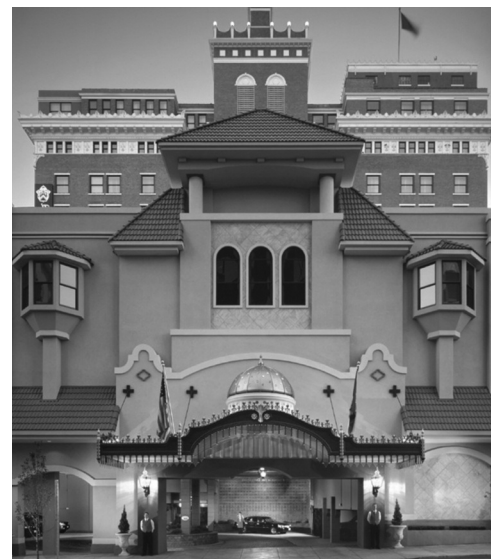


2008 PROGRAM BOOK

37th Annual Meeting of the AANS/CNS Section on Pediatric Neurological Surgery

DECEMBER 2-5, 2008

The Davenport Hotel, Spokane, Washington



Jointly Sponsored by the AANS



American
Association of
Neurological
Surgeons



AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY

December 2 - 5, 2008, Spokane, Washington

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

The AANS designates this educational activity for a maximum of 23.75 *AMA PRA Category 1 Credits™*. Physicians should only claim credit commensurate with the extent of their participation in the educational activity.

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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 AANS, or its Committees, Commissions or Affiliates.

ANNUAL MEETING LEARNING OBJECTIVES

Upon completion of this CME activity, participants should be able to:

- 1) Discuss current and new trends in the management of congenital anomalies such as craniosynostosis, spina bifida and the tethered spinal cord
- 2) Express a new awareness of the nature and management of hydrocephalus
- 3) Express a new and current awareness of pediatric neurotrauma and its management
- 4) Express a new and current awareness of pediatric brain tumors and their management
- 5) Explain new and current techniques in functional neurosurgery for epilepsy and disorders of movement

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Again this year, attendees will self-report CME credit for the programs they attend by going online to MyAANS.org from any computer with internet service. Please have your MyAANS.org username [e-mail address] and password handy during and after the meeting for convenient completion and submission.

Do not self-report CME credit for the optional pre- and post-meeting ticketed events. By turning in your tickets onsite, credit will automatically be added to your record in MyAANS.org.

PEDS

**FUTURE MEETING SITE
2009 BOSTON**



ANNUAL MEETING SITES

1972 Cincinnati

1973 Columbus

1974 Los Angeles

1975 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 Orlando

2006 Denver

2007 South Beach (Miami)

2008 Spokane

JOINT SECTION OF PEDIATRIC NEUROLOGICAL SURGERY

OFFICERS AND COMMITTEES

Pediatric Section Chairs

1972-73	Robert L. McLaurin	1987-89	David G. McLone
1973-74	M. Peter Sayers	1989-91	Donald H. Reigel
1974-75	Frank Anderson	1991-93	R. Michael Scott
1975-76	Kenneth Shulman	1993-95	Arthur Marlin
1976-77	E. Bruce Hendrick	1995-97	Harold L. Rekate
1977-78	Frank Nulsen	1997-99	Marion L. Walker
1978-79	Luis Schut	1999-01	John P. Laurent
1979-81	Fred J. Epstein	2001-03	Thomas G. Luerksen
1981-83	Joan L. Venes	2003-05	Andrew D. Parent
1983-85	Harold J. Hoffman	2005-07	Rick Abbott
1985-87	William R. Cheek	2007-09	Jeffrey H. Wisoff

Officers

Chair	Jeffrey H. Wisoff, MD (2007-2009)
Chair-Elect	Ann-Christine Duhaime, MD (2007-2009)
Secretary	Alan R. Cohen, MD, FACS (2007-2009)
Treasurer	Bruce A. Kaufman, MD, FACS (2007-2009)
Membership Chair	John R.W. Kestle, MD (2004-2008)
Past Chair	Rick Abbott, MD (2005-2007)
Members at Large	Nalin Gupta, MD, PhD (2006-2008) Jeffrey P. Blount, MD, FACS (2006-2008) Thomas Pittman, MD (2007-2009) John R. W. Kestle, MD (2007-2009) James M. Drake, MD (2008-2010) Michael H. Handler, MD, FACS (2008-2010)

Standing Committees

Nominating Committee	Rick Abbott, MD (Chair) 2007 Andrew D. Parent, MD (Chair) 2005 Thomas G. Luerksen, MD 2003
Rules and Regulations Committee: (3 members serving 2 years)	Nathan Selden, MD, PhD, Chair (2004-2009) John Wellons III, MD (2008-2010) Elizabeth Tyler-Kabara, MD, PhD (2008-2010)
Membership Committee: (3 members serving 2 years)	Mark R. Proctor, MD, Chair (2007-2009) Robin M. Bowman, MD (2008-2010) David H. Harter, MD (2008-2010)

Ad Hoc Committees

Education Committee	Paul Steinbok, MD, Chair (2006)
Program and Continuing Medical Education Subcommittee	Sarah J. Gaskill, MD, FACS, Chair (2007) Mark D. Krieger, MD, Vice Chair (2007) John Ragheb, MD, FACS (Miami 2007) David P. Gruber, MD (Spokane, 2008) Liliana C. Goumnerova, MD, FRCS(C) (Boston, 2009)
ISPN Liaison	George I. Jallo, MD (2006)
ASPEN Liaison	Liliana C. Goumnerova, MD, FRCS(C) (2006)
Liaison to AAP Section of Neurological Surgery (SONS)	Joseph H. Piatt Jr., MD (2006)

Examination Questions Subcommittee	Corey Raffel, MD, PhD (2006)
Publications Subcommittee	Douglas L. Brockmeyer, MD (2006)
Neurosurgery On-Call Subcommittee	Jeffrey P. Blount, MD, FACS (2006) Nalin Gupta, MD, PhD (2006)
Training Subcommittee	Jeffrey P. Blount, MD, FACS (2006)
Traveling Fellowship	R. Michael Scott, MD, Chair Ken R. Winston II, MD Alan R. Cohen, MD, FACS
Lifetime Achievement Award	Rick Abbott, MD (2007)
Transition of Care Committee	Harold L. Rekate, MD, Chair (2007)
Research Committee	John R. W. Kestle, MD, Chair (2007) Nalin Gupta, MD, PhD Ann-Christine Duhaime, MD
Publications Committee	Douglas L. Brockmeyer, MD, Chair (2006) Richard C.E. Anderson, MD (2008-2010) Jeffrey R. Leonard, MD (2008-2010) Ann M. Ritter, MD (2008-2010) Peter P. Sun, MD (2008-2010)

Representatives and Liaisons

American Academy of Pediatrics	Joseph H. Piatt Jr. MD (1997)
Joint Council of State Neurosurgical Societies	Michael D. Heafner, MD (1999)
Quality Assurance Committee	Paul A. Grabb, MD (1999) Sarah J. Gaskill, MD, FACS (1999) James M. Drake, MD (1999)
Washington Committee, AANS/CNS	Rick Abbott, MD (2007)
Coding and Reimbursement Committee	Frederick A. Boop, MD, FACS (2004) David P. Gruber, MD (2006)
Education and Practice Management Committee, AANS	Sarah J. Gaskill, MD, FACS (2006)
Liaison Committee, International Society for Pediatric Neurosurgery	George I. Jallo, MD (2006)
Devices and Technology Committee, AANS	Shenandoah Robinson, MD (2008)
Joint Guidelines Committee	John Ragheb, MD, FACS, Chair (2007-2009) Ann Marie Flannery, MD, FACS (2008-2010) Benjamin C. Warf, MD (2008-2010) Sarah J. Gaskill, MD (2008-2010)
Annual Meeting Chair	David P. Gruber, MD
Future Annual Meeting Chair 2009	Liliana C. Goumnerova, MD, FRCS(C)
Abstract Grading Committee	Sarah J. Gaskill, MD, FACS Liliana C. Goumnerova, MD, FRCS(C) David P. Gruber, MD Bruce Kaufman, MD, FACS Mark Krieger, MD Mark Proctor, MD John Ragheb, MD, FACS Jeffrey H. Wisoff, MD

2008 RAIMONDI LECTURER



Renée R. Jenkins, MD, FAAP is a professor and immediate past department chair in the Department of Pediatrics and Child Health at Howard University and an adjunct professor of Pediatrics at George Washington University, both in Washington, D.C.

Dr. Jenkins graduated from Wayne State University School of Medicine and completed her residency at Albert Einstein College of Medicine, Jacobi Hospital in New York City. After completing her fellowship in Adolescent Medicine at Montefiore Hospital, Dr. Jenkins started an adolescent medicine program at Howard University. In 1994, Dr. Jenkins was appointed department chair of Pediatrics, serving in this capacity until March 2007. She is currently the principal investigator at Howard for the DC-Baltimore Research Center on Child Health Disparities in collaboration with Children's National Medical Center and Johns Hopkins University Pediatrics Department, Primary Care Division.

Dr. Jenkins was appointed president of the American Academy of Pediatrics at the 2007 annual meeting. As a member of the AAP, Dr. Jenkins has served on numerous AAP task forces and committees.

She is a member of the American Pediatric Society, Ambulatory Pediatric Association and the Institute of Medicine (IOM), having served on the IOM Board on Children, Youth and Families. In D.C., Dr. Jenkins and colleagues founded the Center for Youth Services and she chaired the Mayor's Committee on Teen Pregnancy Prevention.

Dr. Jenkins' research focuses on adolescent pregnancy prevention. Her publications and presentations range from adolescent health and sexuality to violence prevention and health issues of minority children. She has been the primary author of the adolescent section of *Nelson's Textbook of Medicine* for the last three editions and she lectures throughout the United States and abroad.

