refute the notion that tumor infiltrating lymphocytes stem from a specific clonal response that could be manipulated for therapeutic purposes.

23. Myxopapillary Ependymoma: Long-term Outcome and Treatment

Carrie N. Stair, BA; Mark D. Krieger, MD (Reno, NV); Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: Myxopapillary ependymoma is a rare, slow growing tumor often of the cauda equina region. Previous studies have suggested children are at increased risk for disease dissemination and death.

Methods: To further characterize the long-term outcome of myxopapillary ependymoma in the pediatric population, a 27-year retrospective review was conducted.

Results: Eleven patients with myxopapillary ependymoma were identified. This included five females and six males between the ages of 9 months and 20 years. The average time to follow-up was 5 years. 7(64%) had gross total resection whereas 4(36%) had subtotal resection. 3(27%) patients had secondary disease dissemination on follow-up with an average time to recurrence of 5.7 years. 2 of the 4(50%) patients with subtotal resection had disease dissemination versus 1 in 7(14%) of those with gross total resection. Radiation therapy did not impact recurrence rates. Of the 3 patients with recurrence, one died of treatment toxicity, and one patient was lost to follow-up. The third patient has been salvaged with chemotherapy with 5 year follow-up.

Conclusions: Myxopapillary ependymoma can be effectively treated with gross total resection and no adjuvant therapy. Recurrences may occur in a significantly delayed fashion, requiring long-term surveillance.

24. Intraoperative MRI and the Pediatric Patient: Are We There Yet?

Robert F. Keating, MD; John S. Myseros, MD; Amanda L. Yaun, MD; Derek A. Bruce, MD (Washington, DC)

Introduction: The recent development of the intraoperative MRI has opened new arenas in pediatric neurosurgery for the treatment of brain and spinal cord tumors, epilepsy, and placement of intracranial catheters. We report our initial experience with 12 pediatric patients undergoing surgical resection of intracranial/spinal lesions and discuss the overall utility and limitations.

Methods: The Polestar N-20 (0.148 Tesla) intraoperative MRI (Odin Technologies, Medtronic) was used alone or in conjunction with the Stealth frameless stereotactic system (Medtronic) . Image acquisition utilized T1, T2 and flair sequences. The number of image acquisitions per surgery, additional time spent, complications and relative efficacy were observed.

Results: Twelve patients (7 M / 5 F), ages 7m to 22 years(X= 11.4yr), underwent resection of their intracranial/spinal lesions. Lesions treated consisted of 11 brain tumors with 3 patients manifesting concomitant epilepsy, and a solitary lumbosacral transitional lipoma. One patient underwent placement of intraparenchymal catheters for subsequent convection chemotherapy. The number of intraoperative scans ranged from 2 to 8 (X=2.6), with additional operative time involving 2 to 4.5 hours (X=2.8 hr). The iMRI was felt to offer a significant overall advantage in 7/10 cases, equivocal in 3/10 and not beneficial in 2/10. There were no significant complications.

Conclusions: The introduction of real-time imaging capability in the operative arena currently offers significant advantages for resection of tumors, placement of intracranial catheters, as well as intraspinal tumors. Future improvements in technique and technology will undoubtedly render the intraoperative MRI as an indispensable tool in the pediatric neurosurgeon's surgical armamenatarium.

25. Development of a Long-lasting Silicone Catheter Impregnated with Rifampicin

Hydrocephalus Award Candidate

James P. McAllister, PhD; Xuemei Liang, PhD; Anfeng Wang, PhD; Haiying Tang, BS; Ting Cao, BS; Steven O. Salley, PhD; Kelley Brabant, BS; Carolyn Black; Jie Li,MD; KY Simon Ng, PhD (Detroit, MI)

Introduction: Cerebrospinal fluid (CSF) diversion, or shunting through a silicone catheter is the most common treatment for hydrocephalus and infection is one of the major complications of shunt treatment. Coating with antimicrobial agents on the device surface provides an alternate approach to minimize bacterial cell adherence. Maintaining the structural integrity of the catheter materials and providing a long period of sustained antibiotic release are two important challenges to the development of clinical shunts for long term implantation.

Methods: A new cast molding approach was developed to load the antibiotic rifampicin into the silicone precursor before it was cured. The efficacy of this impregnation method was determined in vitro with Staphylococcus epidermidis grown on the silicone samples, and in vivo with intracranial implants.

Results: Cast molding avoided the microstructural changes observed in samples prepared by the conventional diffusion-controlled technique and minimized the initial "burst effect" of drug release. In in-vitro studies, different morphologies and structures of Staphylococcus epidermidis colonization were observed on untreated silicone surfaces (compacted multilayered structures) and rifampicin-loaded silicone surfaces (sparsely dispersed, single-layered structures), respectively. Some of the Staphylococcus epidermidis cells which were exposed to the continuously released rifampicin were deformed and the secretion of slime was reduced. The rifampicin loaded silicone provided sustained release for at least 90 days and Staphylococcus epidermidis adhesion on rifampicin-loaded silicone surface was decreased significantly.

Conclusions: These results show that rifampicin-loaded silicone prepared by the casting mold approach is suitable for future clinical applications and may reduce the incidence of catheter infection.

26. Diagnosis and Management of Growing Skull Fractures: the Memphis Experience

John S. Winestone, MD; Frederick A. Boop, MD; Naina L. Gross, MD; Michael S. Muhlbauer, MD; Stephanie L. Einhaus, MD; Robert A. Sanford, MD; The University of Tennessee-Memphis; Semmes–Murphey Neurologic and Spine Institute; LeBonheur Children's Medical Center (Memphis, TN)

Introduction: Skull fractures account for a significant portion of pediatric head trauma. The pliable skulls of young infants predispose them to fractures which lacerate brain and dura as the bone is pushed into the intracranial space before returning to the initial position. This traps brain and meninges between the fractured edges. In 1995 the senior author coined the term skull burst fracture in an attempt to describe the violent injury. The pulsation of the trapped neural tissue causes the fracture to grow thereby evolving into a leptomeningeal cyst.

Methods: A retrospective review of pediatric neurosurgeons at our institution revealed 15 cases over a 19 year period.

Results: All patients underwent successful surgery in a subacute manner.

Conclusions: The injury must be identified on presentation in order properly time surgery. MRI was invaluable when the injury was suspected. Operation in the acute time frame is best avoided in light of freshly lacerated brain and torn venous sinuses. The optimal timing is to repair the injury as soon as brain swelling abates. Principles followed include wide craniotomy around the fracture, identification of retracted dura, and replacement of bone exposing healthy osteogenic dura. Extended delay of surgery can lead to leptomeningeal cysts and increased risks of seizures as the dura has had more time to scar onto cortex.

27. Ventricular-subgaleal Shunts at Columbus Children's Hospital

Hydrocephalus Award Candidate

Chris S. Karas, MD; Scott W. Elton, MD (Columbus, OH)

Introduction: To review all ventricular-subgaleal shunts placed at Columbus Children's Hospital in order to assess the surgical procedure, effectiveness of surgery, and complications of CSF diversion to the subgaleal space.

Methods: 25 infants with hydrocephalus of various etiologies were treated with subgaleal shunting over a period of four years. A retrospective analysis of these cases was performed to evaluate multiple aspects of the procedure. Specifically, the surgical procedure, duration of shunt function prior to shunt conversion, radiologic changes, operative complications, and risk of infection are discussed. We have also performed a comparative analysis of shunt placement in the NICU versus the operating room.

Results: Operative complication and infection rates are relatively low despite a population with multiple medical problems including, in some cases, concurrent infectious disease. Revisions, while infrequent, were similarly low risk. Post-implantation imaging confirmed rapid decompression with respect to ventricular size, with relatively long times to subsequent ventricular enlargement. Short anesthesia times and elimination of need for transport of premature infants were the primary benefit of surgery in the NICU.

Conclusion: Ventricular-subgaleal shunting, which can be reliably and safely performed at the bedside, offers a safe and effective temporary means of treating hydrocephalus of various etiologies.

28. Vagus Nerve Stimulation Therapy in Patients with Autism Spectrum Disorder: Results from the Vagus Nerve Stimulation Therapy Patient Outcome Registry

Andrew D. Nguyen, MD, PhD; Samuel A. Hughes ,MD, PhD; Lissa C. Baird, MD; Hal S. Meltzer, MD (San Diego, CA); Arun P. Amar, MD (New Haven, CT); Michael L.J. Apuzzo, MD (Los Angeles, CA); Karen M. Levy, BSN, RN; Michael L. Levy, MD, PhD (San Diego, CA)

Introduction: To determine both the effectiveness of vagus nerve stimulation (VNS) therapy among patients with Autism Spectrum Disorder and persistent or recurrent intractable epilepsy.

Methods: Data were obtained from the VNS therapy patient outcome registry. The integrity of the systems for collecting and processing registry data was authenticated by an independent auditing agency.

Results: Two nonconsecutive cohorts were compared: patients tracked in the registry without Autism Spectrum Disorder (ASD), (non-ASD group n = 3822) and those with a diagnosis of ASD and VNS implantation (ASD n = 77). For the ASD group, the median reduction in seizure frequency of › 50% was 49% at 3 months and 61% after 12 months of VNS therapy. The median reduction in seizure frequency of › 75% was 30% after 3 months and 38% after 12 months. The median reduction in seizure frequency of › 90% was 18% after 3 months and 21% after 12 months. For the non-ASD group overall rates of seizure reduction were 47.0% at 6 months, 52.9% at 12 months, 60.0% at 18 months, and 62.7% at 24 months. Marked improvements in quality of life parameters included a 78% improvement in alertness, 42% improvement in verbal skills, 62% improvement in mood, 49% improvement in achievements and a 30% increase in memory at 12 months follow-up.

Conclusions: The effectiveness of VNS is maintained during prolonged stimulation, and overall seizure control continues to improve with time. Patients with ASD respond as favorably as other patients receiving VNS therapy. In addition, they had substantially improved quality of life.

29. Do Completely Resected Ependymomas in the Very Young Require Adjuvant Therapy?

Mark D. Krieger, MD; Jonathan L. Finlay, MD; Ira E. Bowen, BA; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: Standard therapy for intracranial ependymomas involves age-dependent chemotherapy and/or radiation therapy. However, data exist which indicate that completely resected supratentorial ependymomas may not require such therapy. The survival of children with MRI-confirmed completely resected posterior fossa ependymomas and no such adjuvant therapy is poorly quantified.

Methods: A retrospective chart review identified 28 children treated for intracranial ependymomas at our institution over a 10 year period.

19 of this overall group had no residual disease after surgical resection as confirmed by MRI. 4 of these patients received neither chemotherapy nor radiation therapy as per the parents' wishes. These 4 patients ranged in age from 21 months to 6 years at diagnosis, and included 2 girls and 2 boys. 3 of these tumors were infratentorial. All 4 tumors were of cellular (non-anaplastic) pathology. Follow-up was 11 months, 18 months, three years and seven years. Clinical and radiologic surveillance was frequent, with brain and spine MRIs at least every six months. None of these patients have to date demonstrated tumor recurrence during the follow-up period.

Conclusions: The benefits of chemotherapy and radiation therapy after incomplete surgical resection are now well-documented. However, the risk of disease recurrence after gross total resection confirmed by MR imaging and neurosurgical impression merits further study, both for infratentorial as well as supratentorial tumors.

30. Children with CNS Tumors Discovered Incidentally after Trauma

Gwyneth Hughes, BA; Alan R. Cohen, MD; Shenandoah Robinson, MD (Cleveland, OH)

Introduction: Most children with central nervous system (CNS) tumors present with symptoms related to mass effect or hydrocephalus. The records for children at our institution who had tumors discovered incidentally were compared to those children who were symptomatic at presentation. We hypothesized that asymptomatic tumors discovered incidentally would carry a better prognosis.

Methods: Records from children who were newly diagnosed with CNS tumors over a 10-year period were retrospectively reviewed. Follow-up was the most recent contact or death. Two-tailed student t test or Chi square test was used to determine significant differences between symptomatic and asymptomatic (incidental) tumors.

Results: During a 10 year period, 191 children were newly-diagnosed with a CNS tumor. Nine percent (18 of 191) of tumors were diagnosed incidentally. In all but one of the incidentally found tumors, the evaluation was precipitated by trauma (8 falls, 2 motor vehicle accidents, 6 sports, one assault). No difference was found between the incidental or symptomatic group in age of presentation, or in proportion of tumors with aggressive pathology (33 percent). Interestingly, children with incidental tumors had a higher mortality (22 percent) compared to those who presented with symptoms (15 percent, Chi-squared test, P is 0.06).

Conclusions: Children who have CNS tumors discovered incidentally do not have a better prognosis than children who present with symptoms. CNS tumors continue to pose a significant threat to children, and additional research is necessary to develop more effective therapies, as the prognosis is not necessarily improved by an incidental diagnosis.

31. Use of Minimally Invasive Techniques for Tethered Cord Release: Technical Note

Jonathan E. Martin, MD; Daniel J. Donovan, MD (Honolulu, HI)

Introduction: Sectioning of a thickened filum terminale is a procedure frequently performed by pediatric neurosurgeons, most commonly by a midline approach with a partial or total laminectomy. While the benefits of tethered cord release are well established, the potential impact of disruption of the posterior tension band (lamina, spinous process, and inter/supraspinous ligament) is unknown, and may have substantial impact on later development of spinal deformity and/or degenerative disease. A paramedian approach via laminotomy minimizes disruption of the posterior elements with the potential to reduce the risk of future spinal deformity.

Methods: Division of the filum terminale was affected using a paramedian approach with the METRx tubular retractor system (Sofamor-Danek; Memphis, TN) to expose the L5 hemilamina. After performance of a hemilaminotomy, the thecal sac was exposed through reflection of the ligamentum flavum. The filum was divided in a standard fashion with the assistance of intraoperative neurophysiologic monitoring. Closure and post-operative management were identical to that utilized for a conventional open approach.

Results: Three patients underwent tethered cord release in the manner described. Mean age at the time of operation was 9.3 years (range 2-14). Mean operative time was 2.75 hours (range 2-3.5). No complications were observed.

Conclusions: Sectioning of the filum terminale can readily be performed via a minimally-invasive approach with available tubular retractor systems. The technique has potential long-term benefits in reducing spinal deformity and/or accelerated degenerative disease in these patients.

32. Essential Factors of Tethered Cord Syndrome

Shokei Yamada, MD, PhD (Loma Linda, CA); Daniel J. Won, MD (Fontana, CA); David B. Knierim, MD (Madeira, CA); Javed Siddiqi, MD, PhD (Colton, CA)

Introduction: The lesion of tethered spinal cord was clinically located in the lumbosacral cord by Hoffman et al (1976). Yamada et al proved that underlying mechanism of the disorder is impaired oxidative metabolism and electrophysiological activity in the same cord segments. The question is asked whether spinal cord elongation or filum thickening (Hoffman) is essential for causing tethered cord syndrome (TCS).

Methods: 55 pediatric patients with symptomatic TCS (older than 17 years) and 110 adults with TCS, both without spinal dysraphism, were examined for the level of the caudal end of the spinal cord and the diameter of the filum.

Results: Neither cord elongation (caudal end below L2 vertebra) nor filum thickening (less than 2 mm) was found in 25 children and 30% of adult patients.

Conclusion: The elasticity depends on the quality of the spinal cord and filum and their thickness. High viscoelasticity of normal filum allows it to elongate rapidly during its caudal traction to prevent overstretching of the cord, signifying the importance of filum quality. The elongated cord may indicate overgrowth of the lumbosacral cord in response to vertical tension while its caudal end is anchored by relatively inelastic filum. Only when the filum is replaced by fibrosis and additional stretching stresses occur, TCS is manifested regardless of the presence or absence of cord elongation. The authors emphasize that signs and symptoms to indicate dysfunction of the lumbosacral cord is essential for diagnose of TCS. Protocols for TCS symptomatology established in adult TCS can be utilized to effectively diagnose TCS in children.

33. Decompressive Craniectomy for Treatment of Intractable Intracranial Pressure in Severely Head Injured Pediatric Patients

Kenneth Shulman Award Candidate

Matthew A. Adamo, MD; Daniel L. Friedlich; Eric M. Deshaies; John Dalfino; Walter Edge; John B. Waldman (Albany, NY)

Introduction: Reports have been published regarding the effectiveness of decompressive craniectomy in severely head injured patients, but few focus on the pediatric population. We present our experience with decompressive craniectomy in pediatric patients.

Methods: This is a retrospective analysis of 14 pediatric (9 males and 5 females, age 7-19 years) decompressive craniectomies performed at our institution from 2002-2005. All patients sustained severe head injuries with Glasgow Coma Scores less than 8T, and had CT scans demonstrating intracerebral contusions and cerebral edema. Eleven patients received ICP monitors, while three were taken to surgery immediately for evacuation of extra-axial hematomas. Initial ICP's ranged from 4-20cm H2O. All patients received aggressive ventilator management to keep PCO2 30-35, ventricular drainage, and strict usage of 0.9% NaCl or 3% NaCl to maintain serum sodium 140-155meq/L. Patients with intractable ICP greater than 20mm H2O within the first 24 hours after the injury were taken to the OR for craniectomy and duraplasty. The extent of the craniectomy depended on the size and location of the lesion, extent of cerebral edema and midline shift. ICP monitoring continued throughout the post-operative period. One and six month Glasgow Outcome Scores (GOS) were then assessed.

Results: All patients benefited from the procedure demonstrating reduction of ICP to less than 20cm H2O, radiological improvement and neurological recovery. There were no mortalities. The average GOS at one month was 3.9, and at six months was 4.25.

Conclusions: In our series decompressive craniectomy has been shown to produce favorable outcomes with good functional recovery in pediatric patients.

34. Perinatal Brain Injury Impairs Cerebellar Development in Children and Rats

Jason D. Hill, BA; Shenandoah Robinson, MD (Cleveland, OH)

Introduction: Perinatal brain injury affects many infants born prematurely. Previously white matter lesions received the most attention because they were readily identified by ultrasound. Modern imaging demonstrates that the cerebellum is also affected by prenatal insults, and may contribute to neurologic deficits. We investigated the prevalence of cerebellar underdevelopment in a series of patients with severe perinatal brain injury, and initiated an anatomical study of the pathogenesis of impaired cerebellar development in a rodent model of systemic prenatal ischemia.

Methods: Charts of 73 children born prematurely (less than 1500g) with shunted hydrocephalus and imaging after infancy were reviewed and statistical analyses performed. Immunohistochemistry of the cerebellum from postnatal day 15 rats subjected to prenatal hypoxia-ischemia was compared to sham controls.

Results: One quarter of the children had significant asymptomatic fourth ventricular enlargement suggestive of cerebellar underdevelopment; none required 4th ventricular shunting. In P15 rats, parvalbumin labeling showed delayed maturation of Purkinje cells into a single layer in lobule I (insult: 24 SD4.4 cells per400micron2 (n is7), control: 20.5 SD3 (n is6), p is0.004). Loss of GAD-67-immunoreactive GABAergic neurons (p is0.003) and O4-immunoreactive pro-oligodendrocytes (p is0.001) was present in cerebellar white matter from post-insult rats. These results suggest that prenatal injury affects cerebellar development, and form a baseline from which to evaluate the efficacy of neuroprotective agents in ongoing studies.

Conclusions: Retrospective human data and an animal model of prenatal injury show perinatal brain damage also affects cerebellar development. Interventions to minimize neurologic morbidity related to prematurity must address neural development throughout the brain.

35. Transcutaneous Inductive Pressure (TIP) Monitor: Prototype for a Permanently Implanted ICP Device

Kenneth Shulman Award Candidate

Joshua E. Medow, MD; Bermans J. Iskandar, MD (Madison, WI)

Introduction: The Transcutaneous Inductive Pressure (TIP) monitor is designed to be a permanently implanted ICP measuring device in patients with shunted hydrocephalus. Current methods of evaluation for ICP disturbances are typically indirect, inaccurate, and often inconclusive.

The TIP-monitor concept involves a permanently implanted unit that would have a strain-gauge portion placed in the brain parenchyma and an electronics portion placed in the subgaleal space. No battery is necessary to power the device. The device is powered instead by an external inductive power supply. An interrogation unit will be placed outside of the head to power the TIP-monitor and to receive the signal that it transmits.

Methods: An AC voltage/current was used to a drive an electromagnetic coil which acted to power the "large-scale" TIP-monitor. A potentiometer was used in place of a standard strain-gauge in this prototype. The potentiometer adjustments were used to telemetrically send signals from the TIP-monitor to the extracranial receiver.

Results: The inductive power supply and voltage-to-frequency/frequency-to-voltage converters used for the TIP telemetry provided a maximum of .3% linearity within the main IC circuitry and boasted exceptional accuracy.

Conclusions: The TIP-monitor prototype is a viable concept that proves the ability to power a strain-gauge ICP device inductively. Because it requires no battery power, it can be quite small and may have the potential of lasting for a longer period of time when compared to its earlier implanted ICP predecessors. Additional testing and rescaling will be necessary in order to develop the TIP-monitor concept further.

36. Variation in the Notch Filter Response of the ICP to Arterial Pulse Pressure

Joseph R. Madsen, MD; Rui Zou, PhD (Boston, MA); Michael R. Egnor, MD (Stonybrook, NY); Mark Luciano, MD; Stephen Dombrowski, PhD (Cleveland, OH); Erin J. McCormack, MS; Mark Wagshul, PhD (Stonybrook, NY); Dong Kim, MD (Boston, MA)

Introduction: Intracranial compliance has important implications in hydrocephalus and other conditions, but its definition (dV/dP) is not a dynamic entity. A more general formulation is needed to optimally study digitally-sampled ICP and ABP waveforms. We explored a signal processing approach, time-frequency transfer function (TFTF).

Methods: TFTF calculates gain by considering arterial pressure (ABP) as system input and intracranial pressure (ICP) as system output. We calculated the TFTF from anaesthetized dogs, (12 normals and 6 with 4-12w obstructive hydrocephalus), during experimental interventions including hyperventilation, CSF infusion and CSF removal. We also analyzed ABP-ICP data from 9 patients.

In normal dogs, TFTF reveals a narrow notch filter at the cardiac frequency (in 10/12 dogs), supporting pulse pressure modulation by a Windkessel mechanism (Egnor, 2001). Spontaneous heart rate changes result in rapid adjustment of the frequency of the notch. In normal dogs, hyperventilation enhances the notch filters (in 5/8 animals); CSF infusion reduces the magnitude of notch filter (in 4/4). In hydrocephalic dogs, the notch filters are reduced or absent (n=6/6), while CSF removal caused partial recovery of the notch filter (4/6). The notch was present in only a small fraction of monitored adult patients (1/9).

Conclusions: TFTF is a dynamic approach to visualize the intracranial pulsatile dynamics. It is more accurate than compliance to describe the intracranial system. It can be calculated from ICP monitoring without need for an invasive infusion test, and indeed infusion of fluid or creation of hydrocephalus changes the TFTF. Potential predictive and other clinical applications of TFTF are in investigation.

37. Use of Controlled Hyperosmolality with Hypertonic Saline Solutions in Traumatic Brain Injury: Case Study of 16 Pediatric Patients

Stephen A. Fletcher, DO; James E. Baumgartner, MD; Sean T. Meiner, BS; Len Tanaka, MD; Giuseppe Colasurdo, MD; Beatrice Cua, MD; Nathan Strobel, MD; Lindsay Sharp, BS (Houston, TX)

Introduction: Current guidelines for the care of traumatic brain injury (TBI) indicate neither preference for mannitol sodium nor hypertonic saline for osmolar therapy. The benefits of using concentrated sodium chloride solutions include the ability to achieve higher, therapeutic serum osmolar targets, longer duration of action, and ease of maintenance of a normovolemic state. We report the use of controlled elevation of serum osmolality with hypertonic sodium chloride solutions at our institution with 16 pediatric patients.

Methods: Data was collected by retrospective chart review from 2002-2004 at an urban Level 1 pediatric trauma center. Age, sex, injury, imaging by CT or MRI, along with surgical intervention, intracranial pressure (ICP) values, serum sodium, serum osmolality, and serum creatinine were recorded in a database for analysis. Number, use, duration, and timing of hypertonic saline were recorded to correlate to ICP.

Results: Sixteen children with TBI received hypertonic saline as bolus doses of 7.3% and as a drip of 3%. Three deaths (19%) occurred. Total length of stay was 18.3 days. There were no MRI changes after being in a hyperosmolar state. Further at 6 month followup, rehabilitative outcomes were equivalent to those treated with mannitol.