Dr. Jenkins will deliver the Raimondi Lecture on Thursday, December 4 from 10:30 AM – 12:00 PM.

RAIMONDI LECTURERS

- | | |
|----------------------------|-------------------------------|
| 1978 E. Bruce Hendrick | 1994 Blaise F.D. Bourgeois |
| 1979 Paul C. Bucy | 1995 Robert H. Pudenz |
| 1980 Floyd Gilles | 1996 Samuel S. Flint |
| 1981 Panel Discussion | 1997 M. Michael Cohen, Jr. |
| 1982 Panel Discussion | 1998 Robert A. Zimmerman |
| 1983 Derek Harwood-Nash | 1999 David B. Schurtleff |
| 1984 Anthony E. Gallo, Jr. | 2000 Steve Berman |
| 1985 Frank Nulsen | 2001 Alejandro Berenstein |
| 1986 William F. Meacham | 2002 Volker K.H. Sonntag |
| 1987 Dale Johnson | 2003 Jon Huntsman |
| 1988 Joseph J. Volpe | 2004 J. Michael Bishop |
| 1989 Martin Eichelberger | 2005 James B. McClintock, PhD |
| 1990 George R. Leopold | 2006 Richard D. Lamm |
| 1991 Judah Folkman | 2007 Roberto C. Heros |
| 1992 Olof Flodmark | 2008 Renée Jenkins |
| 1993 Maurice Albin | |

MATSON MEMORIAL LECTURERS

- | | |
|--------------------------|--|
| 1987 John Shillito | 2000 Postponed due to illness |
| 1988 E. Bruce Hendrick | 2001 Donald H. Reigel |
| 1989 Martin P. Sayers | 2002 David McLone |
| 1990 Roger Guillemin | 2003 Robin P. Humphreys |
| 1991 Robert L. McLaurin | 2004 A. Leland Albright |
| 1992 Joseph Murray | 2005 Joan L. Venes |
| 1993 Eben Alexander, Jr. | 2006 James P. McAllister,
James M. Drake, |
| 1994 Joseph Ranschoff | Joseph R. Madsen,
Edward H. Oldfield |
| 1995 John Holter | |
| 1996 None | |
| 1997 Maurice Choux | 2007 Harold L. ReKate |
| 1998 Lisa Shut | |
| 1999 Gary C. Schoenwolf | |



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 Hematoma 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. MEADOW**
The Permeable Proximal Catheter Project: A Novel Approach to Preventing Shunt Obstruction
- 2005 DAVID CORY ADAMSON**
Digital Karotyping Identifies a Novel Retinoblastoma Oncogene
- 2006 ELIAS B. RIZK, MD**
Folate Receptor Function is Essential in CNS Recovery after Injury: Evidence in Knockout Mice
- 2007 JEFFREY P. GREENFIELD, MD, PhD**
A Stem Cell Based Infiltrative Model of Pontine Glioma

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 NESHOR 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 Ventriculoperitoneal 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, MD, PhD

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

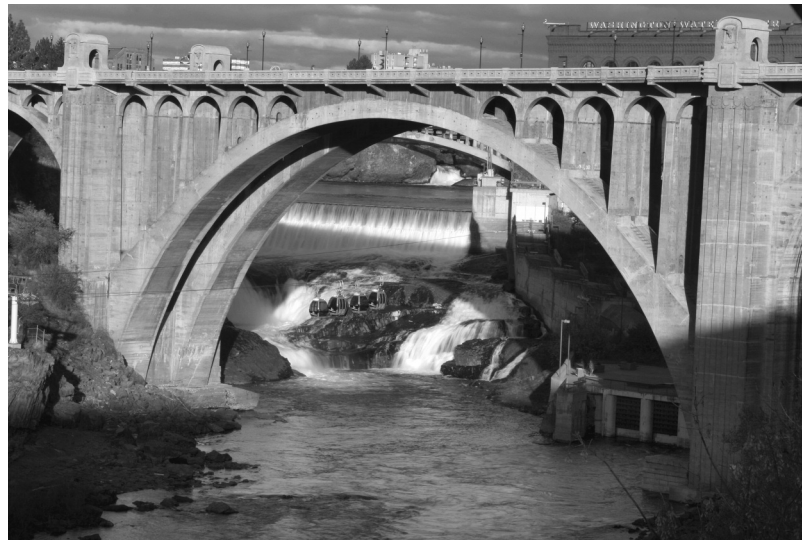
2005 JEFFREY P. GREENFIELD

Intraoperative Assessment of Third Ventriculostomy Success

2006 KURTIS I. AUGUSTE

Greatly Impaired Migration of Aquaporin-4 Deficient Astroglial Cells After Implantation into Mouse Brain

2007 No Prize Awarded



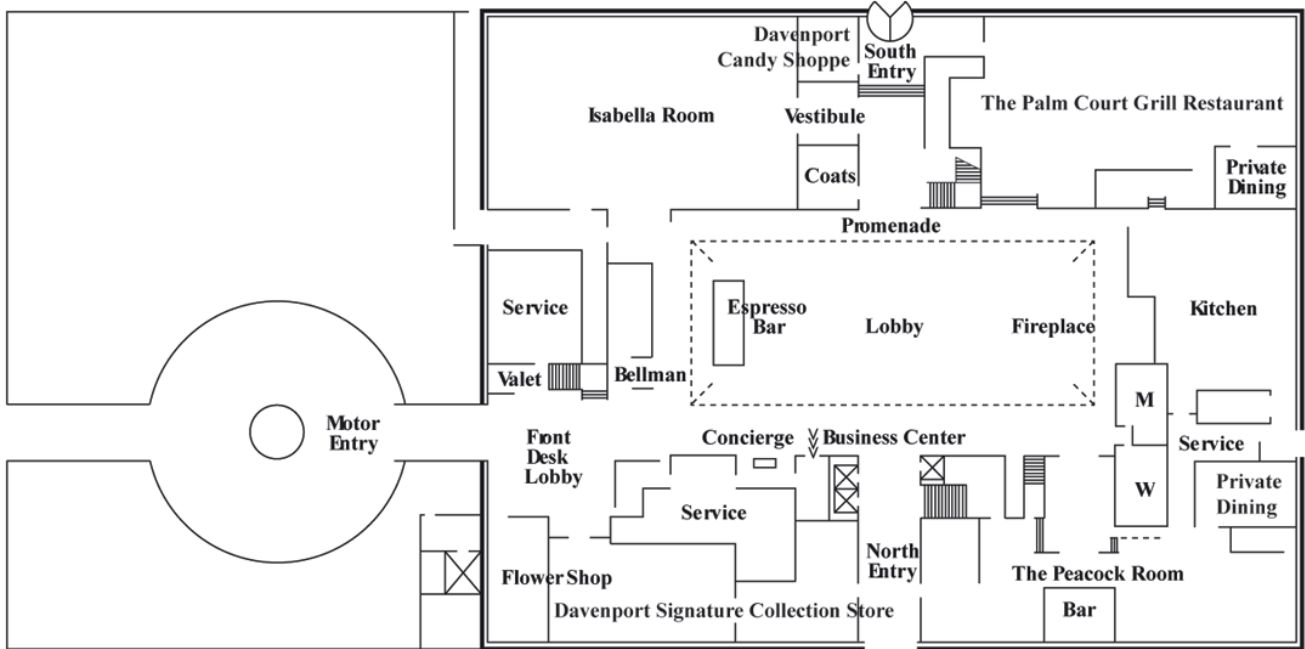
PROGRAM AT-A-GLANCE

	TIME	EVENT	LOCATION
TUESDAY December 2	7:00 AM – 7:00 PM	Registration	Elizabethan Room Foyer
	8:00 AM – 4:30 PM	Pre-Meeting Nurses' Seminar	Earlybird Room
	6:30 – 8:00 PM	Opening Reception	Isabella Ballroom
WEDNESDAY December 3	7:00 AM – 5:30 PM	Registration	Elizabethan Room Foyer
	7:00 – 8:00 AM	Continental Breakfast	Flowerfield Room
	7:00 AM – 5:00 PM	Poster Viewing	Flowerfield Room
	7:50 AM – 12:00 PM	Scientific Sessions	Marie Antoinette Ballroom
	9:00 AM – 5:30 PM	Exhibits	Pennington Ballroom and the Hall of Doges
	10:00 – 10:30 AM	Beverage Break in Exhibit Halls	Pennington Ballroom and the Hall of Doges
	12:00 – 1:00 PM	Lunch in Exhibit Hall	Pennington Ballroom and the Hall of Doges
	1:00 – 4:30 PM	Scientific Sessions	Marie Antoinette Ballroom
	2:30 – 3:00 PM	Beverage Break in Exhibit Halls	Pennington Ballroom and the Hall of Doges
	4:30 – 5:30 PM	Wine & Cheese Reception in Exh. Halls	Pennington Ballroom and the Hall of Doges
THURSDAY December 4	7:00 AM - 5:30 PM	Registration	Elizabethan Room Foyer
	7:00 – 8:00 AM	Continental Breakfast	Flowerfield Room
	7:00 AM – 5:00 PM	Poster Viewing	Flowerfield Room
	8:00 AM – 12:00 PM	Scientific Sessions	Marie Antoinette Ballroom
	9:00 AM – 4:00 PM	Exhibits	Pennington Ballroom and the Hall of Doges
	10:00 – 10:30 AM	Beverage Break in Exhibit Halls	Pennington Ballroom and the Hall of Doges
	12:00 – 1:00 PM	Lunch in Exhibit Hall	Pennington Ballroom and the Hall of Doges
	1:00 – 5:00 PM	Scientific Sessions	Marie Antoinette Ballroom
	2:30 – 3:00 PM	Beverage Break in Exhibit Halls	Pennington Ballroom and the Hall of Doges
	5:00 – 5:30 PM	Business Meeting	Marie Antoinette Ballroom
FRIDAY December 5	7:00 AM – 12:00 PM	Registration	Elizabethan Room Foyer
	7:00 – 8:00 AM	Continental Breakfast in Exhibit Halls	Pennington Ballroom and the Hall of Doges
	7:00 – 10:30 AM	Exhibits	Pennington Ballroom and the Hall of Doges
	7:00 – 12:00 PM	Poster Viewing	Flowerfield Room
	8:00 AM – 12:00 PM	Scientific Sessions	Marie Antoinette Ballroom
	10:00 – 10:30 AM	Beverage Break in Exhibit Halls	Pennington Ballroom and the Hall of Doges

NOTE: All dates, times and room locations are subject to change.