Conclusions: Hypertonic sodium chloride appears to be effective for reducing intracranial pressure due to head injury related cerebral edema. This study has created the stimulus to further evaluate and compare this regimen to other modalities for the treatment of cerebral edema in head injury.

38. Gene Therapy for Late Infantile Neuronal Ceroid Lipofuscinosis: Surgical Considerations

Mark M. Souweidane, MD (New York, NY); Lisa M. Arkin, BA (Philadelphia, PA); Dolan Sondhi, PhD; Neil R. Hackett, PhD; Stephen M. Kaminsky, PhD; Ronald G. Crystal, MD; Michael G. Kaplitt, MD, PhD (New York, NY)

Introduction: Late infantile neuronal ceroid lipofuscinosis (LINCL) is a fatal childhood disease with no known therapy. LINCL results from a deficiency of tripeptidyl peptidase I (TPP-I), encoded by the gene CLN2. A recent study has been initiated replacing TPP-I using an adeno-associated virus vector packaged with human CLN2 cDNA (AAV2CUh-CLN2). Global interstitial administration is an unprecedented surgical technique that warrants novel operative techniques designed to optimize distribution, minimize CSF efflux, and reduce operative duration.

Methods: Preoperative MRI-based frameless stereotaxy was used to select injection and entry sites (3/hemisphere) based upon gyral anatomy and cortical topography. 20G spinal needles, fixed using a Sugita-based retractor system, were used for cortical penetration with angels based upon the preoperative plans. Borosilicate glass catheters were passed through the needles to a predetermined depth. Patients underwent 12 injections (2 depths/entry site) at a rate of 2 µl/min/site for a total volume of 1800 µl and 3.6 x 1012 particle units.

Results: Six patients have undergone gene therapy for LINCL using AAV2CUh-CLN2 for a total of 72 injections. All injections were successfully administered without intra-operative complications. There have been no postoperative infections, CSF leaks, or significant hemorrhage. Postoperative MRI scans showed variable regions of signal change at the injection sites.

Conclusions: Since many children with genetic disorders may be potential candidates for gene therapy, our experience using AAV2CUh-CLN2 in the treatment of LINCL has yielded important information regarding the techniques that can be safely employed for reliable, widespread interstitial administration in the setting of profound global atrophy.

39. Scoliosis and Chiari I Malformations in Children

Mark D. Krieger, MD; Yuri Falkinstein, MD; Ira Bowen, BA; Vernon Tolo, MD; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: The association of Chiari I malformations and scoliosis is well-recognized. The expected goals of treatment, however, remain unclear.

Methods: 79 children with scoliosis and Chiari I treated over a 10 year period were retrospectively identified. All had hydrosyringomyelia on MRI of the spine. 49 patients had curvatures of less than 20 degrees prior to therapy; the other 30 patients had curves ranging from 25 degrees to 80 degrees. 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. Follow-up averaged 35 months. Outcome was evaluated by follow-up MRI and measurement of the curvature.

Results: At 6 months, 70 (89%) had a significant reduction in the syrinx with ascent of the cerebellar tonsils. None of the 49 patients with preoperative curves less than 20 degrees had progression of their curvature postoperatively. Of the 30 patients with significant curves, 7 had a reduction of the curvature after Chiari decompression and 7 had no change; this group required no further therapy. 9 patients (11% of the total group) required bracing and 7 (9%) required operative correction of the scoliosis. Interestingly, the severity of the curvature beyond 20 degrees prior to the decompressive surgery was not predictive of later spinal deformity surgery.

Conclusions: This large series suggests the efficacy of treatment for scoliosis related to Chiari I malformations with syringes in children.

40. Professionalism: A Proposed Curriculum for Neurosurgery

Kenneth Shulman Award Candidate

Sudesh Ebenezer, MD; Joseph R. Madsen, MD; Arthur Day, MD (Boston, MA)

Introduction: Proficiency in non-medical competencies of practice-based learning, interpersonal and communication skills, professionalism, and systems-based practice, has become important for educating residents and maintenance of certification (MOC). A curriculum for educating neurosurgeons in these areas is nonexistent. Because pediatric neurosurgeons are known for their exemplary manner with patients, families, and the health care system, they are poised to take an active role in educating their colleagues in non-medical competencies. This paper's purpose is to propose a curriculum for "professionalism" in neurosurgical education. We model this curriculum after how we teach neurosurgical knowledge and surgical skills – via a gradient approach with progressive responsibility given to the resident. Pediatric neurosurgery cases involving professionalism will be used for discussion.

Methods: We conducted a review of the 62 articles the ACGME's Outcome Project used to conceptualize the meaning of professionalism and develop its corresponding learning objectives. Based on these, we integrated Doll's work on "post-modern curriculum development" into a rational proposal for meeting the mandate for professionalism education.

Results: This work has resulted in a new, practical curriculum model for professionalism in neurosurgical education. A matrix illustrates the links between the ACGME learning objectives for professionalism and curriculum frameworks. This is used to develop a proposed curriculum for professionalism in neurosurgical education. Examples from pediatric neurosurgery are used to illustrate complex issues of professionalism.

Conclusions: Pediatric neurosurgeons, known for outstanding rapport with patients and families, can participate actively in the curriculum development of professionalism in neurosurgical education. This can be achieved using postmodern perspectives in curriculum development.

41. Dural Inversion Procedure for Moyamoya Disease: Experience with Twenty One Cases

Robert C. Dauser, MD; Hatem S. Megahed, MD; Charles W. McCluggage, MD (Houston, TX)

Introduction: Moyamoya disease is a disorder characterized by progressive stenosis of the proximal internal carotid artery and its branches. A variety of surgical procedures have been described to accelerate the development of collaterals from the external carotid circulation in a effort to prevent ischemic and hemorrhagic strokes. The outer periosteal layer of the cranial dura is richly supplied by meningeal vessels from the external carotid artery; the inner meningeal dura seems to prevent the ingrowth of these vessels into the ischemic cortex.

Methods: This study employs a new procedure in which large dural flaps with preserved blood supply are inverted over the cortical surface to permit direct contact between this vascular outer dura and the brain. Twenty one patients with ischemic or hemorrhagic symptoms ranging in age from three to 23 underwent 36 procedures. In 16 of these cases, encephaloduroarteriosynangiosis (EDAS) was done simultaneously. The remaining cases employed only the dural inversion procedure.

Results: All patients had ultimate resolution of ischemic and hemorrhagic symptoms, with no lasting postoperative complications during a followup period of 16 to 116 months. Angiograms done an average of 11 months post surgery on 18 in the series showed good to excellent revascularization in all but one hemisphere. Almost all collateral flow arose from the meningeal vessels, with no benefit seen when the superficial temporal artery (STA) was also used.

Conclusions: This procedure is safe, simple and extremely effective in treating moyamoya disease. The simultaneous use of the STA does not seem necessary.

42 The Role of DNA Methylation in CNS Regeneration

Kenneth Shulman Award Candidate

Elias Rizk, MD; Kate Simon; Nithya Hariharan, MD; David Jarrard, MD; Bermans J. Iskandar, MD (Madison, WI)

Introduction: We have previously shown that folic acid improves CNS regeneration after injury in a dose-dependent fashion. The goal was to determine the mechanism by which folate affects CNS repair. Since a major function of the folate pathway is methylation, we tested the effect of CNS injury and folic acid on global DNA methylation.

Methods: Twenty-eight Sprague-Dawley rats were treated with intraperitoneal injections of folic acid ranging from 0ìg/kg-800ìg/kg, beginning three days before injury and continuing daily. The rats were subjected to a C3 dorsal column injury. Four days after the injury, the spinal cords were homogenized and DNA was purified. A global methylation assay was performed. Finally, using the rat spinal cord regeneration model we suppressed the methylation pathway using nitrous oxide, a specific inhibitor of methionine synthase.

Results: The DNA methylation assay revealed a dose-dependent response to folic acid supplementation in an inverse parabolic curve with 80 ìg/kg being most effective (1200 cpm H3 vs. 2400 in untreated controls). This corresponded inversely with the dose-response curve obtained from our spinal cord regeneration studies, in which folic acid supplementation caused a biphasic increase in spinal axon regeneration into a peripheral nerve graft, with optimal regeneration occurring at 80ìg/kg (16% regenerated axons vs. 1.7% in untreated controls). When the methylation pathway was suppressed using nitrous oxide, the effect of folic acid on spinal regeneration was shut down.

Conclusions: We propose that DNA methylation plays a significant role in repair of the injured CNS, and that optimizing methylation through folate supplementation would optimize such repair.

43. Long-term Motor Outcome Analysis Following Surgical Brachial Plexus Repair Using a Motor Score Composite

Kenneth Shulman Award Candidate

William W. Ashley, MD, PhD, MBA; T. S. Park, MD; Jeffrey R. Leonard, MD; Matthew D. Smyth, MD; Michael Noetzel, MD; Trisha Weatherly, PA-C (St. Louis, MO)

Introduction: Brachial plexus injury is a serious neurosurgical problem. However, among the relatively small number of surgical series there is disagreement regarding optimal surgical treatment. Much of this is the result of complicated pathology that varies greatly from case to case. There is also a great deal of variation in the type, location and extent of injury. As a result, reporting and follow-up can be cumbersome and inter- and intra-patient comparison can be difficult.

Methods: To define a more efficient system of reporting outcome data, we performed a retrospective analysis of a random subset of 100 (n=50) consecutive cases performed by the senior author (TSP). We defined a motor strength composite (MSC) score (range 0.25-1) and used it to report preliminary outcome data. We are in the process of completing the analysis of the remaining patients. MSC was recorded for the initial visit, immediately pre-op, and at several post-op time points.

Results: The mean MSC was 0.34 at diagnosis, 0.6 immediately pre-op, and 0.71, 0.82, and 0.82 at post-op year one, two and three respectively . We found significant differences between initial, pre-op, one and two year post-operative MSC with a plateau after two years.

Conclusions: The MSC was a useful metric that facilitated efficient and reproducible analysis. Our initial data confirms previous results that the most meaningful functional changes occur beyond twelve months after surgery. Further analysis will test the validity of this metric and examine the relative differences between subgroups.

44. Cervical Selective Dorsal Rhizotomy in the not only Spasticity Treatment in 21 Children with Cerebal Palsy

Boris Zivny, MD; Stanislav Severa, MD (Czech Republic)

Introduction: We have performed 126 Selective Dorsal Rhizotomies (SDR) in the treatment of 114 children between 1.5 and 19 years with spastic or mixed forms of Cerebral Palsy since July 3rd 2003. We have starterd our experience with the well recognized SDR in the (thoraco)lumbosacral (SDR-(T)LS) level with excellent results; the first SDR in the cervical (cervicothoracal) (SDR-C(T)) level we have performed September 23rd 2004.

Methods: We have performed 21 SDR in the cervical level (SDR-C(T)) based on preoperative reflex evaluation in children between 3 and 15 years till now, in 4 patients was unilateral procedure done, in 12 patients was SDR in both levels (SDR-(T)LS and SDR-C(T)) performed. We have evaluated the functional results 3 to 9 months postoperatively.

Results: There are no any complications related to SDR-C(T). Functional improvement was found in all children post SDR-C(T): The most seen effects are dramatic reduction of upper extremities and some reduction of lower extremities spasticity, rigidity and contractures, dramatic improvement in gross and some in fine motor skills of the upper extremities, reduction of generalized dystonic attacs, reduction of orofacial spasticity, reduction of hypersalivation and improvement of communicational and cognitive skills.

Conclusions: SDR-C(T) is safe and very efficient procedure significantly enhancing the therapeutic possibilities in the treatment of hemi-, tri- or tetra-paretic patients with broad spectrum of severity of their disability. Optimal SDR-C(T) candidates are the children with spastic hemiplegia. In spastic tri- or tetra-plegia may be combination of SDR-C(T) and SDR-(T)LS very efficient and effect of both procedures is more then simply additive.

45. Dynamical Evolution of Seizures in Children

Steven J. Schiff, MD, PhD; Tim Sauer, PhD; Rohit Kumar (Fairfax, VA); Steven L. Weinstein, MD (Washington, DC)

Introduction: We all sense as clinicians that seizures have different components, yet our studies of seizures has most often delineated 'ictal' from 'interictal'. This study was designed to answer the question whether seizures contain distinct stages, and if so, to characterize the nature of such stages.

Methods: To address this we developed a novel adaptation of the classical discrimination analysis of Fisher (1936). Originally designed to distinguish plant species by their morphology, such an approach can be a powerful technique to distinguish seizure stages by EEG properties. EEG and analysis was recorded from intracranial electrodes from children undergoing evaluation for resective surgery, or from the scalp from nonsurgical patients, under IRB auspices.

Results: We applied this technique of discrimination analysis to sequential episodes of seizure dynamics. We sought to quantify whether these seizures have unique initial and termination phases, to better understand how seizures start and stop. Twelve scalp and twelve intracranial seizure records from 9 children were examined for all possible partitions into beginnings, middles, and ends. Discrimination into 3 groups (initiation, middle, termination) was possible for 21 of 24 seizures, with significance by chi-square ($p<0.01$) and bootstrap ($p<0.002$).

Conclusions: These results argue strongly for an evolution of seizure dynamics that can be consistently partitioned based on dynamical measures and discrimination analysis. The results provide insight into how seizures start and terminate, help define what a seizure onset is, and provide a rigorous means to identify a physiological preseizure state in seizure prediction.

46. MSI Guided Frameless Navigation for Placement of Subdural Grid Arrays Confirms Accuracy of MEG Dipoles in Predicting Ictal Onset in Pediatric Patients

Jeffrey P. Blount, MD (Birmingham, AL)

Introduction: MEG is a method of non-invasive functional imaging for localization of interictal dipoles. Early results have been promising with regard to accuracy of prediction of ictal (seizure) onset but data is sparse that correlates MEG dipoles with electrocorticography from subdural grid arrays. We have utilized MSI based frameless navigation in the placement of subdural grid arrays in a series of pediatric patients with medically refractile epilepsy.

Methods: Between 2003 and 2005 13 patients have undergone 14 operations for grid placement utilizing MSI based frameless navigation. This allowed correlation between dipole clusters and specific electrodes on the subdural grid array. Localization of ictal onset as recorded from the grid was correlated (to within the measurement error of the frameless system) the dipole clusters.

Tight clusters of MEG dipoles were observed in 9/14 studies. For these patients there was an excellent correlation (<1 cm) between MEG dipoles and electrodes of greatest activity for ictal onset . Two patients showed very poor localization or generalized onset and both had poor dipole clusters. Limited numbers of dipoles were noted in 3 patients but all had ipsilateral regional onset of ictal activity (within 5 cm). No patient demonstrated an edge of grid phenomenen.

Conclusions: MSI can be utilized on frameless navigation systems to provide real time intraoperative functional imaging data. We have utilized this system to investigate the accuracy of MEG to predict ictal onset as measured by subdural grid arrays and found excellent accuracy when dipole clusters are tight.

47. Seizure Control Following Temporal Lobectomy in Children: Experience at Memorial Hermann Children's Hospital, Houston

James E. Baumgartner, MD; Joshua Baker, BSN, RN; Stephen A. Fletcher, DO (Houston, TX)

Introduction: In the United States, 37, 500 children under the age of 18 will be diagnosed with epilepsy each year. Of these children, approximately 6 in 100,000 will become refractory to medical management, yielding 17,000 new cases annually. Temporal lobe epilepsy (TLE) encompasses 10-20% of the cases of intractable epilepsy in pediatric patients, and for some of these patients surgery may be an option. We report on the surgical outcome of a series of 100 TLE patients ranging in age from 18 months to 18 at the time of operation.

Methods: We performed a retrospective review of 100 patients treated between 1993-2004. The review included chart reviews, telephone interviews, and follow-up clinic evaluations to assess the impact of surgery on seizure control, functional status, and quality of life. A second independent interview verified the initial tabulated data.

Results: Over 93% were seizure free at two years following surgery. 84% were seizure free off AEDs, while 16 % required AEDs to maintain seizure free status. Approximately 80% took two anti-epileptics or fewer following surgery, compared to an average of 6.8 prior to surgery. There was an overall surgical complication rate of 5%; there were no deaths. One patient with a clotting disorder experienced a small stroke. There was also one case of aseptic meningitis.

Conclusions: Temporal lobectomy in the pediatric population has proven to be a surgical treatment option with low morbidity and demonstrable efficacy among patients with TLE at this institution.

48. Temporal Lobectomy for Epilepsy in Children- Long Term Follow up

Mony Benifla, MD; Hiroshi Otsubo, MD; Carter Snead, MD; Khoshyomn Sami, MD; Sheila Weiss, MD; James Rutka, MD, PhD (Toronto, ON, Canada)

Introduction: We examined our experience with temporal lobectomy for children with epilepsy at the Hospital for Sick Children, Toronto.

Methods: The Medical Records of all patients who underwent temporal lobectomy and/or lesionectomy for intractable epilepsy were reviewed from 1983-2003.

There were 126 children who underwent temporal lobectomy. Post-operative follow up ranged from 1.5 to 10 years. The average age at the time of surgery was 13.5 years. The mean time interval between the first seizure and surgery was 5.6 years. Sixty two patients had a left temporal lobectomy, and 64 a right sided approach. Sixteen patients underwent resection of the temporal neocortex, 46 had a temporal lobectomy and resection of the mesial structures. Six patients had a lesionectomy only. The pathology for all cases included brain tumors in 63 (50%) patients and cavernous angioma in four. Ganglioglioma (18 patients- 15%) and astrocytoma (17 patients- 14%) were the most common tumours. Mesial temporal sclerosis was found in 14 patients (12%), astrogliosis in 13 (10%), cortical dysplasia in 6 (5%). The general outcome according to Engel classification was: grade 1 in 73% of the patients, and grade 4 in 19%. Patients with lesions had better outcome (grade 1 in 82%), as opposed to 64% in non-lesional pathology. The complication rate was 6% and included mainly visual field defects.

Conclusions: Temporal lobectomy for epilepsy in children is an effective and safe procedure which can impact favorably on seizure outcome.

49. Corpus Callosotomy: A Six Year Experience of Clinical Outcomes for Patients with Intractable Epileptic Seizures

Lindsay L. Sharp, BS; James E. Baumgartner, MD; Stephen A. Fletcher, DO; David Clarke, MD; Sean T. Meiner, BS (Houston, TX)

Introduction: Corpus callosotomy, a surgical therapy interrupting conduction pathways of an epileptic discharge, is indicated for a select group of patients with generalized seizures and drop attacks. Our experience indicates that callosotomy is beneficial in eliminating or significantly decreasing seizures in a subset of pediatric epilepsy patients.

Methods: Patients ranging from 20 months to 23 years of age were evaluated at the Texas Comprehensive Epilepsy Center. Preoperative MRI studies were compared to post-operative assessments to quantitate the degree of callosal resection. One surgeon performed the surgeries. Outcomes evaluated include surgical results, type and frequency of seizures, use of anti-epileptic drugs, and quality of life.

Results: 54 corpus callosotomies were performed. Thirty-one patients had 66-95% callosotomy and 21 had 100% callosotomy, 6 that were a completion of the former procedure. Fifty percent (27) of patients were predominantly or completely free of the seizure type for which surgery was intended. In this group, the average area of callosal resection was 94%. Forty-one percent (22) of the patients experienced a 50% reduction in seizures with an average callosal resection area of 86%. Seven percent (4) did not improve even with 74% average callosal sectioning. When more serious seizure events were eliminated, 21% developed simple partial seizures. Acute disconnection syndrome was experienced in 66% of the patients.

Conclusion: Extensive and near complete callosal sectioning provides improvement in the quality of life for these unfortunate pediatric or young adult patients.

50. Vagus Nerve Stimulation in Children Less Than Five-Years-Old

R. Shane Tubbs, PhD; Jeffrey P. Blount, MD; Pongkiat Kankirawatana, MD; Sarah Kiel, RN, CPNP; Robert Knowlton, MD; Paul A. Grabb, MD; Martina Bebin, MD (Birmingham, AL)

Introduction: Vagus nerve stimulation (VNS) has been used in both adults and older children with varying success.

Methods: We retrospectively reviewed our experience with VNS in children less than five-years-old. The mean age at implantation was 20.5 months. Two patients were less than two-years-old at implantation and two patients were less than one-year-old at their initial surgery. The average follow up time for this group was two years.

Results: Of the patients with long-term follow up, 83% had a significant decrease in their seizure frequency. Of these, 33% are seizure free, 50% are improved, and 17% have had no change in seizure status at their most recent clinical examination. Age at implantation of the VNS did not seem to correlate with patient success. In this group, atonic seizures were found to respond the best to VNS with cessation of this type of seizure in 33% of patients. No patients were made worse by the procedure and no morbidity was observed related to VNS.

Conclusion: Based on our small patient cohort, it appears that VNS in very young children with life-threatening epilepsy can be efficacious. Larger groups and other institutional experiences are now needed to verify our findings.

51. The Natural History of Arachnoid Cysts: Progression in Children Less Than 2 Years of Age

Kenneth Shulman Award Candidate

Nader Sanai, MD; Kurtis I. Auguste, MD (San Francisco, CA); Peter P. Sun, MD (Oakland, CA)

Introduction: The natural history of arachnoid cysts in children remains poorly defined. Many cases remain stable over time, while others arbitrarily enlarge or become symptomatic.

Methods: To identify patterns of arachnoid cyst growth, we prospectively reviewed a series of 32 children (range 0 – 17 years, mean 5.6 years) from 1999 – 2005 with arachnoid cysts. Unless immediate surgery was indicated, these patients were observed with repeat CT scans and clinical follow-up every 6 – 12 months (mean follow-up of 2.0 years).

Results: The majority of the lesions were found incidentally (n=17), although headache (n=7) and macrocephaly (n=6) were common presentations. Cysts were typically located in the temporal lobe (n=10), frontal lobe (n=7), and posterior fossa (n=3), although several large lesions were hemispheric (n=4). Overall, 11 patients required surgical intervention. Four underwent immediate fenestration due to mass effect (n=3) or cyst hemorrhage (n=1). Seven patients eventually required fenestration after serial imaging of their cysts demonstrated spontaneous cyst enlargement. Interestingly, at the time of cyst growth, every patient in this latter group was less than 2 years of age (range 1.3 – 13.2 months, mean 7.7 months). The mean time to progression of the arachnoid cyst was 5.4 months after presentation (range 1- 12 months). Open cyst fenestration was completed in 10 patients and endoscopy was used in one patient who subsequently required a repeat open fenestration.

Conclusions: Our experience suggests that, while infrequent, arachnoid cyst progression is more likely to occur in the youngest patients (< 2 years) and within 1 year of presentation.

52. Consequences of Removal of Oregon's Cap on Non-economic Damages on the Neurosurgical Workforce

Monica C. Wehby, MD (Portland, OR)

Introduction: In response to an impending medical liability crisis in the 1980's, the Oregon legislature placed a $500,000 cap on non-economic damages in civil suits in 1987. From 1987 – 1999, the medical liability insurance system stabilized and premiums declined. In 1999, the Oregon Supreme Court overturned the legislation as unconstitutional.

Methods: Surveys (written and phone) conducted by the Oregon Neurosurgical Society and the Oregon Medical Association document the subsequent changes in the medical liability environment and the effect on access to health care.

Results: From 1999-2004, the average demand per claim increased from $870,000 to $3.6 million, with average payment increasing from $247,000 to $470,000. Neurosurgical premiums have more than tripled, 13 of 15 insurance carriers have left, and 91% of neurosurgeons are dissatisfied with their level of coverage. Over the past 2 years, 20 % of Oregon neurosurgeons have left the state or retired, and 55 % are actively exploring relocating. Forty percent have limited their practice, and half have increased referral of complex cases. After a failed attempt at replacing the cap through a ballot measure amending the constitution in 2004, the crisis continues to worsen, particularly in neurosurgery.

Conclusions: Analysis of our neurosurgical survey data reveals the continued detrimental effect of removal of a non-economic damages cap, in contrast to California where the cap legislated in 1975 remains in place.

53. In Vivo Quantum Dot Labeling of Stem Cells in the Developing Embryonic Nervous System

Kenneth Shulman Award Candidate

Jonathan R. Slotkin, MD (Boston, MA); Haining Dai, PhD; Ian Gallicano, PhD; Barbara Bregman, PhD; Joshua Corbin, PhD; Tarik Haydar, PhD (Washington, DC)

Introduction: Nanoparticle technologies hold great promise for the study of cellular migration in the developing embryonic nervous system. Quantum dots (QD, fluorescent semiconductor nanocrystals) are a recently developed class of nanoparticle that, compared to conventional fluorophores, exhibits increased quantum efficiency, broader absorption spectra, narrower emission spectra, and resistance to photo bleaching. To date, in vivo QD labeling of stem cells in the mammalian nervous system has not been achieved.

Methods: We used two methods to microinject QD (Evident Technologies) into the brains of embryonic day 14 mice: 1) High-resolution ultrasound guided injection of QD into the ventral telencephalon, and 2) injection into the lateral ventricle followed by co-electroporation with GFP plasmid DNA.

Results: 2-4 days after QD injection, multi-photon confocal microscopy demonstrated that neural stem cells (NSC) were successfully labeled with QD and could differentiate into mature neuronal(TUJ1+), glial(GFAP+), and oligodendrocyte(NG2+) lineages after migration. When different color QD were co-transplanted, they could be simultaneously detected using a single infrared multiphoton excitation wavelength followed by emission fingerprinting. In addition, 3-D time-lapse multiphoton microscopy was used to image live organotypic embryonic brain slices and demonstrated migrating QD-loaded NSC and radial glia.

Conclusions: We have found that NSC labeled in vivo with QD can be tracked as they migrate and differentiate into mature neuronal and glial lineages. This novel approach will directly impact studies on fate determination and cellular migration. Efforts have begun to refine this technique for potential clinical, in vivo diagnostic applications in developmental nervous system abnormalities, oncologic processes, and nervous system injury.

54. Apoptosis Seems to be the Major Process While Surface and Neural Ectodermal Layers Detach During Neurulation

Mehmet Selcuki, MD, PhD (Izmir, Turkey)

Apoptosis seems to be the major process while surface and neural ectodermal layers detach during neurulation.

Objective: To demonstrate the process of detaching of neural and surface ectodermal layers soon after the neurulation completes.

Materials and methods: SPF chicken egg embryos were used to investigate the neurulation procedure. Ten eggs were saved as controls. The other ten eggs were opened 30th hour of embryo development and cultured with Z-WAD-FMK (peptide caspase inhibitor) to investigate the results of the apoptosis inhibiton. Embryos were staged and developed up to 48 hours in the culture medium. To detection of apoptotic cells between neural and surface dermal layers immunoreactivity of p53 and TUNEL (Terminal deoxyribonucleotide transferase mediated dUTP-X Nick End Labeling) assay were used.

Results: While control group shows positive immunoreactivity of p53 and TUNEL positive apoptotic cells at the site where the neural folds detach form the surface ectoderm, no TUNEL activity and no detachment were detected in apoptosis inhibited group.

Conclusions: As inhibition of apoptosis prevented the detachment of the neural and surface ectodermal layers from each other at the end of the neurulation, inhibition of apoptosis seemed to cause a considerable embryological error accounted for congenital dermal sinus tractus maldevelopment.

55. Cerebral Revascularization for the Medically Intractable Patient with Progressive Cerebral Artery Stenosis Caused by Sickle Cell Disease

Roger Hudgins, MD; Lynn Gilreath, RN; Beatrice Gee, MD; Beatrice Files, MD; William Boydston, MD; Andrew Reisner, MD; Kevin Stevenson, MD; Thomas Burns, PsyD (Atlanta, GA)

Introduction: Cerebrovascular disease affects between 8-17% of all patients with sickle cell disease (SSD). Cerebral infarction is the most common presentation in children and the radiographic appearance in many cased is similar to that seen in idiopathic moya-moya disease.

Methods: We have treated 8 children (4 male, 4 female) with SSD with progressive ischemic events of the proximal circle of Willis despite chronic erythrocyte transfusions to maintain Hb S fraction at <30% and despite the addition of aspirin. Average age was 14, (range 10 – 17). Preoperative neurologic examination, MRI, MRA, arteriography and a comprehensive neuropsychological evaluation were performed in each case. Procedures performed in these 8 children included: 5 encephaloduroarteriosynangiosis (EDAS), 1 encephalomyosynangiosis (EMS), 5 bifrontal pericranial grafts, 1 bifrontal galeal graft, and 1 with multiple burr holes with dural opening.

Results: There were no operative complications. With an average of 2.9 years after surgery, no child has had either clinical or radiographic evidence of an ischemic event in a revascularized zone. One child did have a stroke that involved the non-operated hemisphere due to progressive internal carotid artery stenosis after refusing surgery on that side.

Conclusions: As opposed to idiopathic moya-moya disease, the ischemic presentation of children with SSD is more likely to be frontal infarctions and to present with progressive decrease in IQ and poor school performance. Revascularization appears to be safe in this patient population and to possibly prevent further ischemic injury in the revascularized territory. Surgical issues unique to this patient population will be discussed.

56. Incidence of Venous Infarction after Sacrificing Mid Sagittal Sinus Bridging Veins

Ivan J. Sosa, MD; J. Gordon McComb, MD, FACS; Sean McNatt, MD; Mark Krieger, MD (Los Angeles, CA)

Objective. The transcallosal approach offers an excellent surgical corridor for deep-seated midline lesions. However, one or more cortical bridging veins are routinely sacrificed in this approach, introducing the risk of venous infarction and postoperative brain damage. We studied the incidence of venous infarcts in our pediatric population following this approach.

Methods. A retrospective review of patients who underwent anterior interhemispheric transcallosal approach in which, 1 or more cortical bridging veins were occluded were studied. The study covered the years 1990-2004. Postoperative MRI's (within 72 hours) were analyzed.

Results. 53 patients were identified who met the criteria. Only one patient developed MRI evidence of venous infarction for reasons that are unclear. 16 of the 17 patients who developed post-operative hemiparesis had no radiological evidence of subcortical edema or hemorrhage. The hemiparesis coincided to the tumor location rather than any cerebral venous circulatory disturbance.

Conclusion. The present study shows low vulnerability of the pediatric population to develop cerebral venous infarction after cortical vein occlusion during an inter-hemispheric transcallosal surgical approach.

57. Microsurgical Resection Improves Hind-limb Function until onset of Paresis in an Experimental Intramedullary Spinal Cord Tumor

Justin M. Caplan, BA; Alia Hdeib, BS; Gustavo Pradilla, MD; Betty Tyler, BA; Federico Legnani, MD; William Pennant; Andrey Volkov, BA; Henry Brem, MD; George Jallo, MD (Baltimore, MD)

Introduction: Surgical resection remains the primary modality of treatment for intramedullary spinal cord tumors (IMSCTs). The role of adjunctive radiotherapy and/or chemotherapy remains to be determined. Adequate exploration of new treatment options must include an animal model that correlates well clinically, and thus includes tumor resection. In this study we report the efficacy of microsurgical resection for the treatment of experimental IMSCTs.

Methods: F344 rats were given a 5mcl intramedullary 9L gliosarcoma (100,000 cells) injection and randomized into two groups. Group-1(n=8) received no further treatment. Group-2(n=4) underwent microsurgical tumor resection five days following tumor injection. Animals were evaluated using the Basso, Beattie and Bresnahan scale and euthanized after onset of deficits for histopathological analysis.

Results: On post-operative day 10, control and resection animals had average BBB scores of 5.75+/-1 and 9.13+/-1.6 respectively (P=0.089); on day 12 scores of 2.5+/-1.1 and 5.75+/-1 respectively (P=0.035). There was no significant difference in the onset of paresis between controls (Group-1, 12+/-1.2 days) and resection (Group-2, 12+/-2 days)(p=0.7425). Following onset of paresis, there was no significant difference in functional scores between groups to the time of sacrifice.

Conclusions: Control animals consistently developed hind limb paresis 12 days after 9L tumor injection. Animals undergoing surgical resection had improved motor function over those animals with no treatment following recovery and up to the onset of paresis, resection, however, did not delay the onset of paresis. This post-operative period of improved function offers the investigator the opportunity to explore adjunctive treatment options in combination with surgical resection, more closely mirroring clinical scenarios.

58. Astrocyte and Choroid Plexus Growth on Silicone Coated with Polymers and Self-Assembled Monolayers

Hydrocephalus Award Candidate

James P. McAllister, PhD; Kruti Patel, MS; William E. Grever, PhD; Haiying Tang, BS (Detroit, MI); Jianming Xiang; Richard F. Keep, PhD (Ann Arbor, MI); Kelley E. Brabant, BS; Carolyn A. Black; K.Y. S. Ng, PhD (Detroit, MI)

Introduction: Silicone catheters have vastly improved hydrocephalus treatments but functionality is compromised by tissue obstruction. In this study, silicone surfaces coated with biopolymers (heparin, hyaluronan) and self-assembled monolayers (SAM) (octadecyltrichlorosilane-OTS, fluoroalkylsilane -FAS) were investigated to determine the effect of these coatings on astrocyte and choroid plexus cell growth.

Methods: Chemical vapor deposition, plasma treatment and photo-immobilization methods were used for coating FAS, OTS, and heparin/hyaluronan onto silicone, respectively. Contact angle measurements determined the hydrophobicity and stability of the coatings. Enriched astrocyte and choroid plexus cells were cultured on silicone samples for one and two weeks, respectively, and cell counts were performed to measure growth.

Results: The hydrophobic/hydrophilic properties of the coatings remained stable for at least 30 days. Compared to unmodified silicone, astrocyte proliferation was significantly ($p<0.05$) reduced on FAS-coated surfaces, while no significant difference was observed on OTS. In contrast, heparin and hyaluronan coatings increased astrocyte ($p<0.001$) and choroid plexus cell ($p<0.05$) growth. No significant reduction in choroid plexus cell proliferation was observed on FAS- or OTS-coated surfaces. Low cell growth may be attributed to hydrophobicity of the surfaces. Atomic force microscopy measurements revealed that silicone had the roughest surface and coatings decreased the surface roughness, but this feature did not play an important role on cell growth.

Conclusions: The results indicate that silicone shunts coated with FAS may resist tissue obstruction and improve the treatment of hydrocephalus.

59. The Na/K ATPase Pump is Essential to Regeneration of the Adult CNS

Kenneth Shulman Award Candidate

Bermans J. Iskandar, MD; Elias Rizk, MD; Dandan Sun, PhD; Raghu Vemuganti, PhD; Nithya Hariharan, MD (Madison, WI)

Introduction: After injury to the adult CNS, various genes are activated, some of which are related specifically to regeneration of the injured neurons. Here we show that the Na/K ATPase pump is upregulated in neurons that were able to regenerate after injury compared to injured neurons that did not regenerate; the pump's protein level and activity in the cell are increased, and when inhibited, regeneration is suppressed.

Methods: In an optic nerve model of regeneration, in which a peripheral nerve segment was grafted to the cut edge of an optic nerve, approximately 1% of retinal ganglion cells (RGCs) regenerated through the graft. Using a cell dissociation protocol followed by flow cytometry, the regenerated neurons were separated from the non-regenerated ones. Subsequently, RNA extraction and cDNA mircroarray analysis allowed us to compare the gene expression patterns of the 2 populations of RGCs. Real-Time PCR, immunohistochemistry, in vitro activity levels and in vivo treatment with a Na/K ATPase pump antagonist were performed to confirm the importance of this gene in regeneration.

Results: 25 genes were upregulated in the injured regenerated neurons compared to injured nonregenerated neurons. The Na/K ATPase pump was upregulated 100-fold, and its protein and in vitro activity levels were increased in the regenerated neurons. Treatment with Digoxin, a specific pump antagonist, shut down regeneration of injured neurons in vivo.

Conclusions: For the first time, we differentiate signals associated with CNS regeneration from those associated with injury alone. In addition, we show that the Na/K ATPase pump plays a significant role in CNS regeneration.

60. Use of the Far Lateral Transcondylar Approach in Children

David W. Pincus, MD, PhD; Stephen B. Lewis, MD, FRACS (Gainesvillle, FL)

Introduction: The far lateral transcondylar approach is a useful technique for accessing ventrolateral lesions at the cervico-medullary junction. While several published series include the occasional patient in the pediatric age group, the use of this technique in children has not been specifically addressed in the neurosurgical literature.

Methods: We performed a retrospective medical record review of all pediatric patients in whom the far lateral approach was utilized. Records were reviewed for pathology type, complications, and ability to successfully visualize pathology using the far lateral approach.

Results: We have employed the far lateral approach in 8 children for a variety of ventrolateral pathologies including ependymoma, atypical teratoid rhabdoid tumor, pilocytic astrocytoma, chordoma, medulloblastoma, aneurysm, and bony pathology. In all cases the additional exposure provided excellent access. Complications were similar in number and nature to those encountered using traditional approaches and included vocal chord paresis and meningitis. The technique has been modified for use in conditions involving midline as well as ventrolateral pathology such as tumors involving the 4th ventricle and cerebellopontine angle or patients requiring occipital cervical stabilization in addition to ventrolateral resection.

Conclusions: We have successfully employed the far lateral transcondylar exposure in a small group of pediatric patients. This approach should be considered as an option for ventrolateral exposure of the cervicomedullary junction in children.

61. Laser Image Evaluation of Papilledema and Intracranial Pressure

Jeffrey E. Catrambone, MD; Dennis Roberts, BA, BS, PhD; Gordon Thomas, BA, BS, PhD; Sandra Kosinski, BA, BS, PhD; Wenzhaun He, MD, MS (Newark, NJ)

Introduction: We are evaluating a quantitative method for measuring the severity of papilledema to test the hypothesis that this severity is correlated with the intracranial pressure. By developing this quantitative measure our goal is to have a useful method for monitoring hydrocephalus and traumas that increase the intracranial pressure and treatments that reduce it.

Methods: Using a confocal laser scanning system, acquisition of three-dimensional images of the optic disc was obtained. This topographic image contains information about the spatial shape of the retinal surface. We carried out computer image analysis of various features of the optic disc and correlated these quantitative measures with a papilledema severity index and with intracranial pressure.

Results: Figure 1 shows that the retinal image of papilledema with a distinct flat background, a raised annulus and a slightly depressed cup. For each image, we measured three separate line profiles taken 45° apart, matched the height and averaged. We fit the optic cup with a curve to measure its depth, as shown in Figure 2. A reliable measure of the papilledema is the cup depth, which reduces linearly with papilledema (Figure 3).

Conclusions: Presented are optic cup depth versus severity of papilledema in Fig. 3. Increasing papilledema causes the optic cup depth to decrease linearly. This systematic variation supports our hypothesis that this method provides a quantitative measure of the severity of papilledema and supports the plan for further study of the correlation with ICP. Our theory is a decrease in the optic nerve cup depth would correlate with increased ICP.

62. Intraoperative Assessment of Third Ventriculostomy Success

Hydrocephalus Award Candidate

Jeffrey P. Greenfield, MD, PhD; Mark M. Souweidane, MD (New York, NY)

Introduction: The efficacy of endoscopic third ventriculostomy (ETV) for the treatment of noncommunicating hydrocephalus is typically assessed by clinical outcome and magnetic resonance imaging (MRI) findings. However, in some clinical scenarios this determination is not straightforward. Additional parameters may be helpful in predicting which patients are best served by ETV. We thus sought to determine if any intraoperative findings served as reliable indicators of success.

Methods: In the current series we have evaluated intra-operative findings on 117 consecutive endoscopic third ventriculostomy procedures. Atypical third ventricular anatomy, presence of subarachnoid opacity due to thickened Membranes of Lillequist, and pulsatility of the floor post-fenestration were recorded, if noted, in operative notes. These factors were compared with conventional outcome measures, such as necessity of further surgery or external ventricular drainage and post-operative MRI.

Results: The presence of any one of the following: abnormal third ventricular anatomy, absent pulsation of the floor after fenestration, or scarring of the subarachnoid space predicts failure in approximately 50% of ETVs. Having any two, or all three features, predict nearly universal failure.

Conclusions: It is possible to predict functionality of ETV at the time of surgery. These results may have implications for the immediate (use of post-operative external ventricular drainage, utility of post-operative MRI) and long-term (frequency of follow-up) management of patients requiring CSF diversion for non-communicating hydrocephalus.

63. Has Regulation Improved the CSF Shunt?

Stephen J. Haines, MD (Minneapolis, MN); Jeffrey P. Blount, MD (Birmingham, AL)

Introduction: Prior to 1976 the identification of shunt complications was dependent on investigations and publications from the neurosurgical community. The imposition of regulation after 1976 provided an opportunity for the regulatory process to have an impact on shunt safety and effectiveness. The objective of this study was to investigate whether regulation has improved the safety and effectiveness of CSF shunts.

Methods: The literature on complications of CSF shunting from 1950 to the present has been reviewed and classified. FDA data bases on medical device failure reports have been searched and similarly classified . FDA health device alerts and action items have been searched for CSF shunt related warnings and recalls.

Results: In 1976 the CSF shunt was determined to a class II device, not requiring burdensome "pre-market approval" (PMA) studies prior to marketing and sale. No shunt device has been required to undergo a formal PMA process by the FDA. Four health device alerts have been issued, all related to manufacturing difficulties with specific shunt parts. The FDA has never recalled a CSF shunt. The sensitivity of the published literature and the FDA device failure reporting systems to identification of clusters of complications are compared.

Conclusions: There is little evidence that the passive monitoring system imposed by the FDA in 1976 has played an important role in improving the safety or efficacy of CSF shunts. The enforcement of compliance with technical standards for bio-compatibility manufacturing quality, sterility, etc. has been associated with a noticeable absence of complications related to these fundamental aspects of manufacturing.

64. Utility of Antibiotic Impregnated Extraventricular Drains

Hydrocephalus Award Candidate

R. Shane Tubbs, PhD; James Custis, MD; R. Scott Hammock, MD; Elizabeth Blackburn, RN; John C. Wellons, III, MD; Jeffrey P. Blount, MD; W. Jerry Oakes, MD (Birmingham, AL)

Introduction: Antibiotic impregnated catheters are a new device intended to fight catheter-based infections. Antibiotic impregnated external ventricular drains (EVD) are now routinely used at our institution. However, the limits of their ability to resist infection and how CSF information may be clouded following routine sampling has not been tested.

Methods: A retrospective review was performed including patients with EVD's placed from August 2004 to May 2005. We reviewed cultures of CSF drawn through antibiotic impregnated catheters with cultures of CSF drawn through non-antibiotic impregnated catheters and compared the two cohorts for efficacy (i.e. was there a decrease in post shunt reimplantation infections at long-term follow up).

Results: We documented forty-five pediatric patients who have had 57 antibiotic impregnated EVD's placed. From these, 298 negative cultures and 11 positive cultures for bacteria were identified and three post shunt reimplantation became infected. During this same time period, 42 pediatric patients underwent EVD placement with a non-antibiotic impregnated catheter. From this cohort, eight positive cultures for bacteria were identified and no patient developed a post shunt reimplantation infection at long-term follow up.

Conclusions: These preliminary data suggest that there is little utility in the use of an antibiotic impregnated catheter for EVD placement. Moreover, routine sampling of CSF from an antibiotic impregnated catheter may cloud the interpretation of CSF results perhaps by masking actual infection. This may lead to the premature placement of CSF diversionary shunts.

65. Polymerase Chain Reaction for the Detection of Cerebrospinal Fluid Shunt Infections: A Prospective Study

Kenneth Shulman Award Candidate

R. Shane Tubbs, PhD, PA-C; James Custis, MD; Suman Bharara, PhD; Yancey Gillispie, PhD; John C. Wellons, III, MD; W. Jerry Oakes, MD; Jeffrey P. Blount, MD (Birmingham, AL)

Introduction: We have used a prospective study to analyze a novel technique for the detection and diagnosis of CSF shunt infection. Using techniques of molecular genetics, including polymerase chain reaction (PCR), we evaluated DNA of bacteria in CSF. This study was designed to compare PCR to the traditional techniques of CSF analysis.

Methods: Patients with CSF shunts undergoing evaluation for infection or dysfunction were enrolled. If a shunt tap was required, both routine studies and PCR were performed. If no shunt tap was performed, then CSF was obtained at the time of shunt revision and removal. Patients were followed for at least six months.

Results: 76 patients have been enrolled with 118 samples collected and analyzed. Twenty-three clinically infected shunts were analyzed; 18 infections have been identified with positive cultures including MRSA, MSSA, Enterococcus and Propionibacter acnes; 25 infections have been suspected using PCR. PCR identified all positive culture shunt infections except one; this shunt was infected by Enterococcus. CSF cultures grew Propionibacter from five samples; PCR was negative for each. Clinically, each of these was asymptomatic and none has required shunt removal for infection in the follow up period of six months.

Conclusions: PCR is a powerful new tool that can be used in the diagnosis and differentiation of CSF shunt infections. This modality shows good correlation with current methods for testing for infection with the added benefits of shorter time to diagnosis and treatment of potential CSF infection, specificity, and smaller specimen size.

66. Hydrocephalus in the HB-EGF Transgenic Model of Communicating Hydrocephalus is Stable Over Time.

Hydrocephalus Award Candidate

Bart A. MacDonald, MD; Joseph R. Madsen, MD; Yanping Sun, PhD; Michael Klagsbrun, PhD (Boston, MA)

Introduction: The HB-EGF transgenic mouse model, first shown at this meeting last year, displays a communicating hydrocephalus phenotype and a female greater than male gender variability. Stability over time is an important property to understand to consider novel approaches to this type of hydrocephalus.

Methods: Consecutive MRI scanning was performed on transgenic animals using three dimensional reconstruction from an 8T magnet over a period of 120 days. 17 animals from 2 litters were selected randomly to undergo this imaging schedule. Statistical changes over time were evaluated by ANOVA with repeated measures.

Results: All 17 of the animals undergoing the consecutive MRI had the transgene by PCR analysis of the tail. Of these 17 animals, 6 developed hydrocephalus by imaging volume measurement defined by >40mm3. All 17 however were observed to have no change in the ventricular volume throughout the experiment. A gender specific variability was again noted. Of the 74 (38 female, 36 male) transgene positive animals with MRI volume measurement, female mean volumes were greater (F=83mm3+/-34; M=34mm3+/-10). This difference is statistically significant. Histology as well as imaging showed that ventricular dilation is not associated with occlusion of the ventricular system or aqueduct.

Conclusion: This new transgenic HB-EGF mouse is the first transgenic model of communicating hydrocephalus. Here we showed varying degrees of severity but stable over time, which sets the stage for hormonal and other pharmacotherapeutic approaches.

67. Comparison of Infection Rates with Antibiotic and Non-antibiotic Impregnated Shunt Systems in a Large Series of Pediatric Patients

Greg Olavarria, MD; Pediatric Neurosurgery Group, University of Miami and Miami Children's Hospital (Miami, FL)

Introduction: Antibiotic impregnated shunt systems are garnering widespread attention in the pediatric hydrocephalus population. We present our experience with the Bactiseal antibiotic shunt system in a series of shunted children and compare with non antibiotic impregnated shunt systems for their efficacy in reducing shunt infection rates.

Methods: A single pediatric neurosurgeon performed 64 new vp shunt placements at two institutions. 38 were Medtronic non antibiotic and 26 were Bactiseal antibiotic impregnated shunts (if total and distal revisions are included, the number is 101 procedures total). Etiology of hydrocephalus primarily prematurity/IVH, then infection, other congenital anomalies. Follow up for shunt complications from 3 months to 2 years.

Results: 9 of 38 non antibiotic shunts had infections, 8 with staph aureus or epidermidis requiring removal and antibiotics, one gram negative infection occured (23% infection rate-a high risk population). One shunt with antibiotic impregnation became infected to date with gram negative organism- a patient with a fresh myelomeningocele wound closure (3.8% rate). The antibiotic shunt was effective in high risk patients with multiple previous shunt infections.

Conclusions: Antibiotic impregnated shunt systems have shown good preliminary results in reducing infection rates in high risk patients. A very low infection rate with these shunts is presented and compared with our experience with non antibiotic systems.

68. The Strata Programmable Valve for Shunt-Dependent Hydrocephalus: The Pediatric Experience at a Single Institution

Hydrocephalus Award Candidate

Edward S. Ahn, MD; Markus Bookland, MD; Benjamin S. Carson, MD; Jon D. Weingart, MD; George I. Jallo, MD (Baltimore, MD)

Introduction: The Medtronic PS Medical Strata valve allows the caregiver to non-invasively adjust the pressure flow characteristics with a magnetic adjustment tool. The goal of this study was to examine the efficacy of the Strata valve during our initial experience with it in shunt-dependent children.

Methods: 53 children with a median age of 2.0 years had 61 Strata valves implanted. 32 patients received the Strata valve with their first shunt operation while 21 patients received it as a replacement at the time of shunt revision. The most common etiologies of hydrocephalus were intraventricular hemorrhage and congenital hydrocephalus (24.5% of patients each).