FLOOR PLAN – THE DAVENPORT HOTEL

FLOOR 1



FLOOR 2

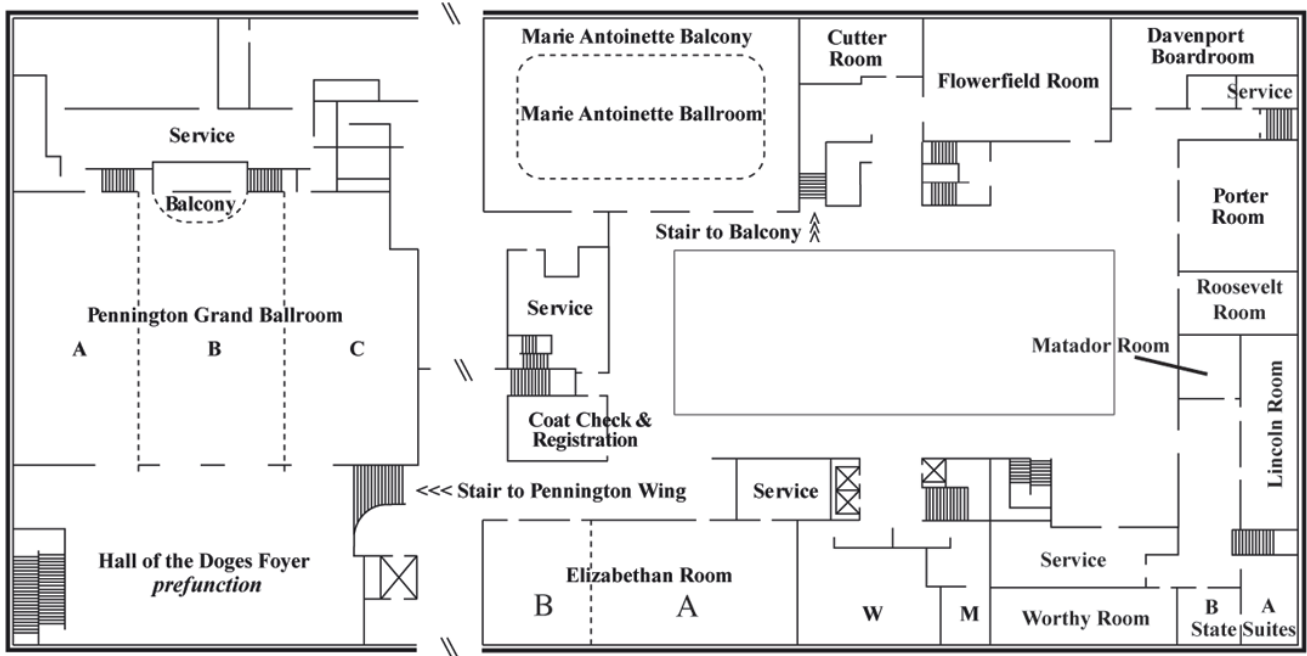
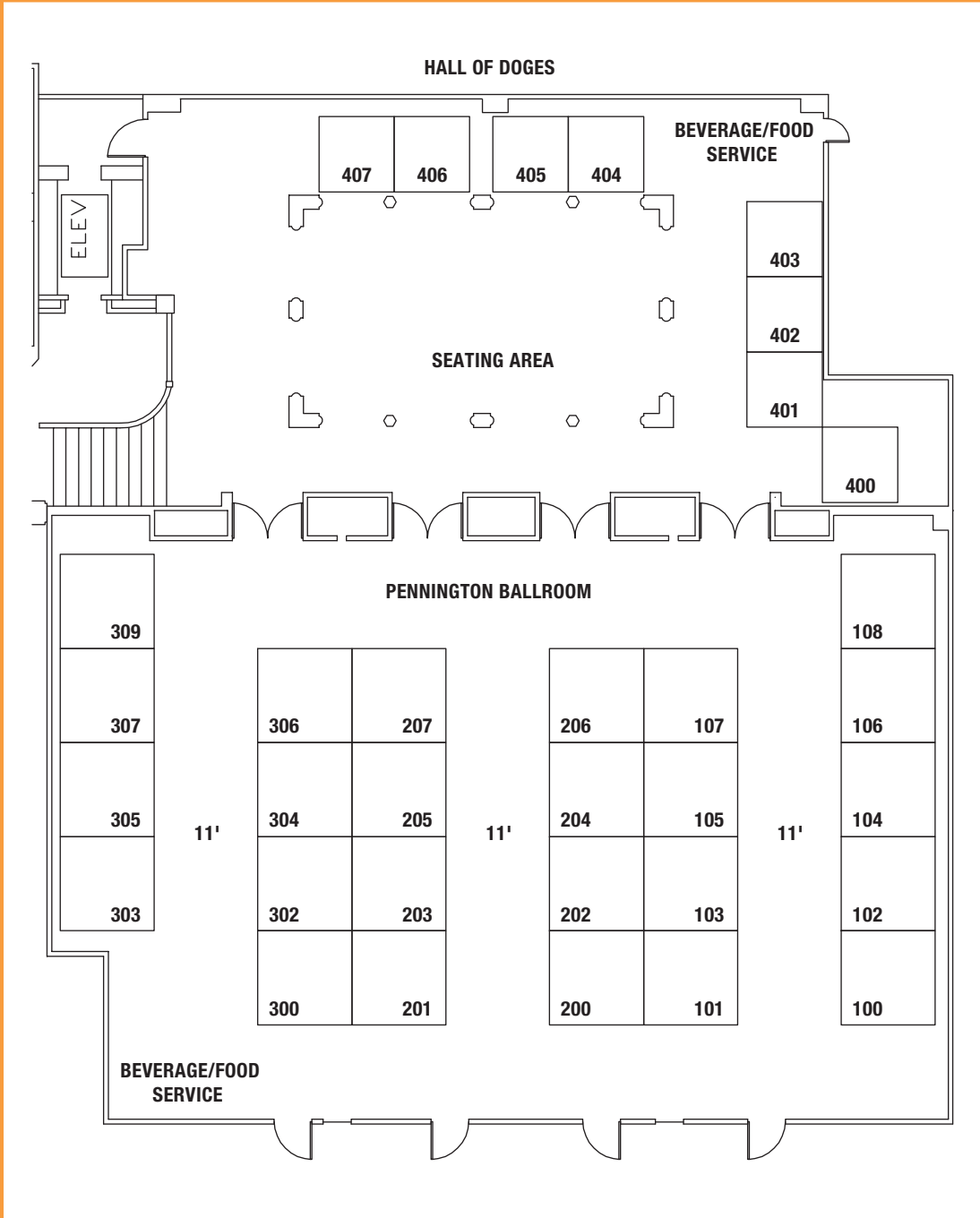


EXHIBIT FLOOR PLAN – THE DAVENPORT HOTEL



EXHIBITOR LISTING

The AANS/CNS Section on Pediatric Neurological Surgery gratefully recognizes the support of these exhibitors.

Aesculap Inc.

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Center Valley, PA 18034
United States
(610) 797-9300
www.aesculapusa.com
Booth: 303

Biomet MicroFixation

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Jacksonville, FL 32218
United States
(904) 741-4400
www.biometmicrofixation.com
Booth: 403

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Dublin, CA 94568
United States
(925) 557-4124
www.meditec.zeiss.com
Booth: 103

Children's Mercy Hospitals and Clinics

2401 Gillham Road
Kansas City, MO 64108
United States
(816) 234-3106
www.childrens-mercy.org
Booth: 402

CMF Medicon Surgical, Inc.

11222 St. Johns Industrial Pkwy, Ste. 7
Jacksonville, FL 32246
United States
(904) 642-7500
www.medicon.de
Booth: 307

Codman, a Johnson & Johnson company

325 Paramount Drive
Raynham, MA 02767
United States
(508) 880-8100
www.codman.com
Booth: 200

ERBE USA, Inc.

2225 Northwest Parkway
Marietta, GA 30067
United States
(770) 955-4400
www.erbe-usa.com
Booth: 201

Hydrocephalus Association

870 Market Street, Ste. 705
San Francisco, CA 94102
United States
(415) 732-7040
www.hydroassoc.org
Booth: 401

IMRIS

100-1370 Sony Place
Winnipeg, MB R3T-IN5
Canada
(204) 480-7070
www.imris.com
Booth: 204

Integra LifeSciences

311 Enterprise Drive
Plainsboro, NJ 08536
United States
(609) 275-0500
www.integra-ls.com
Booth: 207

Karl Storz Endoscopy-America, Inc.

600 Corporate Pointe
Culver City, CA 90230-7600
United States
(310) 338-8100
www.karlstorz.com
Booth: 206

KLS-Martin, LP

P.O. Box 50249
Jacksonville, FL 32250-0249
United States
(904) 641-7746
www.klsmartin.com
Booth: 101

Medtronic, Inc.

710 Medtronic Parkway
Minneapolis, MN 55432-5604
United States
(800) 328-0810
www.medtronic.com
Booth: 100

Moeller Medical GmbH and Co.

Wasserkupperstr. 29-31
Fulda, 36043
Germany
(49) 661 941357-7
www.moeller-medical.com
Booth: 306

Neuro Diagnostic Devices

One Neshaminy Interplex, Ste. 300
Philadelphia, PA 19053
United States
(215) 645-0090
www.NeuroDx.com
Booth: 300

Neurologica Corporation

14 Electronics Avenue
Danvers, MA 01923
United States
(978) 564-8500
www.neuro-logica.com
Booth: 203

ProMed Instruments, Inc.

4529 SE 16th. Place, Ste. 101
Cape Coral, FL 33904-7444
United States
(239) 369-2310
www.headrest.de
Booth: 107

RosmanSearch

30799 Pinetree Rd., #250
Pepper Pike, OH 44124
United States
(216) 256-9020
www.rosmansearch.com
Booth: 302

Sophysa

Parc Club Universite Orsay
22 Rue Jean Rostand
Orsay Cedex, 91893
France
(0) 03 31 69 353500
www.sophysa.com
Booth: 309

Synergetics, Inc.

3845 Corporate Centre Drive
O'Fallon, MO 63368
United States
(636) 939-5100
www.synergeticsusa.com
Booth: 105

Synthes CMF

1301 Goshen Parkway
West Chester, PA 19380
United States
(610) 719-6500
www.synthes.com
Booth: 406

ACKNOWLEDGEMENTS

The AANS/CNS Section on Pediatric Neurological Surgery thanks the following companies for their educational grants in support of the Annual Meeting:

Aesculap

**Codman, a Johnson and
Johnson company**

Medtronic



PROGRAM DESCRIPTIONS

The open scientific sessions provide participants exposure to the latest in research and groundbreaking information available on neurosurgical topics. The Raimondi Lecture will be given by Renée R. Jenkins, MD, FAAP. Educational programming includes topics such as Craniosynostosis, Epilepsy/Functional, Hydrocephalus, Neoplasms, Tumors and Trauma.

Nursing Seminar

Learning Objectives

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

Trauma:

- Discuss key challenges involved in the evaluation of NAT
- Describe the important elements involved in the team approach to NAT

Vascular:

- Identify the major types of CNS vascular malformations, which AVM's are angiographically occult, and the role played by endovascular techniques in the treatment of vascular malformations
- Identify how and when is surgery used to address an AVM
- Among members of a Spanish-speaking family, what aspects of the critical care process are best and least understood when dealing with a child who has a life-threatening, ruptured vascular malformation?

Critical Care:

- Identify the salient features of the CNS pain pathways and how treatment is used to alter these chemical responses in children
- How does our understanding of the science of pain translate into effective bedside management in the PICU?

Developmental Anomalies and Future Innovations:

- What are the key elements of urodynamics and how is this technique used in the evaluation of spinal cord tethering?
- List current applications and challenges in stem cell research as they relate to pediatric neurosurgery

Exhibit Hall

Vendors and their exhibits afford meeting participants an excellent opportunity to view highly specialized equipment and observe first-hand demonstrations of the latest technology available in pediatric neurosurgery. The exhibit hall will be open during the following days and times:

Wednesday, December 3: 9:00 AM – 5:30 PM

Thursday, December 4: 9:00 AM – 4:00 PM

Friday, December 5: 7:00 AM – 10:30 AM

Please support our exhibitors by visiting the exhibit hall located in the Pennington Ballroom and Hall of Doges on the second floor.

Poster Viewing

Poster presentations give interested parties an opportunity to study at their leisure and, at length, the most cutting-edge research performed and documented by leaders in pediatric neurosurgery. Posters will be available for viewing Wednesday and Thursday from 7:00 AM – 5:00 PM and again on Friday from 7:00 AM – 12:00 PM in the Flowerfield Room located on the second floor.

Speaker Ready Room

The Speaker Ready Room is located in the Cutter Room located on the second floor and is open during the following hours:

Tuesday, December 2: 4:00 PM – 7:00 PM

Wednesday, December 3: 7:00 AM – 4:30 PM

Thursday, December 4: 7:00 AM – 5:30 PM

Friday, December 5: 7:00 AM – 12:00 PM

Opening Reception

The opening reception will take place on Tuesday, December 2 from 6:30 – 8:00 PM in the Isabella Ballroom of the Davenport Hotel. Enjoy spending the evening with friends and colleagues over a wonderful assortment of hors d'oeuvres during a wine tasting featuring Pepper Bridge Wine from Walla Walla, WA. All registered attendees and registered guests/spouses receive one complimentary ticket to this event. Business Casual attire suggested.

Post Tour

Friday, December 5

1:00 – 7:00 PM

Cost: \$75 per person

Welcome to snow shoe and cross-country skiing!

Snow shoeing and cross country skiing are some of the best ways to explore the beauty and wonder of Northwest winters and a great form of exercise for all ages and abilities. The Spokane Parks and Recreation Outdoor Program will provide the instruction and equipment you will need to have an enjoyable afternoon. In addition, a delicious dinner will be served immediately following in the lodge. The following is a list of clothing items that you should have with you as weather conditions are not always predictable, even on the morning of the afternoon outing!

Socks (2 pair) – First pair should be light wool or polypropylene liners. Second pair should be heavy wool or polypropylene.

Long underwear (top and bottom) – Polypropylene, Capelin or wool (avoid cotton).

Hat – Required! Much of your body heat will escape from your head. A hat that covers your ears will be the most effective in conserving body heat.

Gloves or Mittens (2 pair) – Bring an extra pair because your hands will get wet.

Wool Sweater/Shirt, Pile Jacket – For times when you are inactive or cold.

Jacket – Wind-resistant, rainproof, not insulated.

Pants – Synthetic, wind/rain pants, exercise tights, knickers, wool pants (avoid cotton, jeans. They become uncomfortable and cold).

Rain Gear – The trip will proceed no matter the weather.

Optional Clothing: Extra shoes and socks for the drive home!

PROGRAM SCHEDULE

TUESDAY, DECEMBER 2

7:00 AM – 7:00 PM

Registration

Elizabethan Foyer

7:00 AM – 8:00 AM

Continental Breakfast

Early Bird Room

NURSES SEMINAR

8:00 AM – 4:30 PM

Early Bird Room

8:00 – 8:20 AM

Welcome and Introduction

David Gruber, MD

Vascular

8:20 – 9:00 AM

Innovations in the Endovascular Management of Pediatric AVM's

Rod Raabe, MD

9:00 – 9:40 AM

Surgical Management of Pediatric AVM's

Benjamin Ling, MD

9:40 – 10:20 AM

AVM Case Presentation: A Family's Perspective

Diana Scherer, ARNP

10:20 – 10:40 AM

BREAK

Trauma

10:40 – 11:20 AM

Current Challenges and Strategies in Non-Accidental Trauma

Ann-Christine Duhaime, MD

11:20 – 12:00 PM

Issues and Pitfalls: The Team Approach to NAT

Deborah Harper, MD

12:00 – 1:00 PM

LUNCH

Porter Room

Critical Care

1:00 – 1:40 PM

The Science of Pain: Modulation and Treatment in Children

Jonathan Carlson, MD, PhD

1:40 – 2:20 PM

Pain Management Issues in the ICU: Lessons from the Bedside

Leslie Martin, RPh

2:20 – 2:40 PM

Propofol Infusion Syndrome: A Case Report and Discussion

Cathy Ormsby, RNC

2:40 – 3:00 PM

BREAK

Developmental Anomalies and Future Innovations

3:00 – 3:40 PM

The Role of Urodynamics in the Evaluation of a Tethered Cord

Barb Andrew, ARNP

3:40 – 4:20 PM

Stem Cell Applications in Pediatric Neurosurgery: Current Innovations and Controversies

Nathan R. Selden, MD, PhD

4:20 – 4:30 PM

Wrap up and Evaluations

Linda Quinlan, PAC, Claudia Ramm, ARNP, Diana Scherer, ARNP

WEDNESDAY, DECEMBER 3

7:00 AM – 5:30 PM

Registration

Elizabethan Foyer

7:00 – 8:00 AM

Continental Breakfast

Flowerfield Room

7:00 AM – 4:30 PM

Speaker Ready Room

Cutter Room

SCIENTIFIC SESSION

7:50 AM – 4:30 PM

Marie Antoinette Ballroom

7:50 – 7:55 AM

Welcome and Opening Remarks

Jeffrey H. Wisoff, MD

7:55 – 8:00 AM

Meeting Overview

David Gruber, MD

8:00 – 10:00 AM

Scientific Session I: Hydrocephalus I

Moderators: Marion L. Walker, MD

Jeffrey H. Wisoff, MD

8:00 – 8:10 AM

1. Combined Endoscopic Third Ventriculostomy and Choroid Plexus Cauterization in American Infants: A Pilot Study

Benjamin C. Warf, MD (Wilmington, DE)

8:10 – 8:20 AM

2. Endoscopic Third Ventriculostomy Versus Cerebrospinal Fluid Shunt in the Treatment of Hydrocephalus in Children: A Propensity Score Adjusted Analysis

Abhaya V. Kulkarni, MD, PhD; James M. Drake, MD, FRCS (Canada, Toronto); John RW Kestle, MD, FRCS (Salt Lake City, UT); Conor L. Mallucci, FRCS (United Kingdom, Liverpool); Spyros Sgouros, FRCS (United Kingdom, Birmingham); Shlomi Constantini, MD, MSc (Israel, Tel Aviv)

8:20 – 8:30 AM

3. Complications of Endoscopic Third Ventriculostomy in Previously Shunted Patients

Mark G. Hamilton, MD, FRCSC (Canada, Calgary); Robin Walker, BSc (Canada, U of Calgary); S. Terry Myles, MD, FRCSC (Canada, Calgary); Walter Hader, MD, FRCSC (Canada, U of Calgary)