Results: During the study period, there were 12 shunt revisions, 3 of which involved replacement of the valve due to a presumed valve malfunction. The one-year shunt survival rate was 69%. 32 patients (60.4%) required adjustment of their valve. There were 52 adjustments, 22 (42.3%) of which were planned at the time of implantation and 30 (57.7%) of which were unplanned and performed with therapeutic aim. Of the 30 therapeutically aimed adjustments, 16 (53.3%) resulted in improvement in the abnormal signs or symptoms.

Conclusions: The Strata valve is efficacious in the treatment of hydrocephalus in children. The shunt survival rate in this series is comparable to that of a previous multi-center trial of the Strata valve. Adjustments can be planned to tailor valve resistance in order to prevent early CSF leakage and the long-term complication of CSF overdrainage. Adjustments can also be used for therapeutic intention and possible prevention of a revision operation.

69. Late Failure of Endoscopic Third Ventriculostomy in Children

Hydrocephalus Award Candidate

Brian T. Jankowitz, MD; Paul Gardner, MD; P. D. Adelson, MD, FACS; A. L. Albright, MD; Ian F. Pollack, MD, FACS (Pittsburgh, PA)

Introduction: Endoscopic third ventriculostomy (ETV) is a well described treatment for hydrocephalus with a failure rate comparable to ventricular shunts. We sought to determine factors that play a role in long-term ETV failures.

Methods: Ninety-nine ETVs were completed between 1989 and 2004 in children <19 years of age. These children were reviewed for age, etiology of hydrocephalus, previous operations, failure rates and time to failure.

Results: There was a 62% success rate with a median follow up of 37.5 months. Twenty of 99 patients (20%) failed within three months of ETV. Seventeen of 99 patients (17%) failed after three months at a median time of 5.5 months (range 3.3 – 44 months). Young age, prior treatment, and a high grade tumor were associated with failure, but had no significant correlation with late failure. The most common symptoms of late failure included headache, nausea/vomiting, irritability, and lethargy. The most common presenting signs were unchanged or progressive hydrocephalus on imaging, increasing occipital-frontal head circumference, persistent developmental delay, and a "tense fontanel."

Conclusion: Long term failure represents a significant complication of ETV. Younger age, history of surgical intervention, and a malignant tumor predict a higher incidence of overall failure, but have no discernible effect upon time to failure. As such, no subgroup of patients appears to be at particular risk of late failure. The observation that ETVs can fail several years after an initially successful procedure suggests that ongoing follow-up of such patients is warranted, similar to that used for patients with indwelling shunts.

70. Pathophysiology of Communicating Hydrocephalus in Clinically-Relevant Experimental Models

Hydrocephalus Award Candidate

Jie Li, MD; Janet M. Miller, PhD; James P. McAllister, PhD; Parthasarathy K. Saranath, BS (Detroit, MI); Michael R. Egnor, MD; Mark Wagshul, PhD (Stony Brook, NY); Curt Stewart, MBA (Carefree, AZ); E. Mark Haacke, PhD (Detroit, MI); Marion E. Walker, MD (Salt Lake City, UT)

Introduction: Communicating hydrocephalus occurs frequently but clinically-relevant animal models amenable to diagnostic imaging and cerebrospinal fluid shunting do not exist.

Methods: Two methods were employed using 25% kaolin or saline injected into the sub-arachnoid space (SAS). For injections into the basal cisterns (n=7), after anterior exposure of the C1-clivus interval, a blunt 30-36 gauge needle was advanced into the SAS and 20-50Ìl of kaolin was injected. For the cortical approach (n=9), a craniotomy was created over both cerebral hemispheres, and a curved, blunt tip 25G needle was advanced gently into the SAS. After separating the partitions in the SAS, a total of 50-60Ìl of kaolin was injected.

Results: All rats undergoing kaolin injection maintained normal behavioral activity. In rats with ventral brainstem injections, kaolin was observed grossly in the basal cisterns but not into the cerebello-pontine angle, indicating that communicating – not obstructive – hydrocephalus had been induced. MRI revealed that ventriculomegaly progressed steadily in 86% of these animals and by 2 weeks post-kaolin the mean Evan's ratio increased significantly (mean 0.43). Rats with cortical injections exhibited deposition of kaolin covering approximately 80% of the surface in all cases, and 89% developed more protracted and mild ventriculomegaly (mean Evan's ratio 0.39) not significantly different from controls.

Conclusions: These preliminary results suggest that communicating hydrocephalus can be induced with blockage of the cortical SAS and basal cisterns. The brainstem approach is the most promising because the clinical presentation of communicating hydrocephalus is most often associated with blockage of the basal cisterns.

71. Effects of Silicone Surface Coatings on Staphylococcus Epidermidis Adhesion and Colonization

Hydrocephalus Award Candidate

James P. McAllister, PhD; Haiying Tang, BS; Xuemei Liang, PhD; Ting Cao, BS; Steven O. Salley, PhD; K.Y. Simon Ng, PhD (Detroit, MI)

Introduction: Surface modifications of silicone have attempted to reduce the incidence of shunt infections. However, the influence of surface hydrophobicity, roughness, and functional groups on bacterial adhesion has not been fully elucidated.

Methods: Silicone was modified with different biopolymers and silanes, including: heparin, hyaluronan, octadecyltrichlorosilane (OTS), and perfluorodecyltrichlorosilane (FAS). The quality and stability of these coatings were examined by contact angle measurement, Fourier-transform infrared spectroscopy, X-ray photoelectron spectroscopy, and atomic force microscopy; bacterial adhesion was quantified using scanning electron microscopy (SEM).

Results: FAS or OTS (contact angle 102.3 ffl 1.4 degrees) and heparin or hyaluronan (55.3 ffl 1.8 degrees) made silicone hydrophobic and hydrophilic, respectively, and these coatings were stable for 30 days. After 4 hr incubation, very few Staphylococcus epidermidis were attached to FAS-coated silicone, while large colonies were found on the heparin-coated silicone. After 12 hr, the size and number of colonies increased significantly, but FAS/silicone still showed the least degree of bacterial adhesion. At 4 h the pattern of least to greatest colony counts on the five different surfaces was FAS-OTS-hyaluronan-silicone-heparin. After incubation for 12 hr, the greatest bacterial adhesion occurred on heparin-coated silicone. Surface roughness did not appear be a determining factor with overall bacterial adhesion.

Conclusions: FAS-coated silicone surfaces displayed the greatest inhibition of bacterial adhesion and colony formation, but there did not appear to be a direct correlation with hydrophobicity. These findings are helpful for devising novel strategies to reduce shunt infections.

72. Inhibitory Effects of Minocycline on Gliosis in the Hydrocephalic H-Tx Rat

Hydrocephalus Award Candidate

James P. McAllister, PhD; Janet M. Miller, PhD; Alexander G. Shanku; Steven D. Ham, DO (Detroit, MI)

Introduction: Persistent gliosis, if present in the hydrocephalic brain, has the potential to alter biomechanical properties, impair cerebral perfusion, and impede neuronal regeneration and plasticity. The purpose of this study was to determine the ability of minocycline, a specific inhibitor of glial reactivity, to reduce glial scar formation in the H-Tx rat model of congenital hydrocephalus.

Methods: Minocycline (45mg/kg/day i.p. in 5% sucrose at a concentration of 5-10mg/ml) was administered to three groups of hydrocephalic H-Tx rats from postnatal days 5-21, 5-12, and 15-21. Days 5-12 correlate with mild to moderate hydrocephalus, while animals become severely hydrocephalic by day 21. Treated animals were compared to aged-matched untreated hydrocephalic littermates. White and gray matter of the neocortex was processed for immunohistochemistry (Isolectin B4 for microglia and Glial Fibrillary Acidic Protein for astrocytes) and analyzed light microscopically and stereologically.

Results: Preliminary data suggest that minocycline administration significantly reduced astrocyte density from 54,270 +/- 19,800 cells/mm3 (mean +/-sdev) in untreated hydrocephalic rats to 18,540 +/- 12,000 cells/mm3 in the treated hydrocephalic animals. Additionally, minocycline appeared effective in reducing the relative amount of microglia. The reactive morphology of microglia was reduced, especially in the periventricular white matter. There was no apparent effect on ventricular size or cortical mantle thickness.

Conclusions: Overall, our data suggest that minocycline treatment may be effective in reducing the gliosis that accompanies ventriculomegaly, and thus may provide an added benefit when used as a supplement to ventricular shunting

73. Endoscopic Third Ventriculostomy in the Management of Patients with Diffuse Pontine Gliomas

Hydrocephalus Award Candidate

Paul Klimo, MD; Liliana C. Goumnerova, MD, FRCS(C) (Boston, MA)

Introduction: Endoscopic third ventriculostomy (ETV) has become the preferred modality of treatment for obstructive hydrocephalus. However, concerns regarding the size of the prepontine cistern and the potential of injury to the basilar artery have caused some to advocate against its application in patients with tumors involving the brainstem. We present a series of patients with diffuse pontine glioma (DPG) and brain stem tumors in whom this procedure was performed. We will discuss the overall results and the technical aspects associated with this procedure.

Methods: Patients were identified and analyzed retrospectively. All procedures were performed by the senior surgeon (LG). 10 patients with tumors involving the brain stem underwent ETV (8 with DPG, one with recurrent ependymoma and one with residual astrocytoma of the cervicomedullary area). All patients had symptoms of increased intracranial pressure although at time of surgery that was not corroborated in the majority. There were no technical difficulties and/or operative complications.

Conclusions: ETV can be performed safely and successfully in patients with tumors in the brain stem. It affords palliation in the terminal stages of the disease in patients with DPG and should be considered in their management.

74. Gray Zone Hydrocephalus and "The 30 Centimeter Syndrome"

Khaled B. Aly, MD (Giza, Egypt)

Introduction: Clinical symptoms and signs of increased intracranial pressure (ICP) may be nonspecific and unreliable, or even entirely absent, in hydrocephalic infants and children. Even with a radiological examination, it is often difficult to distinguish between "arrested hydrocephalus" and slowly progressive hydrocephalus requiring treatment.

Methods: In this work we are presenting 22 children with hydrocephalus where one or more criteria, clinical or radiological, were missing causing uncertainty of the diagnosis. This condition we collectively termed "gray zone hydrocephalus". We then resorted to ICP measurement and tried to correlate the ICP with the clinical and radiological criteria.

Results: Twelve children proved to have elevated ICP, a group we called "positive gray zone hydrocephalus". The other ten children had normal ICP, which we called "negative gray zone hydrocephalus". The clinical and radiological criteria can be quite deceiving in those groups of patients.

A subgroup of "positive gray zone hydrocephalus" was noted. Those were children with ICP around the 30cm water value. They share common characteristics and all were previously labeled as having brain atrophy and mental retardation till the ICP measurement was done. We called this clinical presentation "the 30cm syndrome".

Conclusions: The clinical and radiological criteria of hydrocephalus can be quite misleading if no direct ICP measurement is carried out. A higher awareness and index of suspicion is needed to detect and treat children with the "the 30cm syndrome".

100: Cervical Spine Compression in Pediatric Patients with the 22q11.2 Deletion

Kenneth Shulman Award Candidate
Suresh N. Magge, MD; Donna M. McDonald-McGinn, MS; Shabbar Danish, MD; Denis S. Drummond, MD; Elaine H. Zackai, MD; Phillip B. Storm, MD; Leslie Sutton, MD (Philadelphia, PA)

101: Development and Evolution of Osmotic Therapy at the University of Wisconsin

Kristine Dziurzynski, MD; Bermans Iskandar, MD (Madison, WI)

102: 20 Gy Single and Fractionated Radiotherapy Dose Schedules Prolong Paresis-Free Survival in an Experimental Rat Intramedullary Spinal Cord Tumor Model

Justin M. Caplan, BA; Alia Hdeib, BA; Gustavo Pradilla, MD; Betty Tyler, BA; Federico Legnani, MD; William Pennant; Andrey Volkov, BA; Henry Brem, MD; George Jallo, MD (Baltimore, MD)

103: The Diagnostic Yield of Head CT and Non-accidental Trauma Evaluation in Pediatric Head Injury

Daniel J. Hoh, MD; Mark D. Krieger, MD; Michael Tam, BA; J. Gordon McComb, MD (Los Angeles, CA)

104: Interobserver Variability and the Radiologic Assessment of Ventricular Catheter Placement

William E. Whitehead, MD; Justin Hanig; Jodi L. Smith, PhD, MD; Anna Illner, MD (Indianapolis, IN)

105: Inadvertent Initiation of Vagus Nerve Stimulation Due to Lead Test Interruption: Report of Three Cases

Patricia B. Quebada, MD: Ann-Christine Duhaime, MD (Lebanon, NH)

106: A Review of Head Trauma at Columbus Children's Hospital: Perspectives from Pre- and Post-level 1 Trauma Center Certification.

Kenneth Shulman Award Candidate
Chris S. Karas, MD; Edward J. Kosnik, MD (Columbus, OH)

107: Middle Fossa Arachnoid Cysts and Hydrocephalus

Jogi V. Pattisapu, MD; Christopher A. Gegg, MD (Orlando, FL)

108: Calvarial Reconstruction with In Situ Osteogenisis

Ann Marie Flannery, MD, FACS; Jason Felton, MD; Michael Carsten, MD (St. Louis, MO)

109: Endoscopically-assisted Resection of an Intra-aqueductal Choroid Plexus with Vascular Malformation

Roham Moftakhar, MD; M. Shahriar Salamat, MD, PhD; Soner Sahin, MD; Bermans J. Iskandar, MD (Madison, WI)

110: Problematic Features of Small Ventricles and Overdrainage Analyzed by a Research-Friendly Database.

James P. McAllister, PhD; Steven D. Ham, DO; Katherine M. Kotz, BA; Yandong Zhou, MS; Anupam Gupta, MD; Sandeep Sood, MD (Detroit, MI); Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Holly Gilmer-Hill, MD; Nancy Greninger, RN (Detroit, MI)

111: Generator Replacement as an Index of Vagal Nerve Stimulator Efficacy

James B. Elder, MD; J. Gordon McComb, MD, FACS; Mark D. Krieger, MD, FACS (Los Angeles, CA)

112: Implantation of Antibiotic Impregnated Shunt Catheters to Reduce the Risk of Ventriculoperitoneal Shunt Re-infection

Hydrocephalus Award Candidate
Chris S. Karas, MD; Scott W. Elton, MD (Columbus, OH)

113: Novel Technique for Intraoperative Localization of Deep Lesions: An Adjunct to Frameless Stereotaxy

Deepa Soni, MD; Michael Scott, MD; Edward Smith, MD (Boston, MA)

115: Neuroleptic-Like Malignant Hyperthermic Syndrome (NMS) in Three Patients with Acute Hydrocephalus

Hydrocephalus Award Candidate
Ashraf M. Hassan, MD; Harold L. Rekate; Donna Wallace (Phoenix, AZ)

116: Differential Growth Pattern of Arachnoid Cell Culture on Extracellular Matrix

Cornelius H. Lam, MD; Jing Xiao, MD; Walter C. Low, PhD (Minneapolis, MN)

118: Prospective Follow-up Study of Prenatally Diagnosed Central Nervous System Anomalies

Jae Gon Moon, MD, DMSc; Keun Young Lee, MD, DMSc; Ho Kook Lee, MD, DMSc; Chang Hyun Kim, MD, DMSc; Do Yun Hwang, MD, DMSc (Seoul, Republic of Korea)

119: Post-operative Speech Mapping in Pediatric Patients after Placement of a 64-point Subdural Grid

Kurtis I. Auguste, MD; Vincent Gibbons, MD; Paul Garcia, MD; Nalin Gupta, MD, PhD (San Francisco, CA)

120: Utility of Functional MRI (fMRI) in Children: Practical Applications, Limitations and Strategies for Successful Imaging

Samuel R. Browd, MD, PhD; James Lee, PhD; John Kestle, MD; Marion Walker, MD (Salt Lake City, UT)

121: Pericallosal Pseudoaneurysm with Intraparenchymal Hemorrhage Following an Amusement Park Ride: Case Report and Review of Literature

Edward S. Ahn, MD; E. Francois Aldrich, MD (Baltimore, MD); Arthur J. DiPatri, MD (Chicago, IL)

122: The Superior Sagittal Sinus as Emergency Venous Access in an Infant

Erica F. Bisson, MD; Patrick Graupman, MD (Burlington, VT)

123: Spinal Cord Gangliogliocytoma Presenting as Juvenile Scoliosis: Case Report and Review of the Literature on Idiopathic Scoliosis

Patrick J. Reid, MD; Howard J. Silberstein, MD (Rochester, NY)

124: Management of Bilateral Jumped Facets in the Proximal Thoracic Spine in a Pediatric Patient.

Jonathan E. Martin, MD (Honolulu, HI); Kimberly Bingaman, MD (Augusta, GA); Robert F. Keating, MD (Washington, DC)

125: Choroid Plexus Hypertrophy: What is the Role for Resection of the Choroid Plexus?

Kenneth Shulman Award Candidate
Bart A. MacDonald, MD; Cormac Maher, MD; Liliana Goumnerova, MD (Boston, MA)

126: Disseminated Desmoplastic Medulloblastoma in an African-American Child with Nevoid Basal Cell Carcinoma (Gorlin) Syndrome

Jodi L. Smith, PhD, MD; Philip S. Smucker, MD (Indianapolis, IN)

127: Management of a Pediatric Patient with Complex Skull and Cervical Spine Fractures Using a Modified Halo Brace

Kurtis I. Auguste, MD; Nalin Gupta, MD, PhD (San Francisco, CA); Mark E. Eastham, MD (San Jose, CA)

128: Immediate Complete Resolution of Large Cervico-thoracic Syringomyelia after Third Ventriculostomy

Kenneth Shulman Award Candidate
Ali I. Raja, MD, MS; Carlos A. Guerrero, MD; Badih Adada, MD (Little Rock, AR)

129: Skull Base Approaches for Pediatric Brainstem Tumors

Kenneth Shulman Award Candidate
Ali I. Raja, MD, MS; Carlos A. Guerrero, MD; Badih Adada, MD (Little Rock, AR)

130: Spontaneous clival epidural hematoma as a form of presentation of Ehlers Danlos type IV

Erica F. Bisson, MD; Travis Dumont, MD; Bruce Tranmer, MD (Burlington, VT)

131: Lambdoid Synostosis vs. Positional Molding

Christopher A. Gegg, MD; Jogi V. Pattisapu (Orlando, FL)

132: Programmable Valve Adjustment after Exposure to Gait-Analysis: Case Report

Holly S. Gilmer-Hill, MD; Edward Dabrowski, MD; Patricia Beierwaltes, CNS; James Chinarian, MD; Charles Pelshaw, MD; Gretchen Backer, PT; Nancy Greninger, CNS (Detroit, MI)

133: Skull Base Osteogenic Sarcoma, EC-IC Bypass Surgery , Total Tumor Removal, Case Report

Foad Elahi, MD; Laligam Natarajan Sekhar, MD, FACS (Seattle, WA)

134: Spindle Cell Neoplasm of Spinal Cord with Giant Collagen Rosettes

Juan Alzate, MD; Richmond Abbott, MD; Karen Weidenhein, MD; Jacqueline Bello, MD (New York, NY)

135: Transient Ventriculomegaly in a Child Presenting with Hypernatremia: Case Report

Curtis J. Rozzelle, MD; John G. Fahrbach, IV, MD (Buffalo, NY)

136: Differences of the Timing and Course of Cranial Treatment in Mutation-proven Crouzon and Apert Syndromes

Susumu Ito, MD; Ken'ichi Sekido, MD; Hironobu Sato, MD; Kazuo Yamaguchi, MD; Hiroshi Kanno, MD; Isao Yamamoto, MD (Yokohama, Japan)

137: The Transchoroidal Approach to Posterior Third Ventricular Tumors in Children: Surgical Strategies A Series of 37 Cases

Andrew D. Nguyen, MD, PhD; Samuel A. Hughes, MD, PhD; Lissa C. Baird, MD; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD (San Diego, CA)

138: Microsurgical Resection of Childhood Craniopharyngioma: Long-term Results from a Single Center

Kenneth Shulman Award Candidate
Roger A. Lichtenbaum, MD; Robert Bollo, MD; Jeffrey Wisoff, MD (New York, NY)

139: Injury and Outcomes after Automobile, Motorcycle and All-Terrain Vehicle Injury in Children: an Institutional Review

Mirza N. Baig, MD, PhD; Brandon Miller, BA; John Hayes, PhD; Scott Elton, MD (Columbus, OH)

100: Cervical Spine Compression in Pediatric Patients with the 22q11.2 Deletion

Kenneth Shulman Award Candidate

Suresh N. Magge, MD; Donna M. McDonald-McGinn, MS; Shabbar Danish, MD; Denis S. Drummond, MD; Elaine H. Zackai, MD; Phillip B. Storm, MD; Leslie Sutton, MD (Philadelphia, PA)

Introduction: The 22q11.2 deletion, formerly described clinically as DiGeorge/velocardiofacial syndrome, is one of the most common genetic syndromes. These children may have multiple congenital anomalies that affect the heart, palate, and immune system. Also, approximately half of these patients have cervical spine abnormalities that are usually asymptomatic (Ricchetti, J Bone Joint Surgery 86, 2004). We describe a series of patients with the 22q11.2 deletion who presented with cervical spine compression requiring surgery.

Methods: A retrospective review of 79 patients with the 22q11.2 deletion who were members of a larger cohort of children followed at the Children's Hospital of Philadelphia.

Results: Of these patients, two had significant cord compression at C1. Each had a high-riding or dysmorphic C1 arch causing posterior cord compression. One presented with symptoms of myelopathy requiring a C1 laminectomy. The other also showed C1-2 instability and required a C1 laminectomy and fusion from occiput to C2. A third patient was followed for basilar invagination but did not require surgery.

Conclusions: Patients with the 22q11.2 deletion are known to have a high incidence of cervical spine abnormalities that are usually asymptomatic. While cervical cord compression is rare in the general pediatric population, we describe two patients out of 79 with the 22q11.2 deletion with cervical cord compression at C1 who required operative decompression. Given that many patients with the 22q11.2 deletion require surgery to repair cardiac or palatal anomalies, special attention should be given to identify those children with possible cervical stenosis that could put them at risk if hyperextended during surgery.

101: Development and Evolution of Osmotic Therapy at the University of Wisconsin

Kristine Dziurzynski, MD; Bermans Iskandar, MD (Madison, WI)

Introduction: Usage of osmotic agents, such as urea and mannitol, to treat intracranial hypertension was introduced by Dr. Manucher Javid at the University of Wisconsin in 1954. This application allowed for the advancement of neurosurgical care and operative technique, becoming a staple of modern practice. The history of how this therapy was developed and applied to neurosurgical patients is reviewed in this presentation.

Methods: Original manuscripts published by Dr. Manucher Javid are reviewed to illustrate how the use of urea and mannitol was conceived, developed, and applied to neurosurgical practice.

Results: In 1954 Dr. Javid administered his first dose of urea to a patient with recurrent glioblastoma. Over the following years he conducted several clinical studies, all conducted at the University of Wisconsin, describing effects of urea in treating intracranial hypertension, and brain edema in the operating room to facilitate exposure of the brain. In 1956, Dr. Javid's work was formally presented to the American College of Surgeons, the same year his landmark paper was published in the Journal of the American Medical Association. Several papers followed further exploring the use of osmotic therapy in treating cerebral edema, leading to widespread use of these agents. These studies included first describing the effects of mannitol in treating intracranial hypertension in animals.

Conclusions: The use of osmotic therapy in clinical neurosurgery has enabled advancement of the field to provide treatment of life-threatening problems in addition to reducing the morbidity and mortality of intracranial surgery.

102: 20 Gy Single and Fractionated Radiotherapy Dose Schedules Prolong Paresis-Free Survival in an Experimental Rat Intramedullary Spinal Cord Tumor Model

Justin M. Caplan, BA; Alia Hdeib, BA; Gustavo Pradilla, MD; Betty Tyler, BA; Federico Legnani, MD; William Pennant; Andrey Volkov, BA; Henry Brem, MD; George Jallo, MD (Baltimore, MD)

Introduction: Radiotherapy has a limited role in the treatment of intramedullary spinal cord tumors (IMSCTs). To enhance the use of radiotherapy, its efficacy in a controlled experimental model must be established. In this study we report the efficacy of 20Gy single and fractionated radiotherapy dose schedules for the treatment of IMSCTs.