8:30 – 8:40 AM

4. Endoscopic Third Ventriculostomy in Patients with a Diminished Prepontine Interval

Mark M. Souweidane, MD (New York, NY); Sungkwon Kang, BS (Ithaca, NY); Jonathan Roth, MD (Israel, Tel-Aviv); Peter F. Morgenstern, BS (New York, NY)

8:40 – 8:50 AM

5. Treatment of Complex Multiloculated Hydrocephalus in Infants and Children

Timothy M. Murphy, MB (St Louis, MO)

8:50 – 9:00 AM

6. The Hydrocephalus Clinical Research Network Quality Improvement Initiative

John Kestle, MD (Salt Lake City, UT); John Wellons, MD (Birmingham, AL); Jay Riva-Cambrin, MD (Salt Lake City, UT); Chevis Shannon, MBA (Birmingham, AL); Tracey Habrock-Bach, BS (Salt Lake City, UT); William Whitehead, MD; Sheila Nguyen, MS (Houston, TX); Abhaya Kulkarni, MD; Lindsay O'Connor, MS (Canada, Toronto); Tamara Simon, MD (Salt Lake City, UT)

9:00 AM – 5:30 PM

Exhibit Hall Open

Pennington Ballroom and Hall of Doges

9:00 – 9:10 AM

7. Inflammation Patterns in Experimental Neonatal Hydrocephalus

James P. McAllister, PhD; Jennifer Forsyth, MS; Kelley E. Deren, MS (Salt Lake City, UT)

9:10 – 9:20 AM

8. Occult Intracranial Pressure Elevation in Cerebral Palsy Patients: A Study Using Codman Intracranial Pressure Monitoring Prior to Baclofen Pump Placement

Nirav J. Patel, MD; Bermans J. Iskandar, MD (Madison, WI)

9:20 – 9:30 AM

9. Potential Compensatory Mechanisms in Experimental Neonatal Hydrocephalus

Kelley E. Deren, MS (Salt Lake City, UT); Joon W. Shim, PhD (Boston, MA); Jennifer Forsyth, MS; Osama Abdullah, MS; Edward Hsu, PhD (Salt Lake City, UT); Joseph R. Madsen, MD (Boston, MA); Marion L. Walker, MD; John RW Kestle, MD; James P. McAllister II, PhD (Salt Lake City, UT)

9:30 – 9:40 AM

10. A Longitudinal Comparison of Pre- and Post-operative Dti Parameters in Young Hydrocephalic Children

Ellen L. Air, MD; Weihong Yuan, PhD; Scott K. Holland, PhD; Blaise V. Jones, MD; Karin Bierbrauer, MD; Francesco T. Mangano, DO (Cincinnati, OH)

9:40 – 9:50 AM

11. Diffusion Tensor Imaging of Experimental Neonatal Hydrocephalus

Francesco T. Mangano, DO; Ahmed Shereen, BS; Diana M. Lindquist, PhD; Weihong Yuan Yuan, PhD; Kelley E. Deren, MS; Scott Holland K. Holland, PhD (Cincinnati, OH); James P. McAllister II, PhD (Salt Lake City, UT)

9:50 – 10:00 AM

12. Amyloid-beta Clearance in Experimental Neonatal Hydrocephalus

Kelley E. Deren, MS; Jennifer Forsyth, MS (Salt Lake City, UT); Petra Klinge, MD, PhD (Germany, Hannover); Gerald Silverberg, MD; Conrad E. Johanson, PhD (Providence, RI); James "Pat" McAllister II, PhD (Salt Lake City, UT)

10:00 – 10:30 AM

Beverage Break in Exhibit Hall

Pennington Ballroom and Hall of Doges

10:30 AM – 12:00 PM

Scientific Session II: Neoplasms I

Moderators: Frederick A. Boop, MD, FACS; Benjamin C. Ling, MD

PROGRAM SCHEDULE

10:30 – 10:40 AM

13. Claudin 6 Is a Positive Marker for Atypical Teratoid / Rhabdoid Tumors of the Central Nervous System

Sean A. McNatt, MD; Diane Birks, MS; Andrew Donson, BS; B.K. Kleinschmidt DeMasters, MD; Valerie Barton, BS; Nicholas Foreman, MD; Michael Handler, MD (Denver, CO)

10:40 – 10:50 AM

14. Intraoperative and Postoperative Risk Factors for Post-Resection Hydrocephalus in Children with Posterior Fossa Tumors

Jay K. Riva-Cambrin, MD (Salt Lake City, UT); James Drake, MD; Maria Lamberti-Pasculli, RN (Canada, Toronto); Doug Cochrane, MD (Canada, Vancouver)

10:50 – 11:00 AM

15. Medulloblastoma Growth Enhancement by Hgf/sf Expression in Cerebellar Neural Progenitor Cells is Suppressed by Systemic Antibody Treatment

Toba Niazi, MD; Carolyn A. Pedone, MS; Daniel W. Fults, MD (Salt Lake City, UT)

11:00 – 11:10 AM

16. The Incidence of Pineal Cysts in the Pediatric Population

Wajd N. Al-Holou, BS; Hugh J. Garton, MD; Karin M. Muraszko, MD; Cormac O. Maher, MD (Ann Arbor, MI)

11:10 – 11:20 AM

17. The Role of Surgery in the Management of Optic Pathway Gliomas

Linda W. Xu, BS; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

11:20 – 11:30 AM

18. Magnetic Resonance Imaging Surveillance in Cerebellar Low Grade Astrocytomas

Michael Vassilyadi, MD,FRCS(C); Zachary L. Tataryn, BSC; Daniel L. Keene, MD, FRCS; Enrique C.G. Ventureyra, MD,FRCS(C) (Canada, Ottawa)

11:30 – 11:40 AM

19. Application of Intra-operative Magnet Resonance Imaging in Pediatric Neurosurgery

Mark G. Hamilton, MD, FRCSC (Canada, Calgary); Robin Cox, MD,FRCS(C); Garnette Sutherland, MD, FRCSC; Walter Hader, MD, FRCSC; S. Terry Myles, MD, FRCSC; Ron Levy, MD, PhD (Canada, U of Calgary)

11:40 – 11:50 AM

20. Gangliogliomas: Long-term Follow-up and Role of Radiotherapy, Mayo Clinic Experience

Julia J. Walker; David A. Schomas, MD; Fredric B. Meyer, MD; Nadia N. Laack, MD (Rochester, MN)

11:50 AM – 12:00 PM

21. Bone Fiducial Markers for Fractionated Proton Beam Irradiation in Pediatric Cns Tumors: A Technical Report

Philipp R. Aldana, MD; Sameer Keole, MD; Teresa MacGregor, ARNP; Hector E. James, MD (Jacksonville, FL)

12:00 – 1:00 PM

Lunch in Exhibit Hall

Pennington Ballroom and Hall of Doges

1:00 – 2:30 PM

Scientific Session III: Developmental Anomalies I

Moderators: Daniel Edward Couture, MD

Sarah J. Gaskill, MD, FACS

1:00 – 1:10 PM

22. Endoscopic Endonasal Approach in the Pediatric Population - The University of Pittsburgh Experience

Elizabeth C. Tyler-Kabara, MD, PhD; Ricky Madhok, MD; Daniel M. Prevedello, MD; Ricardo L. Carrau, MD, FACS; Carl H. Snyderman, MD, FACS; Amin B. Kassam, MD, FRCS(C) (United States, Pittsburgh)

1:10 – 1:20 PM

23. Suboccipital Decompression for Chiari I Malformation: Outcome Comparison of Duraplasty with Expanded Polytetrafluoroethylene Dural Substitute Versus Pericranial Autograft

Frank J. Attenello, MS; Vivek Mehta, BS; Giannina L. Garces-Ambrossi, BS; Kaisorn L. Chaichana, MD; Edward Ahn, MD; Benjamin S. Carson, MD (Baltimore, MD); George I. Jallo, MD

1:20 – 1:30 PM

24. New Findings in Children with Achondroplasia: Dynamic Cervicomedullary Cord Compression and Alterations in Csf Dynamics

Parham Mofitakhar, MD (LA, CA); Barry D. Pressman, MD (Cedars-Sinai, Department of Neuroradiology, CA); Moise Danielpour, MD (Cedars Sinai, Department of Neurosurgery, CA)

1:30 – 1:40 PM

25. Surgical Management of Pediatric Tethered Cord Syndrome with and Without Duraplasty: Neurological Outcome and Incidence of Retethering After 115 Consecutive Cases

Giannina L. Garces-Ambrossi, BS; Frank J. Attenello, MS; Matthew J. McGirt, MD; Roger Samuels, BS; Edward Grant Sutter, BS; Ali Bydon, MD; Ziya Gokaslan, MD; Benjamin S. Carson, MD (Baltimore, MD); George I. Jallo, MD

1:40 – 1:50 PM

26. What is the State of the Art in Neural Tube Defect Research In 2008?

Timothy M. George, MD, FACS; John Wallingford, PhD (Austin, TX)

1:50 – 2:00 PM

27. A Novel Adult Rat Model of Tethered Spinal Cord

Michael H. Handler, MD; Brian Callahan, MD; Kim Ellison, BA; Stephen J. Davies, PhD (Aurora, CO)

2:00 – 2:10 PM

28. Chiari I Malformations in a Pediatric Population

Nalin Gupta, MD, PhD; Leslie A. Aitkin; Stephen B. Hulley, MD, MPH; Camilla E. Lindan, MD (San Francisco, CA); Steven Sidney, MD, MPH; Michael Sorel, MS (Oakland, CA); Yvonne W. Wu, MD, MPH (San Francisco, CA)

2:10 – 2:20 PM

29. En Bloc Fronto-orbital Advancement for Coronal and Metopic Synostosis

Raphael Guzman, MD; Joseph Looby, DMD, MD; Stephen A. Schendel, DMD, MD; Michael S.B. Edwards, MD (Stanford, CA)

2:20 – 2:30 PM

30. Children Presenting with Acute Neurologic Deficits and Type I Chiari Malformation

Alex Powers, MD; Matthew Callen, PA-C, MS; David Limbrick, MD, PhD; T.S. Park, MD; Jeffrey Leonard, MD; Matthew Smyth, MD (St. Louis, MO)

2:30 – 3:00 PM

Beverage Break in Exhibit Hall

Pennington Ballroom and Hall of Doges

3:00 – 4:30 PM

Scientific Session IV: Functional, Spasticity, and Peripheral Nerve

Moderators: Rick Abbott, MD
Timothy M. George, MD

3:00 – 3:10 PM

31. Functional Performance following Selective Posterior Rhizotomy: Long-term Results Determined Using a Validated Evaluative Measure

Michele Parolin, MD; Rajeet Saluja, MD; Kathleen Montpetit, MSc; Nathalie Bilodeau, MSc; Chantal Poulin, MD; Marie-André Cantin, MD; Thierry E. Benaroch, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

3:10 – 3:20 PM

32. Deep Brain Stimulation in Pediatric Patients: Long-term Outcomes

Abilash Haridas, MD; Ioannis U. Isaias, MD; Yan Epelboym; Michele Tagliati, MD; Ron L. Alterman, MD (Manhattan, NY)

3:20 – 3:30 PM

33. Electrophysiologically Guided Vs Non Electrophysiologically Guided Selective Dorsal Rhizotomy for Spastic Cerebral Palsy – A Comparison of Outcomes

Paul Steinbok, MBBS, FRCS; Andrew Tidemann, MD; Stacey Miller; Tim Bowen-Roberts (Canada, Vancouver)

3:30 – 3:40 PM

34. Cervical Dorsal Rhizotomy for Upper Extremity Spasticity

Brandon G. Rocque, MD; A Leland Albright, MD (Madison, WI)

3:40 – 3:50 PM

35. The Oberlin Technique for Nerve Repair in Pediatric Brachial Plexus Injury

Tord D. Alden, MD; Arthur J. Dipatri Jr., MD; Shubhra Mukherjee, MD; Erik C. King, MD (Chicago, IL)

3:50 – 4:00 PM

36. Long-term Functional Outcome after Selective Posterior Rhizotomy

Michele Parolin, MD; Rajeet Saluja, MD; Joanne Gibis, MSc; Eileen Kennedy, BSc; Christina Oesterreich, RN; Chantal Poulin, MD; Marie-André Cantin, MD; Thierry E. Benaroch, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

4:00 – 4:10 PM

37. Coaptation of Radial to Auxiliary Nerve for Obstetric Brachial Plexus Palsy with Persistent Deltoid Weakness

Alexander K. Powers, MD; Ian G. Dorward, MD; Nicole Ladousier, PA-C; Matthew D. Smyth, MD; Jeffrey R. Leonard, MD; Tae Sung Park, MD (St. Louis, MO)

4:10 – 4:20 PM

38. Outcome in Cerebral Palsy Patients with Baclofen Pump after Spinal Fusion for Neuromuscular Scoliosis

Michele Parolin, MD; Wilhem Strydom, MD; Jean Ouellet, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

4:20 – 4:30 PM

39. The Infraclavicular Fossa as an Alternate Site for Placement of Baclofen Pump

Brandon G. Rocque, MD; A Leland Albright, MD (Madison, WI)

4:30 – 5:30 PM

Wine and Cheese Reception in Exhibit Hall

Pennington Ballroom and Hall of Doges

Wine tasting featuring Robert Karl Cellars; highly rated by *Wine Spectator*.

THURSDAY, DECEMBER 4, 2008

7:00 AM – 5:30 PM

Registration

Elizabethan Foyer

7:00 AM – 8:00 AM

Continental Breakfast

Flowerfield Room

7:00 AM – 5:30 PM

Speaker Ready Room

Cutter Room

PROGRAM SCHEDULE

SCIENTIFIC SESSION

8:00 AM – 5:00 PM

Marie Antoinette Ballroom

8:00 – 10:00 AM

Scientific Session V: Hydrocephalus II

Moderators: Liliana C. Goumnerova, MD, FRCS(C)

John R. W. Kestle, MD

8:00 – 8:10 AM

40. Application of Shuntcheck Thermal Technique for Evaluation of Csf Flow in Vp Shunts in Hydrocephalic Patients

Gani S. Abazi, MD, MPH (Boston, MA); Laurel Fleming, BA; Tomer Anor, PhD; Joseph R. Madsen, MD (Children's Hospital Boston & Harvard Medical School, MA)

8:10 – 8:20 AM

41. Antibiotic-impregnated Versus Standard Shunt Systems are Associated with Decreased Shunt Infection in High-risk Patient Subgroups

Scott L. Parker, BS; Frank J. Attenello, MS; Giannina L. Garces-Ambrossi, BS; Daniel M. Sciubba, MD; Edward Ahn, MD; Jon D. Weingart, MD; Benjamin S. Carson, MD (Baltimore, MD); George I. Jallo, MD

8:20 – 8:30 AM

42. The Association between CSF Shunt Infection Rates and Antibiotic Impregnated Catheters at a Single Institution

Hugh J. Garton; Jayson Sack, BA, MS, BS; Cormac O. Maher, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

8:30 – 8:40 AM

43. Medical Costs Associated with Shunt Infections in Patients Receiving Antibiotic-impregnated Shunts Versus Standard Shunt Catheters

Frank J. Attenello, MS; Giannina L. Garces-Ambrossi, BS; Daniel M. Sciubba, MD; Edward Ahn, MD; Benjamin S. Carson, MD; Jon D. Weingart, MD (Baltimore, MD); George I. Jallo, MD

8:40 – 8:50 AM

44. Experiences with a Gravity Assisted Valve (paediGAV) In Hydrocephalic Children

Ernst Johannes Haberl, MD (Germany, Berlin D-13 353)

8:50 – 9:00 AM

45. Variability among Pediatric Neurosurgeons in the Threshold for Ventricular Shunting in Asymptomatic Children with Hydrocephalus

Mark S. Dias, MD; Kenneth Hill, MD; Mark Iantosca, MD (Hershey, PA)

9:00 – 9:10 AM

46. The Role of Gravitational Valves in the Management of Complex Pediatric Hydrocephalus

Michael J. Fritsch, MD (Germany, Greifswald)

9:00 AM – 4:00 PM

Exhibit Hall Open

Pennington Ballroom and Hall of Doges

9:10 – 9:20 AM

47. A Mathematical Model to Predict Success of Endoscopic Third Ventriculostomy in the Treatment of Childhood Hydrocephalus in Uganda

Benjamin C. Warf, MD (Wilmington, DE); John Mugamba, MD (Uganda, Mbale); Abhaya V. Kulkarni, MD, PhD (Canada, Toronto)

9:20 – 9:30 AM

48. The Origins of Postinfectious Hydrocephalus in East Africa

Steven J. Schiff, MD, PhD; Sarah Donaldson, MS (University Park, PA); John Mugamba, MD (Uganda, Mbale); Benjamin Warf, MD (Wilmington, DE); Derek Johnson, BA (Uganda, Mbale); Lingling Li, PhD; Vivek Kapur, PhD; Mary Poss, PhD; Bhushan Jayarao, PhD (University Park, PA)

9:30 – 9:40 AM

49. The Development and Implementation of a Pediatric Neuroendoscopic Surgery Program in the Developing World: Mali

Jay K. Riva-Cambrin, MD, FRCS (Salt Lake City, UT); Drissa Kanikomo, MD; Luis Hector, MD; Oumar Diallo, MD (Mali, Bamako)

9:40 – 9:50 AM

50. Risk of Subarachnoid Tumor Dissemination Following Endoscopic Biopsy and Concomitant Third Ventriculostomy

Neal Luther, MD (New York, NY); John C. Wellons III, MD (Birmingham, AL); Mark M. Souweidane, MD (New York, NY)

9:50 – 10:00 AM

51. Endoscopic Management of Large Intracranial Cysts: Expectations and Outcomes in Children

R. Shane Tubbs, PhD, PA-C; Jeffrey Pugh, MD; Blake Pearson, MD; John C. Wellons, III, MD (Birmingham, AL)

10:00 – 10:30 AM

Beverage Break in Exhibit Hall

Pennington Ballroom and Hall of Doges

10:30 AM – 12:00 PM

Raimondi Lecture Renée Jenkins, MD, FAAP



Our AAP Agenda:
Optimal Health & Well-Being for
America's Children

12:00 – 1:00 PM

Lunch in Exhibit Hall

Pennington Ballroom and Hall of Doges

1:00 – 2:30 PM

Scientific Session VI: Epilepsy

Moderators: Howard L. Weiner, MD

Jeffrey G. Ojemann, MD

1:00 – 1:10 PM

52. Surgical Failure in Patients Undergoing Hemispherectomy for Intractable Seizures

Sanjiv Bhatia, MD; Ian Miller, MD; John Ragheb, MD, FACS; Esperanza Pacheco, MD; Glenn Morrison, MD, FACS (Miami, FL)

1:10 – 1:20 PM

53. Corpus Callosotomy in Multistage Epilepsy Surgery in the Pediatric Population

Jessica S. Lin, MD; Sean M. Lew, MD; Wade M. Mueller, MD; Mary L. Zupanc, MD (Milwaukee, WI)

1:20 – 1:30 PM

54. Palliative Hemispherotomy in Patients with Bilateral Seizure Onset

Alexander K. Powers, MD; David D. Limbrick, Jr, MD, PhD; Matthew D. Smyth, MD (St. Louis, MO)

1:30 – 1:40 PM

55. Temporo-parietal-occipital (tpo) Disconnection in Children with Intractable Epilepsy.

Jerard Ross, MD, FRCS (United Kingdom, Liverpool)

1:40 – 1:50 PM

56. Vagal Nerve Stimulators and Magnetic Resonance Imaging

Stephanie Einhaus, MD (Memphis, TN); Joel Chasan; Robert Davis (Memphis, TN); Michael Tobias, MD (Westchester, NY); Karen Butler, BSN, RN; James Wheless, MD; Frederick Boop, MD

1:50 – 2:00 PM

57. Epilepsy Surgery in Tuberous Sclerosis: Strategies and Results in 21 Patients

Charles B. Stevenson, MD; Ellen L. Air, MD, PhD; David N. Franz, MD; Ki H. Lee, MD; Katherine D. Holland, MD; Anna W. Byars, PhD; Kerry R. Crone, MD; Francesco T. Mangano, DO (Cincinnati, OH)

2:00 – 2:10 PM

58. Is Surgical Intervention Beneficial in Patients with Supplementary Sensorimotor Area Seizures Caused by Cortical Dysplasia?