Methods: F344 rats were given a 5mcl intramedullary 9L gliosarcoma injection (100,000 cells) and randomized into three groups. Group-1(n=8) received no further treatment. Group-2(n=8) received 20Gy single-dose external beam radiation by a Cesium-137 laboratory irradiator on post-operative day 5. Group-3(n=8) received 20Gy fractionated-dose radiation (4Gy/day on post-operative days 5-9). Animals were evaluated using the Basso, Beattie, and Bresnahan scale and euthanized after onset of deficits for histopathological analysis.

Results: Animals injected with tumor alone (Group-1) showed a median onset of paresis of 12+/-1.2 days. 20Gy single dose (Group-2) significantly delayed the onset of paresis to 19+/-1.4 days (p=0.0088 vs. control). 20Gy fractionated dose (Group-3) also significantly delayed the onset of paresis to 18+/-1.8 days (p=0.0146 vs. control). There was no significant difference in the delay to paresis between single and fractionated radiation at 20Gy (p=0.9105).

Conclusions: Control animals consistently developed hind limb paresis 12 days after 9L tumor injection. Radiotherapy was efficacious in significantly delaying the onset of paraparesis in both a single and a fractionated dose schedule. This study suggests that 20Gy single and fractionated radiotherapy are safe and efficacious in delaying the onset of paresis in a rodent IMSCT model and may be used to test the synergistic or additive efficacy of new treatment options.

103: The Diagnostic Yield of Head CT and Non-accidental Trauma Evaluation in Pediatric Head Injury

Daniel J. Hoh, MD; Mark D. Krieger, MD; Michael Tam, BA; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: Head trauma is a major cause of morbidity and mortality in children. The severity of injury can raise questions regarding etiology, prompting further evaluation for non-accidental trauma (NAT). Our objectives were to assess: 1) radiographic findings of intracranial injury, 2) mechanisms of injury in different age groups 3) NAT evaluation in patients with evidence of intracranial injury.

Methods: We reviewed 188 consecutive cases in a 5 month period of children presenting to an ER with a head CT and head trauma or suspected child abuse. Positive CT findings (ICH, EDH, SDH, SAH) were recorded. NAT evaluation (skeletal survey, ophthalmologic exam) and notification of the Department of Children and Family Services (DCFS) were noted.

Results: CT evidence of intracranial injury was found in 55 of 188 (29%) patients. 14 of 34 (41%) of children <1 year of age demonstrated positive CT findings, versus 16 of 48 (33%) patients age 1–3 years and 25 of 106 (24%) patients age 3–18 years. Mechanism of injury varied between age groups. Patients <1 year of age suffered low impact falls (10/14, 71%) while children >3 years old were involved in motor vehicle accidents (15/25, 60%). NAT evaluation was performed in 18 patients (18 skeletal surveys, 4 opthalmologic exams), all <3 years old. 1 of 18 (6%) skeletal surveys and 1 of 4 (25%) ophthalmologic exams were positive. DCFS was notified in 12 cases.

Conclusions: Infants are more likely to have intracranial injury with low impact falls, prompting further NAT evaluation in select cases.

104: Interobserver Variability and the Radiologic Assessment of Ventricular Catheter Placement

William E. Whitehead, MD; Justin Hanig; Jodi L. Smith, PhD, MD; Anna Illner, MD (Indianapolis, IN)

Introduction: To assess the inter-observer variability and the radiologic assessment of ventricular catheter location after first time shunt insertion in pediatric patients.

Methods: Three clinicians with experience in the treatment and follow up of pediatric patients with hydrocephalus classified ventricular catheters on postoperative CT scans in 95 patients. Catheters were classified based on:

1. Location (atrium, frontal horn, body, temporal horn, brain, cistern, third ventricle).
2. Environment, (surrounded by CSF, touching brain, slit ventricle)
3. Relationship to choroids plexus (touching choroids plexus, not touching choroid plexus)

To assess the inter-observer variability for these three parameters, overall Kappa statistics for nominal variables were calculated.

Results: Substantial inter-observer agreement occurred for ventricular catheter location (overall Kappa = 0.66), environment (overall Kappa = 0.78), and relationship to choroid plexus (overall Kappa = 0.62). For ventricular catheter location, environment and relationship to choroid plexus, all three observers agreed in 67%, 80% and 65% of the cases, respectively.

Conclusions: The radiologic assessment of ventricular catheter placement shows considerable inter-observer agreement for location, environment and relationship to choroid plexus. This is important to consider when using these variables as surrogate outcomes or predictors of shunt survival.

105: Inadvertent Initiation of Vagus Nerve Stimulation Due to Lead Test Interruption: Report of Three Cases

Patricia B. Quebada, MD: Ann-Christine Duhaime, MD (Lebanon, NH)

Introduction: While vagus nerve stimulation (VNS) for management of intractable epilepsy has a low complication rate, we recently discovered that the stimulator can be inadvertently turned on to a high-amperage default mode in the operating room during surgical placement. In this case the family believed that the child suffered injury from this occurrence. We describe the circumstances causing this phenomenon and provide preventative measures.

Methods: A 19-year-old nonverbal girl with severe epilepsy underwent placement of a Cyberonics VNS device. During the standard Lead Test, a communication fault between the testing wand and the hand-held computer occurred. The Lead Test was then repeated successfully, and the procedure was completed. The patient was observed overnight and had no apparent ill effects and no bradycardia.

Two weeks later, it was discovered that the stimulator had been turned on in a "default mode" which included 1 mA stimulation once/hour for 30 seconds. The parents noted that the child had been irritable, had cried out during sleep, and was less happy. Two additional patients were identified who had similar events; in one case, the patient developed hourly bradycardia, and the other patient remained asymptomatic. Investigation revealed that interruption of the lead test can trigger the computer to program the generator to a default "on" mode at 1 mA, four times the usual initial stimulation amperage.

Conclusions: Interruption of the Lead Test, due to wand movement or electrical interference, can cause inadvertent startup of the VNS. Device interrogation at the conclusion of implantation can prevent this complication.

106: A Review of Head Trauma at Columbus Children's Hospital: Perspectives from Pre- and Post-level 1 Trauma Center Certification

Kenneth Shulman Award Candidate

Chris S. Karas, MD; Edward J. Kosnik, MD (Columbus, OH)

Introduction: Historically, head trauma has accounted for a significant portion of admissions to both neurosurgical services and hospitals in general. This study makes a comparison of pediatric head trauma over six decades and the advent of level one trauma status in 1991.

Methods: Retrospective studies were performed to compile and compare head trauma data at Columbus Children's Hospital from the following three five-year blocks, defined as periods 1, 2, and 3 respectively: 1958-1962, 1978-1982, and 2000-2004. Data from the most recent period represent the post-level one trauma certification era and were compiled by the Columbus Children's Hospital Trauma Registry. Trends are defined over the past fifty-eight years, specifically with respect to administrative details, diagnoses, mechanisms of injury, mortality, and vulnerability of gender.

Results: With respect to the population of Franklin County during each of the three periods studied, the following trends were noted: (1) a decrease in head trauma admissions to the neurosurgery service, (2) disproportionate increase in major head trauma in the most recent period, (3) a significant decrease in mortality rate of major head trauma between periods 1 and 2, but no change between periods 2 and 3, (4) a significant decrease in the rate of minor trauma, (5) an increase in the variety of presenting injury mechanisms, (6) a significant male predominance across all diagnoses, but a female predominance among certain specific mechanisms.

Conclusion: Although some improvement is noted, certain trends in pediatric neurotrauma have persisted despite the evolution of diagnostic and therapeutic technologies, preventative measures, and large scale administrative changes.

107: Middle Fossa Arachnoid Cysts and Hydrocephalus

Jogi V. Pattisapu, MD; Christopher A. Gegg, MD (Orlando, FL)

Introduction: Temporal arachnoid cysts are generally considered to be focal developmental abnormalities. Management of these cysts includes direct shunting, cyst fenestration, or a combination. Many patients improve with these treatments, but in some cases, patients develop a form of shunt dependency as CSF circulation is affected permanently.

Methods: 5 patients (ages 4-16 years) with temporal arachnoid cysts measuring 4-8 cm in size, were initially treated with craniotomy and cyst fenestration, but eventually required a cyst-peritoneal shunt for drainage. 3 children presented with headaches and focal mass effect, and 2 presented with subdural hemorrhage after cyst rupture.

After initial improvement, these 5 children developed a form of shunt dependency. Symptoms of increased intracranial pressure developed during episodes of shunt malfunction, without cyst or ventricular enlargement. Repeat attempts at focal drainage into the subarachnoid spaces were not adequate, and shunt revision resolved the symptoms in 3 patients. Two children subsequently required ventriculoperitoneal shunt insertions.

Discussion: It is possible that some children with temporal arachnoid cysts have a diffuse CSF absorption abnormality (similar to psuedotumor cerebrii). The condition is focally expressed, and subarachnoid communication of the 'mass' may not adequately relieve the symptoms. In some cases, drainage of the ventricular or lumbar CSF may create an alternative avenue of CSF circulation.

Conclusion: Our current understanding of CSF circulation and absorption is being reconsidered, and some cases of focally expressed CSF accumulation may represent a more diffuse phenomenon. Initial treatment efforts may not prove successful in these patients, and this phenomenon may provide an opportunity for further discussion.

108: Calvarial Reconstruction with In Situ Osteogenisis

Ann Marie Flannery, MD, FACS; Jason Felton, MD; Michael Carsten, MD (St. Louis, MO)

Introduction: Acquired skull defects are common as a result of trauma, infection and calvarial expansion, among other causes. The techniques available to repair these defects have included a variety of foreign body implants or bone grafting from proximal or distant sites. Bone Morphogenic Protein (BMP) offers a unique opportunity to fill defects with in situ osteogenis.

Methods: Bony calvarial defects in 6 children ranging in age from 9 months to 15 years were repaired using BMP and a collagen scaffold . The skull defects were a result of trauma (2) , infection (1) and calvarial expansion for synostosis(4).The technique of the reconstruction varied with the size and geometry of the defect. The defects repaired ranged from 10 cm2 to 30cm2. Results of the repair were judged by physical exam and 3D CT.

Results: In 4 patients followed for at least 6 months, The calvarium was completely ossified in 3 cases and had a small residual defect (2cm2) in one, the first case in the series.

Conclusion: BMP shows promise for repairing significant calvarial defects by promoting the growth of the patient's own bone; in situ osteogenisis, avoiding the need for foreign body implants or bone grafts from other sites.

109: Endoscopically-assisted Resection of an Intra-aqueductal Choroid Plexus with Vascular Malformation

Roham Moftakhar, MD; M. Shahriar Salamat, MD, PhD; Soner Sahin, MD; Bermans J. Iskandar, MD (Madison, WI)

Introduction: We report a case of an ectopic choroid plexus with malformed vessels in the cerebral aqueduct, third and fourth ventricles of an adolescent female which was resected with endoscopic assistance.

Methods: A 14 year old girl presented with a one-week history of headaches and emesis. A non-contrasted CT scan of the head demonstrated enlarged lateral and third ventricles. Subsequent MRI with and without contrast revealed an enhancing mass originating in the 3rd ventricle, traversing the cerebral aqueduct and terminating in the 4th ventricle. We used a suboccipital approach to remove the vascular malformation after endoscopically disconnecting it from its feeding and draining vessels in the third ventricle. Total excision was performed. Post operative MRI and arteriogram confirmed complete resection of the choroid plexus with vascular malformation.

Conclusions: Choroid plexus vascular malformations can exist intraventricularly and can be confused with a neoplasm. Resection of these intraventricular lesions can be safely performed with endoscopic assistance.

110: Problematic Features of Small Ventricles and Overdrainage Analyzed by a Research-Friendly Database

James P. McAllister, PhD; Steven D. Ham, DO; Katherine M. Kotz, BA; Yandong Zhou, MS; Anupam Gupta, MD; Sandeep Sood, MD (Detroit, MI); Martin U. Schuhmann, MD, PhD (Leipzig, Germany); Holly Gilmer-Hill, MD; Nancy Greninger, RN (Detroit, MI)

Introduction: Management of patients with small (slit-like) ventricles and/or overdrainage remains problematic. In an effort to understand this condition better, we have analyzed all patients admitted to the Children's Hospital of Michigan since 2003 with the aid of a comprehensive, data-oriented, user-friendly database.

Methods: The database was built using Oracle software for Windows. Patient information was compiled from hospital electronic systems, office charts, and medical records, and organized onto the patient's main page, including demographical information, admission dates, and diagnoses. Data entry time varies: a two-day hospital stay with one shunt revision requires only 15 minutes; a complicated course of 20 shunt revisions per year requires 3 hours. However, once the baseline data have been entered, tracking and following active patients is an expeditious process.

Results: To date, 392 patients with hydrocephalus have been entered into the database with 1,637 OR reports, 2,021 blood tests, 1,960 CSF studies, and 2,029 radiology results. The causes of hydrocephalus included congenital (26.5%), post-hemorrhagic (17.6%), tumors (9.2%), trauma (5.6%), meningitis (2.5%), aqueductal stenosis (2.0%), pseudotumor (1.5%), and miscellaneous/no cause given (35.1%). The overall infection rate was 5%. 65 patients were identified with small ventricles (slit-ventricle syndrome or overdrainage), with an average valve revision rate of 4.95. Of those having small ventricles, 14 (22%) were diagnosed with either intraventricular hemorrhage or post-hemorrhagic hydrocephalus. In contrast, 38 patients (18%) had the same diagnoses but did not develop small ventricles.

Conclusions: This database provided an expeditious analysis and has influenced our treatment of patients with small ventricles.

111: Generator Replacement as an Index of Vagal Nerve Stimulator Efficacy

James B. Elder, MD; J. Gordon McComb, MD, FACS; Mark D. Krieger, MD, FACS (Los Angeles, CA)

Introduction: Outcome analysis of vagus nerve stimulation for refractory epilepsy in children has largely depended on the reports of patients and families on seizure frequency and intensity. Assessing patient satisfaction by monitoring the rate of re-operation for generator failure offers an alternative, and possibly more accurate, method to evaluate stimulator efficacy. This study postulates that successful outcome of vagus nerve stimulator placement is reflected in the number of patients willing to undergo another surgery to maintain function of their device.

Methods: From 1998-2005, 52 children received vagus nerve stimulators at our institution. Retrospective chart review (3 month to 7 year follow-up) indicated pre and postoperative seizure frequency, intensity, and time to generator change. Models analyzed had an expected battery life of 3-5 years.

Results: 15 of 22 (68%) patients with at least 5 years follow-up described a significant improvement in their seizure frequency, 2 of 22 (9%) moderate benefit, and 5 of 22 (23%) no benefit. 10 of 22 (45%) patients requested battery change. This included 4 of 6 patients (67%) who had the device implanted in 1998, 3 of 6 (50%) in 1999, and 3 of 10 (30%) in 2000. The remaining 12 patients (55%) in this group almost certainly had a nonworking device.

Conclusions: Our data suggest that efficacy of the vagus nerve stimulator can be monitored in the long term by following the rate of patient return for battery change. The decreasing rate of battery change from 1998 to 2000 possibly suggests a longer average lifespan than reported by the company.

112: Implantation of Antibiotic Impregnated Shunt Catheters to Reduce the Risk of Ventriculoperitoneal Shunt Re-infection

Hydrocephalus Award Candidate

Chris S. Karas, MD; Scott W. Elton, MD (Columbus, OH)

Introduction: The incidence of shunt re-infection after a primary infection is as high as 20% in the literature. Antibiotic-impregnated shunt catheters have been developed to reduce the risk of infection at primary shunt implantation. Because of cost of the catheters, as well as ongoing concerns over antibiotic resistance, we elected to see if placement of antibiotic-impregnated catheters would reduce the risk of shunt re-infection.

Method: A prospective pilot study of antibiotic-coated catheter implantation over a period of three years was performed. During this interval a total of 27 pediatric patients received distal and/or proximal antibiotic-coated catheter (Bactiseal, Codman, Inc.). Primary and revision shunt infections were confirmed by clinical or imaging evidence of shunt failure, as well as positive cultures. Pre-existing shunts were removed and external ventricular drains placed prior to revision. Catheters were placed for revision of a preexisting system after the infection had been cleared by culture results.

Results: Analysis of shunt-related infection rates post implantation in this group revealed a significantly lower incidence of infection when compared to national and our institutional rate. In addition, there is not a significant increase in non-infectious complications specific to this form of shunt tubing.

Conclusion: Although this is a pilot study, it appears that antibiotic-coated shunt catheters provide a safe and effective means of decreasing the rate of shunt-related re-infections in the pediatric population. Further organized and randomized trials on a larger patient population will more clearly define the utility of these catheters in reducing the risk of shunt re-infection.

113: Novel Technique for Intraoperative Localization of Deep Lesions: An Adjunct to Frameless Stereotaxy

Deepa Soni, MD; Michael Scott, MD; Edward Smith, MD (Boston, MA)

Introduction: Intraoperative stereotaxy has become a powerful tool to assist neurosurgery. However, despite advances in neuronavigational systems, difficulties related to tissue deformation or "brain shift" remain problematic in ensuring an accurate intraoperative localization of lesions (particularly deep lesions). Attempts to correct for brain shift, including mathematical models designed to adjust for tissue deformation; intraoperative re-registration of patients using CT/MRI or computer simulations; and "real-time" MRI-guided procedures, have had variable success in increasing localization accuracy. Unfortunately, these are seldom cost-effective, readily available, or validated in human models.

Methods: We describe a novel technique used to intraoperatively localize deep lesions, as an adjunct to a variety of systems. Upon dural opening, a standard ventricular catheter is cut to a length of approximately 2 cm longer than the projected lesion depth, placed on the end of the stereotactic wand/probe, and passed through the cortex to the lesion depth according to the trajectory projected by the system. The probe is then removed from the ventricular catheter sleeve, which can now serves as the trajectory and depth guide for surgically localizing the lesion.

Results: This technique has been employed since 2001 at both Massachusetts General Hospital and Children's Hospital Boston in a wide variety of cases, including tumors, vascular malformations and congenital lesions. The technique adds less than five minutes to the case time. To date, there are no known complications.

Conclusions: We describe a novel, simple, and economical intraoperative technique for accurately localizing deep brain lesions that may be used as an adjunct to most frameless stereotactic systems.

115: Neuroleptic-Like Malignant Hyperthermic Syndrome (NMS) in Three Patients with Acute Hydrocephalus

Hydrocephalus Award Candidate

Ashraf M. Hassan, MD; Harold L. Rekate; Donna Wallace (Phoenix, AZ)

Introduction: NMS is a rare and potentially lethal complication of antipsychotics, it includes hyperpyrexia, rigidity, and rhabdomyolysis and it is generally thought to be secondary to a central dopaminergic blockade.

Aim: The neurosurgical literature does not seem to recognize the relationship between acute hydrocephalus and NMS. This work will describe this relationship and attempt to elucidate its mechanisms and treatment.

Methods: We report 3 patients with acute hydrocephalus secondary to shunt malfunction who developed a syndrome indistinguishable from NMS with special emphasis on pathophysiology and treatment options.

Results: Our 3 patients all presented on multiple occasions with coma, rigidity, extreme hyperpyrexia and, in two patients rhabdomyolysis at the time of shunt failure. None of the patients had been treated with drugs otherwise associated with the condition. While improvement was seen in all patients with shunt repair or reprogramming, full recovery from these life-threatening attacks was only achieved through the use of an implanted baclofen pump.

Conclusion: NMS as a clinical entity could result from acute hydrocephalus, and the main stay in its treatment in this situation is the management of the hydrocephalus. For recurrent or resistant patients intrathecal baclofen infusion can be life saving.

116: Differential Growth Pattern of Arachnoid Cell Culture on Extracellular Matrix

Cornelius H. Lam, MD; Jing Xiao, MD; Walter C. Low, PhD (Minneapolis, MN)

Introduction: Arachnoid cells play an important role in protecting the central nervous system. They also form part of the substrate that filters and regulates cerebrospinal fluid. How these cells grow on different extracelllar matrix can determine the viability of the cells, predict healing of the cells, and hint at regulatory factors in migration and growth of arachnoid derived tumors such as meningiomas.

Methods: Arachnoid tissue is harvested from patients under IRB approved protocol. Tissue is suspended in D-MEM supplemented with glutamine, 10% FBS, and antibiotics. After dividing the tissue into 1 mm2 pieces, it is placed on Nunc 6-well culture plates that has been plated with fibronectin, collagen, gelatin. As control, virgin plastic primed with medium was used.

Results: 9 days later, arachnoid cell growth was most marked in the fibronectin plated well followed closely by control. Collagen surprisingly did not promote cell adhesion as predicted. No growth was seen on the gelatin plated well.

Conclusions: Despite collagen being an important componènt of the extracellular matrix secreted by the arachnoid cells, externally derived collagen did not seem to encourage cell growth. This could be due to a selective preference for type of collagen by the arachnoid cells. Likewise, growth of arachnoid cells on fibronectin suggests a differential response of arachnoid cells to extracellular matrix component that could have implications on chemotaxis and multiplication of normal as well as tumorous arachnoid derivative.

118: Prospective Follow-up Study of Prenatally Diagnosed Central Nervous System Anomalies

Jae Gon Moon, MD, DMSc; Keun Young Lee, MD, DMSc; Ho Kook Lee, MD, DMSc; Chang Hyun Kim, MD, DMSc; Do Yun Hwang, MD, DMSc (Seoul, Republic of Korea)

Introduction: Although advances in neuroradiologic imagings have enabled us to diagnose intrauterine central nervous system(CNS) anomalies, its management remains difficult because the natural history and postnatal outcome were not well understood. This study is undertaken to clarify the natural history and postnatal outcome of prenatally diagnosed CNS anomaly.

Methods: Between January 1999 and October 2002 there were 18 cases of a fetus with a CNS anomaly prenatally diagnosed by ultrasonography. In six cases, intrauterine magnetic resonance imaging was taken to confirm the findings when ultrasonography was inconclusive. In this prospective follow-up study the authors have applied the "perspective classification of congenital hydrocephalus(PCCH)" proposed by OietalXX.

Results: Hydrocephalus was diagnosed in three cases at PCCH stage I, in six cases at stage II, in nine cases at stage III. In 8 cases, termination of pregnancy were performed due to severe CNS anomalies. Among these cases, hydrocephalus was diagnosed in 3 cases(100%) at stage I, in 3 cases(50%) at stage II, in 2 cases(22.2%) at stage III. Out of these 8 cases, 5 cases underwent autopsy following parental consent. Of the 10 cases who were delivered, 4(40%) patients were operated on the shunt. In these 4 patients, hydrocephalus was diagnosed at PCCH stage III(3 fetuses survived, 1 fetus died at 6 months after birth).

Conclusions: The postnatal outcome is significantly poor in the fetuses with CNS anomaly diagnosed in the early gestation. So it is important to diagnose the fetal CNS anomalies in the early stage of gestation and follow up periodically.

119: Post-operative Speech Mapping in Pediatric Patients after Placement of a 64-point Subdural Grid

Kurtis I. Auguste, MD; Vincent Gibbons, MD; Paul Garcia, MD; Nalin Gupta, MD, PhD (San Francisco, CA)

Introduction: Intraoperative speech mapping is an important adjunct to resection of epileptic foci in the dominant hemisphere. Awake craniotomies are limited by patient cooperation in the pediatric population. While extraoperative electrocorticography with implanted subdural electrodes is well-documented, there are few studies that describe speech mapping in children . We describe the technical details of subdural grid placement, staged craniotomies, and speech testing for language localization in children.

Methods: A large craniotomy exposes ~10 centimeters of the middle and superior temporal gyri, inferior frontal sulcus and origin of the central sulcus. A 64 contact subdural grid is trimmed to maximize cortical contact and supplemented by strip electrodes. Speech mapping of non-eloquent and eloquent cortex is started on post-operative day 2. Unipolar stimulation begins at 2 millivolts, and is then increased until speech arrest occurs during naming or repetition.

Results: Two illustrative cases are described. Speech mapping revealed displacement of speech cortex in a 6 year-old male. An extensive resection was performed with no effect on language. Mapping demonstrated receptive speech in the posterior temporal lobe and expressive speech in the inferior frontal lobe of a 14 year-old male. 5 cm of the left temporal lobe was resected resulting in transient post-operative dysnomia.

Conclusions: The details of operative exposure and extraoperative speech mapping in pediatric patients are described and previously published work with pediatric language distribution is reviewed. The three-part strategy of grid placement, mapping and resection is safe and effective treatment for dominant hemisphere lesions in children who may not tolerate intraoperative, awake speech mapping.

120: Utility of Functional MRI (fMRI) in Children: Practical Applications, Limitations and Strategies for Successful Imaging

Samuel R. Browd, MD, PhD; James Lee, PhD; John Kestle, MD; Marion Walker, MD (Salt Lake City, UT)

Introduction: Functional MRI (fMRI) is commonly utilized in adult neurosurgery for preoperative planning and more recently for intraoperative guidance. Preoperative fMRI can be successfully acquired in children as young as four years of age with appropriate patient selection and planning. The advantages of fMRI for tumor mapping, epilepsy evaluations, and risk assessment are well documented in adults but relatively few reports have discussed fMRI in the context of pediatric neurosurgery.

Methods: fMRI was utilized for preoperative mapping and intraoperative guidance in three pediatric neurosurgical cases. Our institutional sensitivity and specificity when comparing fMRI to awake intraoperative mapping is 95% and 80% respectively with phase reversal and fMRI correlating in all cases where both modalities were used. fMRI localized eloquent cortex preoperatively in all pediatric cases and was valuable for preoperative surgical planning and risk assessment.

Conclusions: Current applications, technical limitations, and strategies for successful functional imaging in children will be reviewed.

121: Pericallosal Pseudoaneurysm with Intraparenchymal Hemorrhage Following an Amusement Park Ride: Case Report and Review of Literature

Edward S. Ahn, MD; E. Francois Aldrich, MD (Baltimore, MD); Arthur J. DiPatri, MD (Chicago, IL)

Introduction: There have been multiple reports of neurological injuries in adults associated with amusement park rides. These injuries most commonly include subdural hematomas, arterial dissections, and subarachnoid hemorrhage. While rare, this potential cause of intracranial hemorrhage is of particular interest in the pediatric population due to the high popularity of this activity.

Methods: Case report.

Results: We present the case of an 8-year-old boy who experienced headache and malaise immediately after exiting an amusement park ride. Seven days later he complained of a sudden, severe headache and acted confused. He then became obtunded and developed a non-reactive pupil. Imaging studies revealed a large left frontal hematoma with intraventricular extension. Following rescuscitation and placement of an external ventricular drain, cerebral angiography revealed a 3.4 x 1.5 cm partially thrombosed pseudoaneurysm arising from the distal portion of the left anterior cerebral artery. A decompressive craniotomy was performed. At surgery a large hematoma was evacuated and infarcted brain was debrided. Attempts to address the pseudoaneurysm were prevented by the degree of cerebral edema. Repeat cerebral angiography revealed that the aneurysm no longer filled. Except for a hemiparesis, the child made an excellent recovery.

Conclusions: We present the rare case of a pericallosal artery pseudoaneurysm that developed in a young boy following an amusement park ride. With the high popularity of this activity among the pediatric population, this case illustrates the importance of recognizing amusement park rides as a potential risk factor for children presenting with intracranial hemorrhage.

122: The Superior Sagittal Sinus as Emergency Venous Access in an Infant

Erica F. Bisson, MD; Patrick Graupman, MD (Burlington, VT)

Introduction: Emergency venous access in a multi-trauma infant in shock can be difficult. Lack of ability to obtain peripheral or central access can lead to death in rare instances.

Methods: We present a case of successful volume resuscitation in a 2 week old infant via the superior sagittal sinus.

Results: Neurosurgeons are trained to respect and fear the superior sagittal sinus. Its use in emergency resuscitation has not been reported. As the superior sagittal sinus should remain patent even in a profoundly hypovolemic patient, it is a target for access when other attempts have failed.

Conclusions: The use of this technique should be reserved for emergencies. Moreover, only individuals familiar with venous sinus anatomy and able to handle complications that may arise from the procedure should attempt it.

123: Spinal Cord Gangliogliocytoma Presenting as Juvenile Scoliosis: Case Report and Review of the Literature on Idiopathic Scoliosis

Patrick J. Reid, MD; Howard J. Silberstein, MD (Rochester, NY)

Introduction: Scoliosis may be associated with myriad of neural axis abnormalities (Chiari I malformation with or without syrinx, Chiari II malformation, tethered cord, isolated syringomelia, hydromyelia, diastematomyelia, terminal lipoma, and intrinsic spinal cord tumors). It is accepted that the occurrence of spinal cord pathology is more likely if the curve is to the left. We report a rare case of thoracic cord gangliocytoma presenting with severe left thoraco-lumbar scoliosis. The case and a review of the related literature on idiopathic scoliosis will be discussed.

Methods: The literature for idiopathic scoliosis was reviewed along with the need for MRI examination, the characteristics of scoliosis that may be associated with neural axis abnormalities, and the spectrum of associated neural axis abnormalities.

Results: A poor correlation exists between clinical findings, plain radiographs, and subsequent occult intraspinal anomalies on MRI. MRI was helpful in evaluating children with atypical idiopathic scoliosis or congenital scoliosis, gait abnormality, limb pain or weakness.

Conclusions: Idiopathic scoliosis is a highly prevalent familial disorder. Scoliosis can be the initial neurologic sign suggesting intraspinal pathology. MRI is indicated in evaluation of congenital scoliosis, all patients with infantile idiopathic scoliosis who have a curve greater than or equal to 20 degrees, and in atypical idiopathic scoliosis with severe curves (greater than 45 degrees) despite skeletal immaturity, and an abnormal neurologic examination. Appropriate investigation of idiopathic scoliosis may allow early identification of spinal cord tumors such as gangliocytomas, preferably before significant neurological deficits have arisen. This would allow timely surgery minimizing the degree of the postoperative deficit.

124: Management of Bilateral Jumped Facets in the Proximal Thoracic Spine in a Pediatric Patient

Jonathan E. Martin, MD (Honolulu, HI); Kimberly Bingaman, MD (Augusta, GA); Robert F. Keating, MD (Washington, DC)

Introduction: Flexion-distraction injuries of the proximal thoracic spine are unusual due to the stability imparted to this region of the spine by the supporting sterno-costal ring. These highly unstable injuries require arthrodesis to provide an optimal environment for potential neurologic recovery and allow for early mobilization of the patient. The evolution of surgical technique and instrumentation systems over the past decade has expanded options for fixation available to neurosurgical practitioners. Pedicle screws have supplanted hooks and wires as the most widely utilized fixation device in the lower thoracic and lumbar spine. Many providers remain reluctant to utilize pedicle screws in the proximal thoracic spine due to concerns for safe placement. We report a case of pedicle screw fixation of a proximal thoracic injury in a pediatric patient.

Methods: A 10 year-old female suffered perched facets at T3-4 following a severe motor vehicle accident. Comorbid injuries included a severe closed head injury and bilateral pulmonary contusions. Pre-operative CT scanning was obtained from T2-T5. Coaxial pedicle length and width at the isthmus was measured bilaterally at these levels. Appropriate instrumentation was selected pre-operatively on the basis of these measurements. The patient subsequently underwent T2-5 posterior segmental instrumentation without complication.

Results: Post-operative CT confirmed safe placement of all instrumentation. Early mobilization was accomplished without bracing. Follow-up imaging at 6 months demonstrated excellent fusion of the instrumented levels.

Conclusions: Pedicle screw placement in the proximal thoracic spine can be a safe and effective means of fixation, providing biomechanical advantages in the treatment of post-traumatic deformity.

125: Choroid Plexus Hypertrophy: What is the Role for Resection of the Choroid Plexus?

Kenneth Shulman Award Candidate

Bart A. MacDonald, MD; Cormac Maher, MD; Liliana Goumnerova, MD (Boston, MA)

Introduction: Choroid plexus hypertrophy is an uncommon condition seen most often in children and very rarely in adults. The most common location for overgrowth is the lateral ventricles.

Methods: A 19 month old male presented with developmental delay and macrocephaly. MRI demonstrated hydrocephalus due to villous choroid plexus hypertrophy with a large choroid plexus cyst in the left atrium. The patient underwent endoscopic fenestration of the cyst and ventriculoperitoneal shunt placement. An attempt at endoscopic coagulation of the choroid plexus was aborted due to the exuberant amount of choroid plexus and some bleeding. He was readmitted with shunt failure due to difficulty with peritoneal absorption of CSF and ultimately a shunt infection requiring removal of the shunt and placement of an EVD. The daily production of CSF was over 2L. Following treatment of the infection a VA shunt was placed which also failed and the patient ultimately underwent a craniotomy for resection of the choroid plexi. An EVD was placed and the patient eventually required reinsertion of the ventriculoperitoneal shunt.

Results: Pathology revealed exuberant choroid plexus with extensive papillary features and some areas of focal papilloma.

Conclusions: Choroid plexus hypertrophy is a rare disorder, which may be difficult to treat. We present an unusual case with multiple complications leading ultimately to resection of the choroid plexus. We will present the current literature and discuss the indications for resection of the choroid plexus.

126: Disseminated Desmoplastic Medulloblastoma in an African-American Child with Nevoid Basal Cell Carcinoma (Gorlin) Syndrome

Jodi L. Smith, PhD, MD, Philip S. Smucker, MD (Indianapolis, IN)

Introduction: Standard treatment of medulloblastoma consists of resection followed by chemotherapy and radiotherapy. Medulloblastoma occurs in approximately 5% of patients with nevoid basal cell carcinoma (Gorlin) syndrome (NBCCS), an autosomal dominant disorder that predisposes to neoplasias, including basal cell carcinomas and medulloblastoma, and widespread congenital anomalies. NBCCS results from mutations in the patched (PTCH) gene.

Clinical report: A 2.5-yo African-American boy with a history of macrocephaly, gross motor delay, bilateral rib fusion/segmentation anomalies, and a prior brain MRI showing a left temporal arachnoid cyst presented to our hospital because of difficulty ambulating. His family history was significant for multiple basal cell carcinomas and palmar and plantar pits in the father. Examination of the child revealed frontoparietal bossing, hypertelorism, macrocephaly, papilledema, and ataxic gait. A brain MRI demonstrated three large, heterogeneously-enhancing, posterior fossa masses and ventriculomegaly.

He underwent resection. Final pathologic diagnosis was desmoplastic medulloblastoma. Based on this, his clinical examination, and his past medical and family histories, we suspected NBCCS, and radiotherapy was withheld. DNA testing revealed a novel PTCH gene mutation, confirming NBCCS.

Conclusion: The diagnosis of NBCCS must be considered, especially in younger patients with desmoplastic medulloblastoma, because adjuvant radiotherapy in such patients often leads to the formation of basal cell carcinomas and other intracranial neoplasms within the irradiated field. This case emphasizes the significance of obtaining thorough family and past medical histories and of carefully examining the patient and close relatives for signs of NBCCS to avoid the potentially devastating pitfalls of missing this diagnosis.

127: Management of a Pediatric Patient with Complex Skull and Cervical Spine Fractures Using a Modified Halo Brace

Kurtis I. Auguste, MD; Nalin Gupta, MD, PhD (San Francisco, CA); Mark E. Eastham, MD (San Jose, CA)

Introduction: A halo brace is a standard technique used to immobilize fractures of the cervical spine. The horseshoe-shaped crown requires seating of the pins in intact cranial bone. We discuss a modification of the halo brace in a child with an unstable cervical spine fracture and complex skull fractures which prevented standard brace placement .

Methods: The patient is a 22-month-old male who was a pedestrian struck by a motor vehicle. He was neurologically intact but sustained a C2 fracture and linear, comminuted, depressed fractures of the right parietal and temporal bones. In order to safely place the halo brace the crown was rotated 180 degrees and the pins were offset to avoid the skull fractures . With the crown reversed, multiple pins attached to the skull in the occipital region. A custom-fit foam pad separated these pins from surfaces behind the patient and supported the patient's weight.

Results: Six crown pins were placed and adequate pressure was applied to each without displacing neighboring fractures. Serial X-rays confirmed successful immobilization and fusion of the C2 fracture. The patient's halo was removed after 12 weeks. He remained neurologically intact and his fractures are healed on follow-up imaging.

Conclusion: The halo brace can be modified safely to satisfy the anatomic needs of patients with complex spine and skull fractures. In the setting of a reversed halo crown, we recommend supplementing with padding to protect the posterior pins from contact or weight-bearing.

128: Immediate Complete Resolution of Large Cervico-thoracic Syringomyelia after Third Ventriculostomy

Kenneth Shulman Award Candidate

Ali I. Raja, MD, MS; Carlos A. Guerrero, MD; Badih Adada, MD (Little Rock, AR)

Introduction: Syringomyelia is often associated with intracranial obstructive pathology. A decrease in syrinx size after a posterior fossa decompressive surgery or cerebrospinal fluid diversion procedure usually occurs, and can been seen as early as 2 weeks. Immediate complete resolution of the syrinx has not been reported in the literature.

Methods: A 15-year-old patient with a large cervico-thoracic syrinx underwent third ventriculostomy for hydrocephalus secondary to a brainstem tumor. Magnetic resonance imaging scan on post-operative day 4 showed complete resolution of the syrinx. Details of the illustrative case are presented followed by review of pertinent literature.

Conclusions: Complete resolution of a large cervico-thoracic syrinx after third ventriculostomy over a very short period of time is extremely rare.

129: Skull Base Approaches for Pediatric Brainstem Tumors

Kenneth Shulman Award Candidate

Ali I. Raja, MD, MS; Carlos A. Guerrero, MD; Badih Adada, MD (Little Rock, AR)

Introduction: Tumors of the brainstem represent a challenging group pediatric brain tumors. We utilize skull base approaches and techniques for treating complex lesions of this region. This enhances the extent of tumor resection by providing a wider operative exposure with minimal brain retraction, leading to better results even in the most difficult cases.

Methods: The choice of the skull base approach used was guided by the location of the tumor, relationship to the surrounding structures, and radiological characteristics. Three illustrative cases are discussed along with a description of the surgical approaches used.

Conclusions: Detailed anatomical knowledge and use of microsurgical skull base techniques enables superior outcomes.

130: Spontaneous clival epidural hematoma as a form of presentation of Ehlers Danlos type IV

Erica F. Bisson, MD; Travis Dumont, MD; Bruce Tranmer, MD (Burlington, VT)

Introduction: Ehlers-Danlos syndrome Type IV is an autosomal dominant connective tissue disorder characterized by defective collagen synthesis. This disorder is of particular interest to neurologists and neurosurgeons as there is an increased incidence of cerebrovascular disease due to excessive fragility of blood vessels.

Methods: We present a unique case of a pediatric patient with a spontaneous epidural hematoma as the initial presentation of Ehlers-Danlos Type IV and review the relevant literature.

Results: A 3 year old male presented with a several day history of posterior cervical pain and nuchal rigidity and was found to have a spontaneous retroclival epidural hematoma with extension cauded to the upper thoracic spine. After extensive evaluation including genetic testing the patient was found to meet criteria for the diagnosis of Ehlers-Danlos Type IV.

Conclusions: It is important to recognize the spectrum of connective tissue disorders as a possible etiology of spontaneous hemorrhage or stroke in the pediatric population. In this subset of patients there are both diagnostic and interventional pitfalls. Additionally, operative intervention has increased morbidity and mortality secondary to vascular fragility and should therefore be undertaken with caution and only when conservative measured have failed.

131: Lambdoid Synostosis vs. Positional Molding

Christopher A. Gegg, MD; Jogi V. Pattisapu (Orlando, FL)

Introduction: Lambdoid craniosynostosis is the most rare form of craniosynostosis and like occipital positional molding ,which is common, posterior plagiocephaly is seen. The treatments and the effects on the growing brain are very different between the two; thus a clear diagnosis must be made.

Methods: The authors present a case of lambdoid craniosynostosis with features of positional molding. The infant had the typical parallelogram appearance of occipital positional molding, rather than the trapezoid appearance of lambdoid synostosis. A bulging anterior fontanelle and inability to palpate the lambdoid suture on the associated side required radiographic evaluation, which identified lambdoid craniosynostosis. A good cosmetic outcome was achieved by posterior cranial reconstruction, which relieved the increased intracranial pressure (normal anterior fontanelle).

Conclusions: The hallmark features in this case of a bulging anterior fontanelle, inability to palpate the lambdoid suture, a winged ipsilateral ear, and a skull base tilt were important in making the correct diagnosis.

132: Programmable Valve Adjustment after Exposure to Gait-Analysis: Case Report

Holly S. Gilmer-Hill, MD; Edward Dabrowski, MD; Patricia Beierwaltes, CNS; James Chinarian, MD; Charles Pelshaw, MD; Gretchen Backer, PT; Nancy Greninger, CNS (Detroit, MI)

Introduction: The pressure settings of programmable magnetic shunt valves may be inadvertently changed by magnetic fields greater than 0.8 Tesla. We report the case of an 8 year-old girl with hydrocephalus whose programmable shunt setting was changed after exposure to magnetic gait-analysis.

Methods: The patient is an 8 year-old girl with L4-level myelomeningocele and shunted hydrocephalus. She had a ventriculoperitoneal shunt in place, with a Codman Medos Programmable valve. At the time of her gait analysis, her setting was 100. She was within the electromagnetic field of the gait-analysis apparatus for approximately 90 minutes. She had had no other exposures to magnetic fields. Over the next two days, she was extremely irritable and complained of severe headaches. Skull x-ray showed her valve setting to be 70 mm water. Her valve was reprogrammed to 100 mm water, and her symptoms resolved.

Conclusion: To our knowledge, this is the first report of a gait-analysis apparatus changing the pressure setting of a programmable shunt valve. When patients with programmable shunts undergo gait-analysis as part of their physical therapy regimens, skull xrays should be immediately performed to verify their valve settings.

133: Skull Base Osteogenic Sarcoma, EC-IC Bypass Surgery, Total Tumor Removal, Case Report

Foad Elahi, MD; Laligam Natarajan Sekhar, MD, FACS (Seattle, WA)

Introduction: In this case study we want to show cerebral bypass surgery for sake of total tumor removal for the pathologies located in the skull base region with involvement of the carotid artery in pediatric patients.

Methods: This is a 5 year-old boy presented with headache, partial third cranial nerve palsy. MRI and CT Scan imagings show skull base involvement by a destructive tumor. He was admitted to another institute, where he had the first transnasal tumor biopsy. He was diagnosed as osteogenic sarcoma. In our hospital, he underwent of two stage surgeries. The first stage was EC-IC bypass due to tumor involvement of the carotid artery. On the second stage total tumor resection with excellent patient recovery was done.

Conclusions: In the case report we report the first case of cerebral vascular bypass in pediatric age group due to tumor involvement of carotid artery. We do not want to reach to a conclusion with this case report; however cerebral vascular bypass and attempt for total tumor resection in extensive skull base tumor involvement should be among neurosurgeons' techniques and should be individually offered to the patients. We strongly advocate young neurosurgeons to get familiarize with vascular bypass surgical techniques which would be life saving for total tumor surgeries

134: Spindle Cell Neoplasm of Spinal Cord with Giant Collagen Rosettes

Juan Alzate, MD; Richmond Abbott, MD; Karen Weidenhein, MD; Jacqueline Bello, MD (New York, NY)

Introduction: Schwannomas occurring on the spinal nerve roots are common, benign neoplasms with a characteristic histological, immunohistochemical and ultrastructural features that readily distinguish them from other spindle-cell tumors that may arise in this location.

Methods: We report a 17-year-old male with progressive scoliosis of 11 years duration, and lower extremity weakness for 7 years. At surgery, an extra-axial tumor extending from T7 to T10, unattached to dura and largely exophytic, was partially resected.

Result: Light microscopy revealed a moderately cellular proliferation of elongated to stellate spindle cells in a loose collagenous matrix, with uniform vesicular nuclei. A biphasic pattern, palisaded nuclei or Verocay bodies were not present. Giant collagen rosettes unassociated with peripheral hypercellularity or with inflammatory activity were present. There was no necrosis, mitotic activity or staining for MIB-1. Reticulin and collagen were present in the tumor matrix. Immunohistochemistry revealed that the tumor cells were strongly positive for CD34 and moderately positive for S100. The tumor cells were negative for bcl2, desmin, smooth muscle actin and epithelial membrane antigen. Electron microscopy revealed that some but not all of the spindle cells possessed external lamina, and contained rough endoplasmic reticulum and occasional mitochondria. Pinocytosis and intercellular junctions were not present. Gliotic, disorganized central nervous system tissue nests, leptomeninges, peripheral nerve fascicles, and adipose tissue were intimately associated with the spindle cells.

Conclusions: This is an unusual neoplasm that has both fibroblastic and Schwannian features as well as giant collagen rosettes, and has so far exhibited benign behavior.

135: Transient Ventriculomegaly in a Child Presenting with Hypernatremia: Case Report

Curtis J. Rozzelle, MD; John G. Fahrbach, IV, MD (Buffalo, NY)

Introduction: Ventricular enlargement in patients with shunted hydrocephalus typically indicates shunt malfunction. To our knowledge, transient ventriculomegaly associated with severe hypernatremia that resolves with normalization of serum sodium concentration has not been reported.

Methods: A 3 year-old female with a history of myelomeningocele repair, shunted hydrocephalus, and shaken baby syndrome who presented in a hypernatremic state as a result of dehydration. CT of the head revealed ventricular enlargement compared with previous imaging. Shunt tap revealed intracranial hypotension, with good proximal shunt flow.

Results: The child was treated medically for her hypernatremic state, and returned to her neurologic baseline. Subsequent CT scans of the head demonstrated a return of the ventricular system to pre-morbid size. No shunt revisions have been required and ventricular size was again unchanged on a head CT scan performed eight months later.

Conclusions: Based on the initial radiographic presentation and subsequent follow up, we hypothesize that this patient presented with an "ex vacuo" ventricular enlargement as a result of hypernatremia. The proposed mechanism of this phenomenon is reversible cerebral volume loss due to a decrease in intracellular water. However, we emphasize the importance of assessing shunt patency and intracranial pressure when evaluating ventricular enlargement in any shunted patient.

136: Differences of the Timing and Course of Cranial Treatment in Mutation-proven Crouzon and Apert Syndromes

Susumu Ito, MD; Ken'ichi Sekido, MD; Hironobu Sato, MD; Kazuo Yamaguchi, MD; Hiroshi Kanno, MD; Isao Yamamoto, MD (Yokohama, Japan)

Introduction: The aim of this study is to elucidate differences of timing and course of cranial treatment between Crouzon and Apert syndromes with mutations of fibroblast growth factor receptor (FGFR) gene.

Methods: Ten patients with Crouzon and six with Apert syndrome were enrolled in this study. All of the patients underwent molecular genetic investigation for FGFR2 gene. In addition, these sixteen patients had a follow-up period longer than 10 years. We compare the timings and procedures of cranial operations between two syndromes, retrospectively.

Results: In Crouzon syndrome, five of the ten patients underwent first cranial operations including linear craniectomies before one year of age. Eventually, nine of these patients underwent fronto-orbital advancement (basically according to Whitaker LA) or frontal remodeling with Z plasty (according to Marchac D). 50% of the ten patients required cranial surgeries more than one time. Seven of ten mutations of FGFR2 gene in these patients were related to cysteine residues.

In Apert syndrome, however, all six patients required fronto-orbital advancements before the age of 6 months. Moreover, all these patients underwent additional forehead remodeling with Z plasty between the age of 3 and 6 years because of progression of oxycephaly. The mutations of FGFR2 gene were Ser252Trp in four and Pro253Arg in two patients.

Conclusions: In patients with Apert syndrome, cranial operations were needed earlier and more often than in ones with Crouzon syndrome. Mutations in FGFR2 gene cause both syndromes; however, biological differences between these syndromes may affect their clinical courses.

137: The Transchoroidal Approach to Posterior Third Ventricular Tumors in Children: Surgical Strategies A Series of 37 Cases

Andrew D. Nguyen, MD, PhD; Samuel A. Hughes, MD, PhD; Lissa C. Baird, MD; Hal S. Meltzer, MD; Michael L. Levy, MD, PhD (San Diego, CA)

Introduction: Surgical approaches to posterior third ventricular tumors in children remain controversial. We retrospectively reviewed 37 patients with posterior third ventricular lesions treated via an anterior surgical approach, based on tumor origin and potential ependymal involvement.

Methods: A total of 37 patients underwent surgery for posterior third ventricular tumors over a ten-year period. Patient age was 111 +/- 60 months (range, 5 to 204 months). Transchoroidal approaches were used in all patients and performed by a single surgeon (MLL). Neuropsychological evaluation was performed in 20 patients.