Keyne K. Johnson, MD (Orlando, FL); Daniel Yoshor, MD (Baylor College of Medicine, TX)

2:10 – 2:20 PM

59. Evaluation of Seizure Response to Vagal Nerve Stimulation as an Outcome Predictor of Temporal Lobectomy for Patients with Medically-intractable Epilepsy.

Samer K. Elbabaa, MD (Little Rock, AR); Ethan Munzinger, BS; Dimitri Sigounas, BS; Kyle Weant, PharmD; Eldad Hadar, MD (Chapel Hill, NC)

2:20 – 2:30 PM

60. The Pediatric Neurosurgical Workforce: Defining the Current Supply

Susan R. Durham, MD, MS; Jessica Lane; Scott Shipman, MD, MPH (Lebanon, NH)

2:30 – 3:00 PM

Beverage Break in Exhibit Hall

Pennington Ballroom and Hall of Doges

3:00 – 5:00 PM

Scientific Session VII: Neoplasms II

Moderators: Bruce A. Kaufman, MD, FACS

Mark M. Souweidane, MD

3:00 – 3:10 PM

61. Recurrent Craniopharyngiomas: Aspects of Surgical Management in Children

Robert E. Elliott, MD (New York, NY); Kevin Hsieh, MD; Jeffrey Wisoff, MD, FACS (New York University Medical Center, NY)

3:10 – 3:20 PM

62. Longitudinal Assessment of Local Delivery Methods in Rodent Brainstem Model

Akihide Kondo, MD; Stewart Goldman, MD; Marcelo B. Soares, PhD; Veena Rajaram, MD; Tadanori Tomita, MD, Prof (Chicago, IL)

3:20 – 3:30 PM

63. Risk Factors for Shunt Malfunction in Pediatric Brain Tumor Patients

Melvin E. Omodon, BS; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

3:30 – 3:40 PM

64. The Utility of Fourth Ventricular Drains Following Resection of Posterior Fossa Tumors in Children

Cole E. Denton, BA; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

3:40 – 3:50 PM

65. Biologically Active Autologous Hsp-gp96 Vaccine (hsppc-96) can be Generated from Common Pediatric Brain Tumors: A Potential Source of Tumor Specific Polyvalent Antigen for Adjunct Immunotherapy

Phiroz Tarapore; Nalin Gupta, MD, PhD; Kurtise Auguste, MD; Anu Banerjee, MD (San Francisco, CA)

3:50 – 4:00 PM

66. Treatment of Choroid Plexus Tumors: A 20-year Institutional Experience

Chetan Bettegowda, MD, PhD; Vivek Mehta, BS; Jon Weingart, MD; Ben Carson, MD; George Jallo, MD; Edward Ahn, MD (Baltimore, MD)

4:00 – 4:10 PM

67. Endoscopic Biopsy and Third Ventriculostomy in Children with Third Ventricular Tumors

Sean A. McNatt, MD; Jesse Smith, BA; Corbett Wilkinson, MD; Ken Winston, MD (Denver, CO)

4:10 – 4:20 PM

68. Neurofibromatosis Type I: Transition between Childhood and Adulthood

Sandrine de Ribaupierre, MD (Canada, London); Matthieu Vinchon, MD (France, Lille); Olivier Vernet, MD; Benedict Rilliet, MD (Switzerland, CHUV)

4:20 – 4:30 PM

69. Surgical and Therapeutic Strategy of Pediatric Craniopharyngiomas Based on the Quality of Life Study after Growing Up

Shigetoshi Yano, MD, PhD; Mareina Kudo, MD; Jun-ichi Kuratsu, MD, PhD (Japan, Kumamoto)

4:30 – 4:40 PM

70. Safety of Interstitial Infusion of 8H9-PE38 to the Pons for Application in a Glioma Model

Neal Luther, MD; Ioannis Karempelas, MD; Nai-Kong V. Cheung, MD, PhD; Ira J. Dunkel, MD; Mark A. Edgar, MD; Philip H. Gutin, MD; Mark M. Souweidane, MD (New York, NY)

4:40 – 4:50 PM

71. Aggressive Surgery for Recurrent Craniopharyngioma.

Timothy M. George, MD, FACS; Nicole Higginbotham, NP, MS (Austin, TX)

4:50 – 5:00 PM

72. Endoscopic Management of Third Ventricular Colloid Cysts in Children

Rohit K. Goel, MD, MS; Ananth K. Vellimana, MD; Ashish Suri, MD, MS; P Sharat Chandra, MD, MS; Rajender Kumar, MD, MS; Bhawani Shankar Sharma, MD, MS (India, New Delhi)

5:00 – 5:30 PM

Business Meeting

Marie Antoinette Ballroom

FRIDAY, DECEMBER 5, 2008

7:00 AM – 12:00 PM

Registration

Elizabethan Foyer

7:00 AM – 8:00 AM

Continental Breakfast in Exhibit Hall

Pennington Ballroom and Hall of Doges

7:00 – 10:30 AM

Exhibit Hall Open

Pennington Ballroom and Hall of Doges

7:00 AM – 12:00 PM

Speaker Ready Room

Cutter Room

SCIENTIFIC SESSION

8:00 AM – 12:00 PM

Marie Antoinette Ballroom

8:00 – 10:00 AM

Scientific Session VIII: -Trauma, Vascular, and Arachnoid Cysts

Moderators: Ann-Christine Duhaime, MD

Jeffrey R. Leonard, MD

8:00 – 8:10 AM

73. Noninvasive Icp and Brain Compliance Monitoring—clinical Physiologic Tests of Verification and Applications

Kim H. Manwaring, MD (Phoenix, AZ); Preston K. Manwaring, MS (Hanover, NH); Katie Klas, NP, MS (Phoenix, AZ); Jimmy Nguyen, MD (Tucson, AZ)

8:10 – 8:20 AM

74. Critical Evaluation of Decompressive Craniectomy in Infants and Toddlers

Matthew Adamo, MD; Doniel Drazin, MA; Caitlin Smith, BS; John Waldman, MD (Albany, NY)

8:20 – 8:30 AM

75. Scaled Cortical Contusion in Immature Swine: Effect of Age and Gender on Lesion Volume

Symeon Missios, MD; Brent T. Harris, MD, PhD; Patricia B. Quebada, MD; Carter P. Dodge, MD; Simon C. Hillier, MD; Beth A. Costine, PhD; Michael K. Simoni, BS; Rachel Curtis, BS; Leslie Adams; Ann-Christine Duhaime, MD (Lebanon, NH)

8:30 – 8:40 AM

76. Folic Acid Supplementation Enhances Cns Regeneration in Vitro

Krista Stewart; Sarah Bassiouni; Brenton Meier, BS; Nithya Hariharan, MD (Madison, WI); Elias Rizk, MD (Hershey, PA); Bermans J. Iskandar, MD (Madison, WI)

8:40 – 8:50 AM

77. Surgical Treatment of Arachnoid Cysts in Children

George A. Alexiou, MD; Maria Varela, MD; Neofytos Prodromou, PhD (Greece, ATHENS)

8:50 – 9:00 AM

78. Pial Synangiosis for Moyamoya Syndrome: The Hospital for Sick Children Experience.

James A. J. King, MBBS, PhD; Peter Dirks, MD, PhD (Canada, Toronto)

9:00 – 9:10 AM

79. Urinary Biomarkers Predict Presence of Moyamoya Disease

Edward R. Smith, MD; David Zurakowski, PhD; R. Michael Scott, MD; Marsha A. Moses, PhD (Boston, MA)

9:10 – 9:20 AM

80. Normal Deep Venous Drainage in Vein of Galen Aneurysmal Malformations: Clinical Implications in Treatment Strategies

Edward S. Ahn, MD; Ingrid Burger, MD, PhD; Rachel Lagos, MD; Juan Gomez, MD; Lydia Gregg, BA; Philippe Gailloud, MD (Baltimore, MD)

9:20 – 9:30 AM

81. The Association between Moyamoya Syndrome and SCA Does not Correlate with Common Laboratory Values and Transcranial Doppler Ultrasound Results

Todd C. Hankinson, MD, MBA; Matthew Balatbat; Jason Wade; Robert Starke, BS; Monica Bhatia, MD; Margaret Lee, MD; Maureen Licursi, MSN, ACNP; Neil A. Feldstein, MD; Richard C.E. Anderson, MD (New York, NY)

9:30 – 9:40 AM

82. Surgical Treatment of Moyamoya with Pial Synangiosis Provides Independence from Exchange Transfusions in Sickle Cell Disease

Edward R. Smith, MD; Matthew R. Naunheim, BA (Boston, MA)