Results: Tumors included Astrocytoma (29.7%), Mixed Germinoma (10.8%), Ependymoma (10.8%), Neurocytoma (2.7%), DNET (2.7%), Pilocytic astrocytoma (16.2%), Gliosis (2.7%), PNET (10.8%) and Anaplastic Astrocytoma (2.7%). Total gross resection was performed in 88% of patients with benign tumors. There was no surgical mortality. Increased intracranial pressure occurred in 30% of patients, requiring CSF diversion in 14%. Transient motor deficits (30%) and memory abnormalities (9%) were noted following surgery. Overall morbidity included prolonged mild to moderate hemiparesis in 3 patients (8%), and postoperative seizures in 2 patients (6%). Neuropsychological testing documented deficits in verbal memory in three patients (8%). One patient had post-operative aphasia and one required surgery for a post-operative epidural hematoma. Mean follow-up period was 66 months. 72% of patients achieved good outcomes with/without disability. Morbidity was related to preoperative exam and tissue diagnosis.

Conclusions: The transchoroidal approach for posterior third ventricular tumors in children is a versatile and safe approach. Advantages of the approach may include less cognitive dysfunction given minimal manipulation of the fornices.

138: Microsurgical Resection of Childhood Craniopharyngioma: Long-term Results from a Single Center

Kenneth Shulman Award Candidate

Roger A. Lichtenbaum, MD; Robert Bollo, MD; Jeffrey Wisoff, MD (New York, NY)

Introduction: Craniopharyngiomas are the most common non-glial tumor of childhood. We present a series of 83 patients who underwent surgical resection and discuss both short- and long-term neurological, ophthalmologic, endocrine and neuropsychological results.

Methods: A retrospective chart review was performed on the senior author's series of 83 consecutive patients (ages 1.5 to 23) over a period of 20 years. All patients underwent frontotemporal craniotomies, which were supplemented with endoscopic approaches when necessary. Recurrent tumors were treated with re-operation. When gross total resection for recurrence was unachievable, radiation was used to supplement subtotal resection.

Results: Gross total microsurgical resection was obtained in 98% of newly diagnosed patients and subtotal or partial resection in 2%. Those patients who had a radiographic gross total resection had a recurrence rate of 18%; re-operation was always attempted for recurrences with 80% having a gross total resection at second surgery. Disease control was obtained in 98% of patients who had initial gross total resections and 83% of patients who had partial or subtotal resections. Twenty-two percent of the patients had previously undergone attempted surgical resections and/or radiation therapy at outside institutions; of those, 77% achieved disease control following re-operation at our institution. The overall surgical mortality was 3%.

Conclusion: Long-term outcomes following microsurgical resection by an experienced surgeon compare favorably to those following subtotal resection with radiation therapy for newly diagnosed and recurrent craniopharyngiomas. Radiation therapy should be reserved for patients with inoperable tumors. Long-term neurologic, visual, endocrine and neuropsychologic implications will be discussed.

139: Injury and Outcomes after Automobile, Motorcycle and All-Terrain Vehicle Injury in Children: an Institutional Review

Mirza N. Baig, MD, PhD; Brandon Miller, BA; John Hayes, PhD; Scott Elton, MD (Columbus, OH)

Introduction: This study was undertaken to compare the outcomes of pediatric patients admitted to our institution for trauma resulting from car, motorcycle and ATV accidents.

Methods: We conducted a retrospective review of Columbus Children's Hospital's trauma registry from January 1993 to December 2003. Data from all patients admitted to the emergency room due to motor vehicles accidents were analyzed, for a total of 1608 patient records. Gender, age, length of stay, Glasgow coma score, revised trauma score, disposition and use of a protective device were studied.

Conclusions: Of 1608 patients, 1257 (78%) were injured in automobile accidents, 123 (7.6%) were injured in motorcycle accidents and 228 (14.2%) were injured in all terrain vehicle accidents. Injuries from all vehicle types peaked during the summer months. Patients involved in motor vehicle crashed presented with significantly worst GCS scores than those injured in motorcycle and all terrain vehicle accidents, though there was no statistically significant difference in length of stay between all three injury modalities. Protective devices were underutilized in all three motor vehicle categories, and were associated with significantly higher GCS scores and shorter lengths of stay among patients admitted after automobile accidents. The higher incidence of motor vehicle accidents and the correlation of seat belt use with better outcomes underscores the necessity to improve motor vehicle safety education for children, who are less likely to be restrained as they age.

Rick Abbott, MD
Childrens Hospital at Montefiore
3316 Rochambeau Ave.
Bronx, NY 10467

Jafri Malin Abdullah, MD, PhD, FRC
Hosp. Univ. Sci/Neurosurgery/Neurosci.
Jalan Hospital USM Kubang Kerian
Malaysia

P. David Adelson, MD, FACS
Children's Hosp. of Pittsburgh
3705 5th Ave./Neurosurgery
Pittsburgh, PA 15213-2583

Nejat Akalan, MD
Hacettepe University Sch. of Med.
Dept. of Neurosurgery
Ankara 06100
Turkey

A. Leland Albright, MD
Children's Hosp. of Pittsburgh
3705 5th Ave./Neurosurgery
Pittsburgh, PA 15213-2524

Lance Altenau, MD
501 Washington, Ste. 700
San Diego, CA 92103

A. Loren Amacher, FRCS
3 Hospital Dr.
Lewisburg, PA 17837

Luis V. Amador, MD
1440 Veteran Ave., Ste. 336
Los Angeles, CA 90024-4832

Ahmed S. Ammas, MD, PhD
King Fahd Military Medical Complex
Building 71, Flat G02
Dhahran 31932
Saudi Arabia

Jim D. Anderson, MD
PO Box 658
San Carlos, CA 94070-0658

Brian T. Andrews, MD
45 Castro St., Ste. 421
San Francisco, CA 94114

Thomas J. Arkins, MD
Connecticut Neurosurgery PC
330 Orchard St., Ste. 316
New Haven, CT 06511-4417

Patricia A. Aronin, MD, MS
Central Texas Neurosurgery for Children
1215 Red River St., Ste. 232
Austin, TX 78701

Elaine J. Arpin, MD
S.W. Florida Neurosurgical Assoc.
413 Del Prado Blvd., Ste. 102
Cape Coral, FL 33990-5703

Wilson T. Asfora, MD, FRCSC F
1210 W. 18th St., Ste. 104
Sioux Falls, SD 57104

Saleh S. Baeesa, MD, FRCSC
King Abdulaziz University Med. Ctr.
PO Box 80215
Jeddah 21589
Saudi Arabia

Walter L. Bailey, MD
500 River St.
Minneapolis, MN 55401

Gene A. Balis, MD, FACS
Neurological Surgeons Associates
3000 E. Fletcher Ave., Ste. 340
Tampa, FL 33613-4645

Steven J. Barrer, MD, FACS
Abington Neurosurgical Associates
2510 Maryland Rd., Ste. 185
Willow Grove, PA 19090-1134

Henry M. Bartkowski, MD, PhD
Akron Childrens Hospital
1 Perkins Square, Rm. 6411
Akron, OH 44308-1062

James E. Baumgartner, MD
3418 Georgetown St.
Houston, TX 77005-2910

Robert Micheal Beatty, MD
Neurosurgery of Kansas City
2040 Hutton Rd., #105
Kansas City, KS 66109-4564

William O. Bell, MD
Neurosurgical Assoc. of the Carolinas
2810 N. Maplewood Ave.
Winston-Salem, NC 27103-4138

Mitchel S. Berger, MD, FACS
UCSF/Dept. of Neurosurgery
505 Parnassus Ave., M-786
San Francisco, CA 94143-0112

J. A. Bermudez, MD
Children's Hospital/Dept. of Neurosurgery
200 Henry Clay Ave.
New Orleans, LA 70118

Karin Sabin Bierbrauer, MD
Cincinnati Children's Med. Ctr.
3333 Burnet Ave./Ped. Neurosurgery
Cincinnati, OH 45229

Peter McL. Black, MD, PhD
Brigham Women's Hospital
75 Francis St./Neurosurgery
Boston, MA 02115

Jeffrey P. Blount, MD, FACS
Children's Hospital of Alabama
1600 7th Ave. S., ACC 400
Birmingham, AL 35233

John Scott Boggs, MD
1820 Barrs St., Ste. 104
Jacksonville, FL 32204

Frederick A. Boop, MD, FACS
Semmes Murphey Clinic
1211 Union Ave., Ste. 200
Memphis, TN 38104-3562

William R. Boydston, MD
Pediatric Neurosurgery Assoc.
5455 Meridan Mark Rd., Ste. 540
Atlanta, GA 30342-1640

Douglas L. Brockmeyer, MD
Primary Children's Medical Center
100 N. Medical Dr., Ste. 2400
Salt Lake City, UT 84113-1103

Jeffrey A. Brown, MD, FACS
100 Merrick Rd., Ste. 128W
Rockville Centre, NY 11570

Derek A. Bruce, MD
78 Millbrook Rd.
Nantucket, MA 02554

Michael James Burke, MD, FACS
Neurosurgery Inst. of South Texas
3643 S. Staples
Corpus Christi, TX 78411-2456

George T. Burson, MD
Neurosurgery Arkansas
9601 Lile Dr., Ste. 310
Little Rock, AR 72205

Leslie D. Cahan, MD
Kaiser Foundation Hospital
1505 N. Edgemont St., Rm. 4141
Los Angeles, CA 90027-5209

Jeffrey W. Campbell, MD
A.I DuPont Hosp. for Children
1600 Rockland Rd./Neurosurgery
Wilmington, DE 19803

Carolyn Marie Carey, MD, FACS
880 6th St. S.
St. Petersburg, FL 33701

Peter W. Carmel, MD
UMDNJ-New Jersey Med. Sch.
90 Bergen St., Ste. 7300
Newark, NJ 07103-2425

Benjamin Solomon Carson, MD
Johns Hopkins Univ. Hosp.
600 N. Wolfe St., Harvey 811
Baltimore, MD 21287-8811

Oguz Cataltepe, MD
Div. of Neurosurgery
55 Lake Ave. N., Ste. S2-848
Worcester, MA 01655

Jeffrey E. Catrambone, MD
UMDNJ
90 Bergen St., Rm. 8126
Newark, NJ 07103

Michael J. Chaparro, MD, FACS
Palm West Pediatric Neurosurgery
3898 Via Poinciana, Ste. 18
Lake Worth, FL 33467

Paul H. Chapman, MD, FACS
Massachusetts General Hospital
55 Fruit St. GRB502
Boston, MA 02114-2696

William R. Cheek, MD
3009 Robinhood
Houston, TX 77005

W. Bruce Cherny, MD
100 E. Idaho St., Ste. 202
Boise, ID 83712

Maurice Choux, MD
14 av Solvert C
Marseille 13009
France

Samuel F. Ciricillo, MD, FACS
5238 Fair Oaks Blvd.
Carmichael, CA 95608-5766

David Douglas Cochrane, MD
Childrens & Womens Hlth. Ctr. of BC
B2W 4500 Oak St.
Vancouver, BC V6H-3N1
Canada

Alan R. Cohen, MD, FACS
Rainbow Babies & Children's Hosp.
11100 Euclid Ave., Rm. B501
Cleveland, OH 44106-1736

John Jeffrey Collins, MD
4759 Ridgetop Dr.
Morgantown, WV 26508

Shlomo Constantini, MD
Dana Children's Hospital/
Tel Aviv Med. Center
6 Weizman St./Ped. Neurosurg.
Tel Aviv 64239
Israel

Richard A. Coulon, jr. MD
Childrens Hosp./Dept of Neurosurgery
200 Henry Clay Ave.
New Orleans, LA 70118

Kerry R. Crone, MD
Childrens Hosp. Med. Ctr./Neurosurgery
3333 Burnet Ave., ML 2016
Cincinnati, OH 45229-3039

Robert C. Dauser, MD
Texas Children's Hospital
6621 Fannin, Ste. 950
Houston, TX 77030-2303

Richard A. A. Day, MD
Montana Neurosurgery Ctr.
2835 Fort Missoula Rd., Ste. 202
Missoula, MT 59804-7423

Concezio Di Rocco, MD
Univ. Cattolica/Neurochirurgia
Largo Gemelli 8
Rome 00168
Italy

Mark S. Dias, MD
Pennsylvania State Med. Sch.
500 University Dr./Neurosurgery
Hershey, PA 17033

Joseph F. Dilustro, MD
Children's Hospital
601 Childrens Ln., Ste. 5A
Norfolk, VA 23507

Arthur J. DiPatri Jr. MD
Children's Mem. Hosp./Ped. Neuro.
2300 Children's Plaza, Box 28
Chicago, IL 60614

Peter B. Dirks, MD
Hospital for Sick Children
555 University Ave.
Toronto, ON M5G-1X8
Canada

David J. Donahue, MD
Southwest Neurological Surgery
800 8th Ave., Ste. 306
Fort Worth, TX 76104-2602

James R. Doty, MD, FACS
1340 Broad Ave., Ste. 440
Gulfport, MS 39501

James M. Drake, MD
Hospital for Sick Children
555 University Ave., #1504-D
Toronto, ON M5G-1X8
Canada

Ann-Christine Duhaime, MD
Dartmouth Hitchcock Med. Ctr.
1 Medical Center Dr.
Lebanon, NH 03756

John A. Duncan, III MD, PhD
Rhode Island Hospital
2 Dudley St., Ste. 530
Providence, RI 02905-3236

Charles Cecil Duncan, MD, FACS
Yale Univ. Sch. of Med.
333 Cedar St. TMP 419
New Haven, CT 06520-8082

Mary E. Dunn, MD
2425 S. Shore Blvd.
White Bear Lake, MN 55110

Susan R. Durham, MD
Dartmouth-Hitchcock MC/Neurosurgery
1 Medical Center Dr.
Lebanon, NH 03756-0001

Michael S. B. Edwards, MD, FACS, FA
300 Pasteur Dr., Rm. R207
Stanford, CA 94305-5327

Michael R. Egnor, MD
NY Spine & Brain Surgery PC
Neurosurgery/HSC T12-080 SUNY
Stony Brook, NY 11794-8122

Stephanie L. Einhaus, MD
Semmes-Murphey Clinic
6325 Humphreys Blvd.
Memphis, TN 38120

Howard M. Eisenberg, MD
Univ. of Maryland Med. Ctr.
22 S. Greene St., Ste. S12D
Baltimore, MD 21201-1544

Ibrahim Muftah El Nihum, MD, FACS
1602 Rock Prairie Rd, Ste. 4400
College Station, TX 77845

Richard G. Ellenbogen, MD, FACS
5706 63rd Ave. N.E.
Seattle, WA 98105-2040

Seyed M. Emadian, MD, PhD
Premier Neurosurgery & Spine Ctr.
730 Kings Ln.
Tullahoma, TN 37388

Fred J. Epstein, MD
18 Locust Rd.
Greenwich, CT 06831

Mark D. Erasmus, MD
New Mexico Neurosurgery P.C.
522 Lomas Blvd. N.E.
Albuquerque, NM 87102-2454

Walter J. Faillace, MD, FACS
812 W. Janice Ct.
La Crosse, WI 54601

Neil Arthur Feldstein, MD, FACS
New York Neurological Inst.
710 W. 168th St., Rm. 414
New York, NY 10032

David Alan Fell, MD
Neurosurgery Specialists
6767-A S. Yale
Tulsa, OK 74136-3302

Ann Marie Flannery, MD, FACS, FA
SSM Cardinal Glennon Childrens Hosp.
1465 S. Grand Blvd.
St. Louis, MO 63104

Eldon L. Foltz, MD
2480 Monaco Dr.
Laguna Beach, CA 92651

Paul C. Francel, MD, PhD
10001 S. Western, Ste. 101
Oklahoma City, OK 73139

Kathleen B. French, MD
3020 Hamaker Ct. B104
Fairfax, VA 22031-2220

Arno H. Fried, MD
Hackensack Univ. Med. Ctr.
30 Prospect Ave./WFAN Peds Ctr.
Hackensack, NJ 07601

David M. Frim, MD, FACS
University of Chicago
5841 S. Maryland Ave., MC 4066
Chicago, IL 60637-1463

Herbert E. Fuchs, MD, PhD
Duke University Medical Center
Box 3272
Durham, NC 27710

Joseph H. Galicich, MD
PO Box 276
Alpine, NJ 07620-0276

Hugh J. L. Garton, MD, MHSc
Univ. of Michigan/Mott Childrens Hosp.
1500 E. Medical Center Dr.
Ann Arbor, MI 48109-0033

Sarah J. Gaskill, MD, FACS
2103 Elm Vista
San Antonio, TX 78230-2772

Rosemaria Gennuso, MD
4499 Medical Dr., Ste. 340
San Antonio, TX 78229

Timothy M. George, MD
Duke University Med. Ctr.
Box 3272/Neurosurgery
Durham, NC 27710-0001

P. Langham Gleason, MD
1722 9th St.
Wichita Falls, TX 76301

Roberta P. Glick, MD
Cook County Hosp./Neurosurgery
1901 W. Polk
Chicago, IL 60612-3701

John C. Godersky, MD
Anchorage Neurosurgical Associates
3220 Providence Dr., Ste. E3-020
Anchorage, AK 99508

James T. Goodrich, MD, PhD
Albert Einstein/Montefiore Med. Ctr.
111 E. 210th St./Neurosurgery
Bronx, NY 10467-2401

Liliana C. Goumnerova, MD FRCS(C)
Childrens Hospital Bader 365
300 Longwood Ave.
Boston, MA 02115-5724

Paul A. Grabb, MD
1725 E. Boulder, Ste. 104
Colorado Springs, CO 80909

Clarence S. Greene Jr. MD
CHildren's Mercy Hosp./Neurosurgery
2401 Gillham Rd.
Kansas City, MO 64108

David P. Gruber, MD
Inland Neurosurgery & Spine Assoc.
105 W. 8th Ave., Ste. 200
Spokane, WA 99204-2318

Laurance J. Guido, MD
30 Sutton Pl., Ste. 15A
New York, NY 10022-2365

Nalin Gupta, MD, PhD
University of California – San Francisco
400 Parnassus Ave., Rm. A808
San Francisco, CA 94143-0112

Francisco A. Gutierrez, MD
201 E. Huron, Ste. 9-160
Chicago, IL 60611

Yoon Sun Hahn, MD
Univ. of Illinois-Chicago Coll. of Med.
912 S. Wood St./Neurosurg., 4th Fl. N.
Chicago, IL 60612-7325

Stephen J. Haines, MD
Univ. of Minnesota/Neurosurgery
420 Delaware St. S.E., MMC 96
Minneapolis, MN 55455

Mark G. Hamilton, MD
Alberta Children's Hospital
1820 Richmond Rd. S.W.
Calgary, AB T2T-5C7
Canada

Lonnie L. Hammargren, MD
3196 S. Maryland Pkwy., Ste. 106
Las Vegas, NV 89109-2312

Mary Kathryn Hammock, MD
8650 Sudley Rd., Ste. 309
Manassas, VA 20110-4416

Michael Hillel Handler, MD, FACS
1010 E. 19th Ave., Ste. 605 Tammen Hall
Denver, CO 80218-1034

William C. Hanigan, MD, PhD
University of Illinois at Peoria
719 N. William Kumpf Blvd., #100
Peoria, IL 61605

David Houston Harter, MD
New York Medical College
Munger Pavillion, Rm. 329
Valhalla, NY 10595

Michael D. Heafner, MD
Carolina Neurosurgery & Spine Assoc.
1010 Edgehill Rd. N.
Charlotte, NC 28207-1885

Michael A. Healy, MD
Neurosurgical Network Inc.
2222 Cherry St. Ste. MOB2
Toledo, OH 43608

Ian M. Heger, MD
Memorial Healthcare System/Neurosurg.
1150 N. 35th Ave., Ste. 300
Hollywood, FL 33021

Leslie C. Heilbusch, MD
Midwest Neurosurgery
8005 Farnam Dr., Ste. 305
Omaha, NE 68114-4441

Robert W. Hendee, Jr. MD
10709 Rigsbee Ct.
Austin, TX 78739

Martin M. Henegar, MD
Carolina Neurosurgery & Spine Associates
1010 Edgehill Rd. N.
Charlotte, NC 28207-1885

Thomas J. Holbrook, Jr. MD
720 Rabon Rd.
Columbia, SC 29203

Robert D. Hollenberg, MD
McMaster University
1200 Main St. W. Rm. 4E8
Hamilton, ON L8N-3Z5
Canada

Gregory W. Hornig, MD
Childrens Mercy Hosp./Neurosurgery
2401 Gillham Rd.
Kansas City, MO 64108

Roger J. Hudgins, MD
Pediatric Neurosurgery Associates
5455 Meridan Mark Rd., Ste. 540
Atlanta, GA 30342-1640

Stephen L. Huhn, MD
Stanford University Medical Center
300 Pasteur Dr., R203/Neurosurgery
Stanford, CA 94305-5327

Robin P. Humphreys, MD, FRCSC, FXX
67 Lyndhurst Ave.
Toronto, ON M5R 2Z8
Canada

Mark R. Iantosca, MD
Neurosurgeons of Central Connecticut
100 Retreat Ave., Ste. 705
Hartford, CT 06106

Bermans J. Iskandar, MD
University of Wisconsin – Madison
600 Highland Ave., K4/832
Madison, WI 53792

George I. Jallo, MD
Johns Hopkins Hosp./Pediatric Neurosurg.
600 N. Wolfe St., Harvey 811
Baltimore, MD 21287

Hector E. James, MD
Wolfson Childrens Hosp./Pavilion Bldg.
836 Prudential Dr., Ste. 1005
Jacksonville, FL 32207

John A. Jane Sr. MD, PhD
University of Virginia Health System
Box 800212/Neurosurgery
Charlottesville, VA 22908

David F. Jimenez, MD, FACS
University of Texas/Neurosurgery
7703 Floyd Curl Dr., Box 7843
San Antonio, TX 78229-3900

Dennis L. Johnson, MD
408 Elm Ave.
Hershey, PA 17033-1751

John K. Johnson, MD, FACS
Southeastern Neurosurgical & Spine Inst.
20 Medical Ridge Dr.
Greenville, SC 29605-5605

Mary M. Johnson, MD
3223 Chatham Rd.
Atlanta, GA 30305-1101

Martin Johnson, MD
31870 S.W. Country View Ln.
Wilsonville, OR 97070-7476

Robert F. C. Jones, MD
Sydney Children's Hospital
21 Norfolk St.
Paddington, NSW 2021
Australia

Allen S. Joseph, MD, FACS
10101 Park Rowe, Ste. 200
Baton Rouge, LA 70810

John E. Kalsbeck, MD
Riley Hospital for Children
702 Barnhill Dr.
Indianapolis, IN 46202-5200

Paul M. Kanev, MD
Baystate Med. Ctr./Neurosurgery
759 Chestnut St.
Springfield, MA 01199

Samuel S. Kasoff, MD
11 Sycamore Ln.
White Plains, NY 10605

Bruce A. Kaufman, MD, FACS
Children's Hospital of Wisconsin
9000 W. Wisconsin Ave., PO Box 1997
Milwaukee, WI 53201-1997

Robert F. Keating, MD
Children's National Med. Ctr.
111 Michigan Ave. N.W.
Washington, DC 20010

David L. Kelly, Jr. MD
Wake Forest University
Medical Center Dr./Neurosurgery
Winston-Salem, NC 27157-1029

John R. W. Kestle, MD
Primary Children's Medical Center
100 N. Medical Dr., Ste. 1475
Salt Lake City, UT 84113-1103

David M. Klein, MD
690 Fearrington Post
Pittsboro, NC 27312-8507

Laurence J. Kleiner, MD
Childrens Medical Center
One Childrens Plaza/Neurosurgery
Dayton, OH 45404-1815

David S. Knierim, MD
GED 4
9300 Valley Children's Pl.
Madera, CA 93638-8761

Edward J. Kosnik, MD
Columbus Children's Hospital
931 Chatham Ln.
Columbus, OH 43221-2417

Karl F. Kothbauer, MD
Kantonsspital Luzern
Div. of Neurosurgery/Dept. of Surgery
170 East End Ave
Luzern 6000
Switzerland

Mark D. Krieger, MD
1300 N. Vermont, Ste. 1006
Los Angeles, CA 90027

Cornelius H. Lam, MD
University of Minnesota
420 Delaware St. S.E., MC 96
Minneapolis, MN 55455-0374

John A. Lancon, MD
University of Mississippi Med. Ctr.
2500 N. State St.
Jackson, MS 39216

Mark Robert Lee, MD
Med. Coll. of Georgia/Neurosurgery
1120 15th St., BI 3088
Augusta, GA 30912-0004

Michael Lee Levy, MD, PhD, FAC
8010 Frost St., Ste. 502
San Diego, CA 92123

Veetai Li, MD
Children's Hospital of Buffalo
219 Bryant St./Neurosurgery
Buffalo, NY 14222-2006

Kenneth I. Lipow, MD
Connecticut Neurosurgical Specialists
267 Grant St.
Bridgeport, CT 06610-2805

Morris D. Loffman, MD
17173 Strawberry Dr.
Encino, CA 91436

Rafael Longo-Cordero, MD
Univ. Gardens
Calle Rochester 911
San Juan, PR 00927-4812

Ralph C. Loomis, MD
Mountain Neurological Ctr.
7 Vanderbilt Park Dr.
Asheville, NC 28803

Kenneth M. Louis, MD, FACS
3000 E. Fletcher Ave., #340
Tampa, FL 33613-4656

Mark G. Luciano, MD, PhD
Cleveland Clinic Foundation
9500 Euclid Ave. S80
Cleveland, OH 44195-0001

Thomas G. Luerssen, MD
Riley Hospital for Children
702 Barnhill Dr., Ste. 1730
Indianapolis, IN 46202-5200

Joseph R. Madsen, MD
Children's Hosp./Brigham & Womens Hosp.
300 Longwood Ave., Rm. 312
Boston, MA 02115-5724

Gail A. Magid, MD
241 Fourth Ave.
Santa Cruz, CA 95062-3815

Gary Magram, MD
Inova Children's Hospital
8505 Arlington Blvd. Ste. 100
Fairfax, VA 22031

Kim Herbert Manwaring, MD
Phoenix Children's Hospital
1919 E. Thomas Rd.
Phoenix, AZ 85016-7710

Timothy B. Mapstone, MD
Univ. of Oklahoma HSC/Neurosurgery
1000 N. Lincoln Blvd., Ste. 400
Oklahoma City, OK 73104

Arthur E. Marlin, MD
27240 Boerne Stage Rd.
Boerne, TX 78006

Todd A. Maugans, MD
Children's Medical Center
1 Children Plaza
Dayton, OH 45404

John R. Mawk, MD, JD
788 Ashland Ave.
St. Paul, MN 55104

James P. McAllister, PhD
WSU Sch. of Med./Neurosurgery
4201 St. Antoine UHC-6E
Detroit, MI 48201

David McAuley, MD
Mill Cottage
10 Mill Rd./Ballyknockan
Newtownards, EN BT236NG
United Kingdom

Jack E. McCallum, MD
1 Stevens Dr.
Benbrook, TX 76126

J. Gordon McComb, MD
University Children's Medical Group
1300 N. Vermont Ave., #1006
Los Angeles, CA 90027-6005

C. Scott McLanahan, MD
Carolina Neurosurgery & Spine Assoc.
1010 Edgehill Rd. N.
Charlotte, NC 28207-1885

Robert L. McLaurin, MD
2412 Ingleside Ave., Apt. 5C
Cincinnati, OH 45206-2185

David Gordon McLone, MD, PhD
Children's Memorial Hospital
2300 Children's Plaza, Ste. 28
Chicago, IL 60614-3318

Michael Dean Medlock, MD
4 Centennial Dr., 2nd Fl.
Peabody, MA 01960-7935

Hal S. Meltzer, MD
University of California – San Diego
200 W. Arbor Dr., Ste. 8893
San Diego, CA 92103-8893

Arnold H. Menezes, MD
University of Iowa Hospitals
200 Hawkins Dr./Neurosurgery
Iowa City, IA 52242-1009

Glenn A. Meyer, MD
Medical College of Wisconsin
9200 W. Wisconsin Ave.
Milwaukee, WI 53226-3522

W. Jost Michelsen, MD
330 Borthwick Ave., Ste. 108
Portsmouth, NH 03801

Thomas H. Milhorat, MD
North Shore University Hospital
300 Community Dr./Neurosurgery
Manhasset, NY 11030

John I. Miller, MD, FACS
544 E. 86th St., Ste. 6W
New York, NY 10028-7536

Mark A. Mittler, MD
Long Island Neurosurgical Associates
410 Lakeville Rd., Ste. 204
New Hyde Park, NY 11042-1103

Richard H. Mojel, MD
3656 Ella Lee Ln.
Houston, TX 77027-4105

Jose L. Montes, MD
Montreal Children's Hospital
2300 Tupper St., Rm. C819
Montreal, PQ H3H-1P3
Canada

German Montoya, MD
532 Virginia Dr.,
Orlando, FL 32803-1856

Leon E. Moores, MD, FACS
203 Kent Oaks Way
Gaithersburg, MD 20878-5614

Thomas M. Moriarty, MD, PhD
Kosiar Children's Hospital
210 E. Gray St., Ste. 1102
Louisville, KY 40202-3907

Michon Morita, MD
1380 Lusitana St., Ste. 712
Honolulu, HI 96813

William Joseph Morris, MD
915 6th Ave., Ste. 2
Tacoma, WA 98405-4662

Glenn Morrison, MD
Miami Children's Hospital
3200 S.W. 60 Ct., Ste. 301
Miami, FL 33155-4071

S. David Moss, MD
Phoenix Children's Hospital
1919 E. Thomas Rd.
Phoenix, AZ 85016-7710

Michael S. Muhlbauer, MD
Semmes Murphey Clinic
6325 Humphreys Blvd.
Memphis, TN 38120-2300

Michael G. Muhonen, MD
455 S. Main St.
Orange, CA 92868-3835

Karin M. Muraszko, MD
1878 Snowberry Ridge Rd.
Ann Arbor, MI 48103

Awni F. Musharbash, MD
PO Box 910262
Amman 11191
Jordan

Cheryl A. Muszynski, MD, FACS
Children's Hospital of Wisconsin
9000 W. Wisconsin Ave., Ste. 405
Milwaukee, WI 53201-1997

S. Terence Myles, MD
Foothills Medical Centre
1403-29 St. N.W., 12th Fl.
Calgary, AB T2N-2T9
Canada

John S. Myseros, MD, FACS
Children's National Med. Ctr.
111 Michigan Ave. N.W.
Washington, DC 20010

Joseph M. Nadell, MD
Children's Hospital
200 Henry Clay Ave.
New Orleans, LA 70118-5720

Mahmoud G. Nagib, MD
305 Piper Bldg., 800 E. 28th St.
Minneapolis, MN 55407-3799

Michael F. Nido, PA-C
Carolina Neurosurgery & Spine Assoc.
1010 Edgehill Rd. N.
Charlotte, NC 28207-1885

W. Jerry Oakes, MD
Children's Hospital of Alabama
1600 7th Ave. S. ACC 400
Birmingham, AL 35233-1711

Mark Stephen O'Brien, MD
Arkansas Children's Hospital
800 Marshall St., Slot 838
Little Rock, AR 72202

Jeffrey G. Ojemann, MD
UW/Children's Hosp. & Regional Med.
4800 Sand Point Way N.E.
Seattle, WA 98105

Miguel A. Pagan, PA-C
19136 Cypress View Dr
Fort Myers, FL 33912-4825

Larry Keith Page, MD
13845 S.W. 73rd Ct.
Miami, FL 33158

Dachling Pang, MD
Kaiser Permanente Hospital
280 W. MacArthur Blvd./Ped. Neurosurgery
Oakland, CA 94611

Andrew D. Parent, MD
University of Mississippi Medical Center
2500 N. State St.
Jackson, MS 39216-4500

Tae Sung Park, MD
St. Louis Children's Hospital
1 Children's Pl., Ste. 4S20
St. Louis, MO 63110-1002

Michael David Partington, MD, FACS, FA
Gillette Children's Specialty Healthcare
200 E. University Ave.
St. Paul, MN 55101

Jogi Venkata Pattisapu, MD
Pediatric Neurosurgery PA
58 W. Michigan St.
Orlando, FL 32806-2037

Jerry O. Penix, MD
928 Holladay Point
Virginia Beach, VA 23451

Joseph A. Petronio, MD
Gillette Children's Specialty Healthcare
200 E. University Ave.
St. Paul, MN 55101

Joseph H. Piatt, Jr. MD
St. Christopher's Hosp. for Children
Erie Ave. at Front St.
Philadelphia, PA 19134-1095

Prem K. Pillay, MBBS FACS
Asian Brain-Spine-Nerve Center
3 Mt. Elizabeth #15-03
Singapore 228510
Singapore

Thomas Pittman, MD
Univ. of Kentucky Med. Ctr.
800 Rose St. Rm. MS105-A
800 Rose Street
Lexington, KY 40536

Ian F. Pollack, MD
Children's Hospital of Pittsburgh
3705 5th Ave./Neurosurgery
Pittsburgh, PA 15213-2524

Harold D. Portnoy, MD
Michigan Head & Spine PLLC
44555 Woodward Ave., Ste. 506
Pontiac, MI 48341-2982

Mark R. Proctor, MD
Childrens Hospital
300 Longwood Ave., Bader 3
Boston, MA 02115-5724

Joseph V. Queenan, MD
Hahnemann Univ. Hosp./Neurosurgery
Broad & Vine St., MS407/New College Bldg.
Philadelphia, PA 19107

Corey Raffel, MD, PhD
Dept. of Neurosurgery E6B
200 First St. S.W.
Rochester, MN 55905-0001

John Ragheb, MD
Miami Children's Hosp./
Pediatric Neurosurgery
3200 S.W. 60th Ct., Ste. 301
Miami, FL 33136-2104

Mahmoud Rashidi, MD
2601 Oswell St. Ste., 101
Bakersfield, CA 93306

Donald H. Reigel, MD
4222 Corton Ct.
Allison Park, PA 15101-2788

Harold Louis Rekate, MD
Barrow Neurological Institute
2910 N. 3rd Ave.
Phoenix, AZ 85013-4434

Theodore S. Roberts, MD
Children's Hospital Medical Center
4820 Sand Point Way N.E., CH-50
Seattle, WA 98105

Shenandoah Robinson, MD
Rainbow Babies & Children's Hospital
11100 Euclid Ave., RBC B501
Cleveland, OH 44106-1736

Walker L. Robinson, MD
Carle Clinic & Foundation Hosp.
602 W. University Ave.
Urbana, IL 61801

Luis A. Rodriguez, MD
Memorial Healthcare
1150 N. 35th Ave., Ste. 300
Hollywood, FL 33021-5424

Bruce R. Rosenblum, MD
Riverview Medical Center
160 Ave. at The Commons
Shrewsbury, NJ 07702-4802

Alan Rosenthal, MD
7840 Talavera Pl.
Delray Beach, FL 33446

Allen S. Rothman, MD, FACS
175 Memorial Hwy.
New Rochelle, NY 10801-5640

Curtis J. Rozzelle, MD
219 Bryant St.
Buffalo, NY 14222

Catherine A. Ruebenacker-Mazzola, MD
99 Powder Hill Rd.
Montvale, NJ 07645-1017

John R. Ruge, MD, FACS
630 S. Oak St.
Hinsdale, IL 60521-4634

James T. Rutka, MD, PhD, FRC
Hospital for Sick Children
555 University Ave. #1504
Toronto, ON M5G-1X8
Canada

Petr O. Ruzicka, MD
314 Hobart Ave.
Short Hills, NJ 07078

Robert A. Sanford, MD
Semmes Murphey Clinic
6325 Humphreys Blvd.
Memphis, TN 38120

Osamu Sato, MD
1-5-40 Tamagawa Gakuen
Machida
Tokyo 1940041
Japan

Guy M. Sava, MD
ISJ Clinic-Mayo Hlth. System
129 Bartholomew Dr.
Mankato, MN 56001

Steven J. Schiff, MD, PhD
George Mason University
Krasnow Institute MS-2A1
Fairfax, VA 22030-4444

Steven J. Schneider, MD, FACS
Long Island Neurosurgical Associates
410 Lakeville Rd., Ste. 204
New Hyde Park, NY 11042-1101

R. Michael Scott, MD
The Children's Hosp. Boston
300 Longwood Ave. Bader 319
Boston, MA 02115-5724

Nathan R. Selden, MD, PhD, FAC
Oregon Health & Science Univ./L-472
3181 SW Sam Jackson Park Rd.
Portland, OR 97239-3098

Wan Tew Seow, MD
KK Women's & Children's Hospital
100 Bukit Timah Rd.
Singapore 229899
Singapore

Ronald F. Shallat, MD
33 Evergreen Dr.
Orinda, CA 94563

Kenneth N. Shapiro, MD
Neurosurgeons for Children
1935 Motor St. 3rd FL
Dallas, TX 75235

John Shillito, MD
102 Cedar Meadows Ln.
Chapel Hill, NC 27517

Howard J. Silberstein, MD
1445 Portland Ave., Ste. 305
Rochester, NY 14621-3008

James C. Simmons, MD
190 Grove Park Rd.
Memphis, TN 38117

Gary Robert Simonds, MD
6411 Fairway Forest Dr.
Roanoke, VA 24018-7445

Frederick H. Sklar, MD
Neurosurgeons for Children
1935 Motor St.
Dallas, TX 75235-7701

Lenwood P. Smith, Jr., MD
Palmetto Neurosurgery & Spine
3 Medical Park Rd., Ste. 310
Columbia, SC 29203-6873

Harold P. Smith, MD
300 20th Ave. N., Ste. 106
Nashville, TN 37203-2131

Jodi L. Smith, MD, PhD
Riley Hospital for Children
One Children's Sq., Ste. 1730, #2510
Indianapolis, IN 46202-5200

Matthew D. Smyth, MD
St. Louis Children's Hospital
One Children's Pl.
St. Louis, MO 63110

Sandeep Sood, MD
Pediatric Neurosurgery Group PC
3901 Beaubien 2nd Fl.
Detroit, MI 48201

Mark M. Souweidane, MD
Dept. Neurological Surgery
525 E. 68th St.
New York, NY 10021-9800

Phillip G. St. Louis, MD
532 Virginia Dr.,
Orlando, FL 32803-1856

Sherman Charles Stein, MD
310 Spruce St.
Philadelphia, PA 19106-4201

Paul Steinbok, MD
British Columbia Children's Hosp.
4480 Oak St., Rm. K3-159
Vancouver, BC V6H-3V4
Canada

Bruce B. Storrs, MD, FACS, FA
4521 W. Azeele St.
Tampa, FL 33609-2554

Douglas L. Stringer, MD
2011 N. Harrison Ave.
Panama City, FL 32405-4545

Merle Preston Stringer, MD
2011 N. Harrison Ave.
Panama City, FL 32405-4545

Michael H. Sukoff, MD
17602 E. 17th St., Ste. 102-118
Tustin, CA 92780

Peter P. Sun, MD
Children's Hospital of Oakland
744 52nd St./Neurosurgery
Oakland, CA 94609-1810

Anthony F. Susen, MD
193 Old Glebe Point Rd.
Burgess, VA 22432-2006

Leslie N. Sutton, MD
Children's Hospital of Philadelphia
34th & Civic Center Blvd.
Philadelphia, PA 19104

Dale M. Swift, MD
Neurosurgeons for Children
1935 Motor St. 3rd Fl.
Dallas, TX 75235-7701

Michael S. Taekman, MD
15 Oakmont Ct.
San Rafael, CA 94901-1235

Tadanori Tomita, MD
Children's Memorial Hospital
2300 Children's Plaza, Ste. 28
Chicago, IL 60614-3363

Eric R. Trumble, MD
22 Lake Beauty Dr., Ste. 204
Orlando, FL 32806

Gerald F. Tuite, Jr., MD
Ste. 428 CSB/PO Box 250616
96 Jonathan Lucas St.
Charleston, SC 29425

Noel Tulipan, MD
8533 McCrory Ln.
Nashville, TN 37221-5905

Michael S. Turner, MD
Indianapolis Neurosurgical Group
1801 N. Senate Blvd. Ste. 535
Indianapolis, IN 46202-1228

David D. Udehn, MD
4350 7th St., Unit E
Moline, IL 61265-6870

Ronald H. Uscinski, MD
18111 Prince Philip Dr., #310
Olney, MD 20832

Michael Vassilyadi, MD
Children's Hospital East Ontario
401 Smyth Rd.
Ottawa, ON K1H-8L1
Canada

Joan L. Venes, MD
124643 Camelia Way
Auburn, CA 95602-8268

Enrique C. Ventureyra, MD
Children's Hospital East Ontario
401 Smyth Rd.
Ottawa, ON K1H-8L1
Canada

John Kenric Vries, MD
Pediatric Neuro. Children's Hosp. of Pittsburgh
125 DeSoto
Pittsburgh, PA 15213

Steven L. Wald, MD
97 Grove Ln.
Shelburne, VT 05482

John B. Waldman, MD
Albany Medical College
47 New Scotland Ave. MC-61 NE
Albany, NY 12208

Marion L. Walker, MD
Primary Children's Medical Center
100 N. Medical Dr., Ste. 2400
Salt Lake City, UT 84113-1103

John Wilson Walsh, MD, Ph
Tulane University School of Medicine
1430 Tulane Ave. SL47
New Orleans, LA 70112

John D. Ward, MD
Medical College of Virginia
Box 980631, MCV Station
Richmond, VA 23298

Daryl E. Warder, MD, PhD
Prevea Clinic
900 S. Webster Ave., PO Box 19070
Green Bay, WI 54307

Howard L. Weiner, MD
New York University Medical Center
317 E. 34th St., #1002
New York, NY 10016-4974

Martin H. Weiss, MD, FACS
LAC-USC Medical Center
1200 N. State St., Ste. 5046
Los Angeles, CA 90033-1029

Bradley E. Weprin, MD
Neurosurgeons for Children
1935 Motor St., 3rd Fl.
Dallas, TX 75235-7701

Jean K. Wickersham, MD
3030 Children's Way, Ste. 402
San Diego, CA 92123-4228

Philip J. A. Willman, MD
5325 Greenbriar Dr.
Corpus Christi, TX 78413

Ronald J. Wilson, MD
400 W. 15th St., Ste. 800
Austin, TX 78701

Joel W. Winer, MD
York Neurosurgical Associates PC
2319 S. George St.
York, PA 17403-5009

Jeffrey A. Winfield, MD, PhD
1000 E. Genesee St., Ste. 602
Syracuse, NY 13210

Ken R. Winston, MD
1056 E. 19th Ave., Box B330
Denver, CO 80218-1007

Jeffrey H. Wisoff, MD
New York University Medical Center
317 E. 34th St., #1002
New York, NY 10016-6402

Daniel Won, MD
11780 Pecan Way
Loma Linda, CA 92354-3452

Meredith V. Woodward, MD
Valley Children's Hospital
9300 Valley Children's Pl.
Madera, CA 93638-8761

Shokei Yamada, MD
5410 Via San Jacinto
Riverside, CA 92506

Karol Zakalik, MD
William Beaumont Hospital
3535 W. 13 Mile Rd., Ste. 504
Royal Oak, MI 48073-6710

Ahmad Zakeri, MD
4235 Secor Rd.
Toledo, OH 43623-4231

Edward J. Zampella, MD
Atlantic Neurosurgical Specialists
310 Madison Ave., Ste. 200
Morristown, NJ 07960

Luis Manuel Zavala, MD
555 Mowry Ave., Ste. A-B
Fremont, CA 94536-4101

John G. Zovickian, MD
104 Requa Rd.
Piedmont, CA

NAME _____

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

NURSES' SEMINAR

Session Details:

RATING SCALE: Excellent — Average — Poor

1. Overall, this course was valuable.	A	B	C	D	E
2. Overall, the quality of the Nurses' Seminar was:	A	B	C	D	E
3. The faculty allowed enough time for questions/discussion.	A	B	C	D	E
4. The quality of the presentation of papers was:	A	B	C	D	E
5. Did you find the materials presented were at the right level for your need in practice?	A	B	C	D	E

6. Should this session be offered at future meetings? YES NO

7. What did you learn in this seminar that you will apply to your practice?

_____

_____

_____

8. Overall, how could this session be improved?

_____

_____

9. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

_____

_____

COMMENTS – 2005 Nurses' Seminar:

_____

_____

PLEASE TURN IN EVALUATION FORMS TO YOUR INSTRUCTOR

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION I: CRANIOSYNOSTOSIS

Session Details:

	RATING SCALE Excellent		Average		Poor
1. Because of the course I am able to:					
a. Appraise new proposed craniosynostosis procedures, including late vault remodeling and minimally invasive procedures.	A	B	C	D	E
b. Describe technical and methodological challenges in evaluating late effects of craniosynostosis surgery.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION II: CONGENITAL ANOMALIES

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Appraise new observations in the pathophysiology of Chiari malformations and tethered spinal cord.	A	B	C	D	E
b. Compare observations in animal models of congenital CNS anomalies with the human syndromes.	A	B	C	D	E
c. Discuss advances in radiographic and electrophysiological guidance in tethered spinal cord surgery.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION III – TUMORS

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Describe new proposed methods of delivery of chemotherapeutic agents to CNS tumors.	A	B	C	D	E
b. Relate preoperative radiographic findings of pediatric brain tumors to long term outcome.	A	B	C	D	E
c. Review techniques of novel gene discovery in pediatric brain tumors.	A	B	C	D	E
d. Formulate the role of preresection chemotherapy in selected brain tumors.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION IV: TUMORS

Session Details:

	RATING SCALE Excellent		Average		Poor
1. Because of the course I am able to:					
a. Estimate the value of intraoperative MRI and new techniques of functional mapping on pediatric brain tumor therapy.	A	B	C	D	E
b. Contrast interstitial delivery of monoclonal antibodies into tumors with polymer release of molecular constituents.	A	B	C	D	E
c. Discuss the major morbidities of craniopharyngioma Resection inlong term follow-up.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION V – VARIOUS TECHNICAL TOPICS

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Discuss criteria for diagnosis and technical advances in tethered cord syndrome surgery.	A	B	C	D	E
b. Quantify the value of incidental tumor discovery after trauma in predicting outcome.	A	B	C	D	E
c. Review the value of vagal nerve stimulation in autism.	A	B	C	D	E
d. List pros and cons of early surgery for leptomeningeal cysts.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION VII: FUNCTIONAL/MISCELLANEOUS

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Compare outcomes in surgical resection of temporal seizure foci, corpus callosotomy, and vagal nerve stimulation.	A	B	C	D	E
b. Relate the advantages of navigation techniques in seizure surgery.	A	B	C	D	E
c. Indicate potential roles of nanotechnology, including quantum dots, in neurosurgery.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION VIII: MISCELLANEOUS

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Discuss challenges of bringing new technologies such as coated shunts and scanning laser ophthalmoscopy to clinical use.	A	B	C	D	E
b. Describe recent advances in surgery for stroke and ischemia in arterial and venous disease.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION IX: HYDROCEPHALUS SYMPOSIUM

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Describe the pitfalls of large scale outcomes studies in hydrocephalus.	A	B	C	D	E
b. Identify several questionable assumptions made by clinicians in routine care of patients with hydrocephalus.	A	B	C	D	E
c. Contrast the impetus for innovation in impoverished areas of the world with wealthy industrialized states.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

SCIENTIFIC SESSION X: HYDROCEPHALUS

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Classify potential drug-impregnated catheter devices in shunt function.	A	B	C	D	E
b. Identify a growth factor whose overexpression may cause hydrocephalus.	A	B	C	D	E
c. Appraise the effect of endoscopic ventriculoscopy and adjustable valves on the clinical treatment of hydrocephalus.	A	B	C	D	E
2. Topic addressed completely.	A	B	C	D	E
3. Content relevant to my practice.	A	B	C	D	E
4. Sufficient opportunity for questions/discussion.	A	B	C	D	E

5. What did you learn in this seminar that you will apply to your practice?

6. Overall, how could this session be improved?

7. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NAME

Your response and comments to the following questions are needed to assist the Annual Meeting Committee in developing future programs. Your time and effort in completing this evaluation form is appreciated.

RAIMONDI LECTURE EVALUATION

Session Details:

	RATING SCALE				
	Excellent		Average		Poor
1. Because of the course I am able to:					
a. Enumerate the leadership and scientific approach characteristics which accelerated early exploration of Antarctica.	A	B	C	D	E
b. Discuss aspects of the Arctic ecosystem suggesting an importance for biodiversity in the discovery of future pharmaceutical agents.	A	B	C	D	E

PLEASE TURN IN EVALUATION FORMS IN EVALUATION DROP BOXES

NOTES

NOTES