9:40 – 9:50 AM

83. Endoscopic Management of Intracranial Arachnoid Cysts

Rohit K. Goel, MD, MS; Ananth K. Vellimana, MD; Ashish Suri, MD; P Sharat Chandra, MD, MS; Rajendar Kumar, MD, MS; Bhawani S. Sharma, MD, MS (India, New Delhi)

9:50 – 10:00 AM

84. Management of Pediatric Brainstem Cavernous Malformations: The Past 20 Years of Experience at Hsc

Ratan D. Bhardwaj, MD, PhD; Kurtis I. Auguste, MD, PhD; Abhaya V. Kulkarni, MD, PhD; Peter B. Dirks, MD, PhD; James M. Drake, MD, MSc; James T. Rutka, MD, PhD (Canada, Toronto)

10:00 – 10:30 AM

Beverage Break in Exhibit Hall

Pennington Ballroom and Hall of Doges

10:30 AM – 12:00 PM

Scientific Session IX: Spine and Transition of Care

Moderators: Anthony Michael Avellino, MD
Gordon J. McComb

10:30 – 10:40 AM

85. Fusion Rates Following Rigid Internal Fixation of the Occiput to C2 are Equivalent with or without C1 Instrumentation

Richard C.E. Anderson, MD; Todd C. Hankinson, MD, MBA (New York, NY); David Pincus, MD, PhD (Gainesville, FL); Luis Rodriguez, MD (Tampa, FL); David Harter, MD (New York, NY); Douglas Brockmeyer, MD (Salt Lake City, UT)

10:40 – 10:50 AM

86. Incidence of Cervical Spine Injury in Infants with Head Trauma

Michael H. Handler, MD (Aurora, CO); Joel S. Katz, BA (New York, NY); C. Corbett Wilkinson, MD; Sean McNatt, MD (Aurora, CO)

10:50 – 11:00 AM

87. Use of Iso-c And O-arm for Image Guided Spinal Fixation Screw Placement in Children

David W. Pincus, MD, PhD; Leigh Ann Perkins, ARNP, MSN; Frank Bova, PhD; Mu Yang, MS; Jeffrey Bennett, MD; J. Bridger Cox, MD (Gainesville, FL)

11:00 – 11:10 AM

88. CT Morphometric Analysis for Pediatric C1 Lateral Mass Screw Placement

Roukoz B. Chamoun; William Whitehead, MD; Daniel Curry, MD; Thomas Luerssen, MD; Andrew Jea, MD (Houston, TX)

11:10 – 11:20 AM

89. Hybrid Spinal Constructs Using Sublaminar Polyester Bands in Posterior Instrumented Fusions in Children: A Series of 5 Cases

Andrew Jea, MD; Ashwin Viswanathan, MD; Keyne K. Johnson, MD; William E. Whitehead, MD; Daniel J. Curry, MD; Thomas G. Luerssen, MD (Houston, TX)

11:20 – 11:30 AM

90. Management of Osteoblastoma and Osteoid Osteoma of the Spine in Childhood

Sasha C. Burn, FRCS; W C. Halliday, MD; R Zeller, MD; J M. Drake, MD, FRCSC (Canada, Toronto)

11:30 – 11:40 AM

91. Ventriculoperitoneal Shunt Failure Following Intradural Spinal Surgery

Jeffrey Pugh, MD; Chevis N. Shannon, MBA; R S. Tubbs, PhD; J C. Wellons III, MD; J P. Blount, MD; W J. Oakes, MD (Birmingham, AL)

11:40 – 11:50 AM

92. The Adult Hydrocephalus Clinic: A Paradigm Shift for Management of Adult Hydrocephalus Patients by Pediatric Neurosurgery

Mark G. Hamilton, MD, FRCSC (Canada, Calgary)

11:50 AM – 12:00 PM

93. Assessing the Early Results of a Multidisciplinary Adult Spina Bifida Transition Clinic

Julian J. Lin, MD; Brandon Bond, BA; Lynn Lyle, RN (Peoria, IL)

12:00 PM

Closing Remarks

1:00 PM

Shuttle bus departs for Snoe Shoeing and Cross Country Skiing at Main Entrance of Davenport Hotel

SPEAKER DISCLOSURE INFORMATION

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Julia Walker
Benjamin C. Warf, MD
Linda Xu
Shigetoshi Yano, MD, PhD

ORAL ABSTRACTS

1. Combined Endoscopic Third Ventriculostomy and Choroid Plexus Cauterization in American Infants: A Pilot Study

Benjamin C. Warf, MD (Wilmington, DE)

Introduction: In East Africa, combined endoscopic third ventriculostomy and choroid plexus cauterization (ETV/CPC) was found to be superior to ETV alone in infants with hydrocephalus (HC). This study reports the initial experience in American infants.

Methods: ETV/CPC was performed in 25 infants age <1yr over a period of 20 months. Criteria for success were normalization of head growth and stabilization or decrease in ventricular volume.

Results: Of 13 infants with post-hemorrhagic HC (PHH), 7 (mean corrected age 0.3m) failed and 6 (mean corrected age 4.4m) succeeded (mean follow up 18m, range 14-22m). ETV/CPC was successful in 4/5 (80%) of PHH infants age >3m and in 2/8 (25%) <3m at time of treatment. All 6 infants with myelomeningocele (MM) (mean age 5.6m) were successfully treated (mean follow up 13m, range 6-20m). 2/3 infants with congenital aqueduct stenosis were successful (mean follow up 11m, range 8-15m), as was 1/1 post-infectious HC (follow up 13m). ETV/CPC failed in 1 with Dandy-Walker malformation, and one with PF tumor when diffuse subarachnoid disease developed after 6m. Overall success was 15/25 (60%). There were no operative mortalities and no significant morbidity.

Conclusions: HC with MM appears to be the best indication for ETV/CPC in infants. Shunt dependence might be avoided in the majority with PHH if ETV/CPC is performed at >3m corrected age. Additional studies must determine any differences between ETV/CPC and shunting in regard to cognitive outcomes, quality of life, long-term morbidity, and the number of HC-related operations and cost of treatment over time.

2. Endoscopic Third Ventriculostomy Versus Cerebrospinal Fluid Shunt in the Treatment of Hydrocephalus in Children:

A Propensity Score Adjusted Analysis

Abhaya V. Kulkarni, MD, PhD; James M. Drake, MD, FRCS (Canada, Toronto); John RW Kestle, MD, FRCS (Salt Lake City, UT); Conor L. Mallucci, FRCS (United Kingdom, Liverpool); Spyros Sgouros, FRCS (United Kingdom, Birmingham); Shlomi Constantini, MD, MSc (Israel, Tel Aviv)

Introduction: Meaningful comparisons of ETV versus shunt are virtually non-existent in the literature, largely because the patient populations are so different: favorable factors (e.g., older age) are disproportionately represented in most ETV series. To address this, we used the statistical technique of propensity score (PS) matching (which balances patient selection criteria, such as age and etiology) in a large sample of children with hydrocephalus.

Methods: We analyzed previously collected data on children treated with ETV (N=489) and shunt (N=647). We built a logistic regression PS model, using age and etiology, to predict the probability that a patient would receive either ETV or shunt. We then matched ETV and shunt patients with identical PS, creating a sample that was perfectly balanced in age and etiology. Cox survival analysis was performed, with modeling of the hazard ratio over time.

Results: In the 216 perfectly matched pairs (432 total patients), 46.3% were <1 year old, 21.3% had aqueductal stenosis, and 18.5% were post-IVH. In Cox regression, the relative risk of failure appeared to be highly time-dependent. In the early post-operative period (<3 months), the risk of ETV failure was significantly higher than shunt failure. However, after this period, there was a relative survival benefit for ETV that appeared to be durable over time.

Conclusions: This analysis represents one of the first methodologically rigorous attempts to directly compare ETV and shunt in a large sample of highly similar patients. While shunts appear to have a lower risk of early failure, ETV appears to have superior long-term survival advantage.

3. Complications of Endoscopic Third Ventriculostomy in Previously Shunted Patients

Mark G. Hamilton, MD, FRCSC (Canada, Calgary); Robin Walker, BSC (Canada, U of Calgary); S. Terry Myles, MD, FRCSC (Canada, Calgary); Walter Hader, MD, FRCSC (Canada, U of Calgary)

Introduction: Endoscopic third ventriculostomy (ETV) is considered to be a safe and effective treatment for hydrocephalus in selected patients as an initial treatment for obstructive hydrocephalus and at the time of shunt malfunction in previously shunted patients. We compared the outcome and complications of ETV between patients with newly diagnosed hydrocephalus and those with a previous shunting procedure.

Methods: A retrospective review of patients undergoing ETV, from 1996-2004, at Alberta Children's Hospital and Foothills Medical Centre was completed.

Results: A total of 131 patients were identified with a minimum follow up of one year. Seventy-one of eighty-six patients (82.5%) who underwent ETV as a primary procedure and 36 of 45 (80%) of patients who had ETV at the time of shunt malfunction were shunt free at last follow up. Patients undergoing ETV less than one year old were more likely to require an additional procedure for control of their hydrocephalus ($p<0.01$). Serious complications after ETV occurred more frequently in patients that presented at the time of shunt malfunction (14/45, 31%) compared to patients undergoing primary ETV (7/86, 8%) ($p=0.02$).

Conclusions: ETV is an effective treatment in selected patients both with newly diagnosed hydrocephalus as well as in patients with a previous shunting procedure presenting with malfunction. Complications of ETV occur more frequently in previously shunted patients than in patients treated for newly diagnosed hydrocephalus and care must be taken in the selection and treatment of these patients.

4. Endoscopic Third Ventriculostomy in Patients with a Diminished Preoperative Interval

Mark M. Souweidane, MD (New York, NY); Sungkwon Kang, BS (Ithaca, NY); Jonathan Roth, MD (Israel, Tel-Aviv); Peter F. Morgenstern, BS (New York, NY)

Introduction: Successful fenestration of the floor of the third ventricle is critical to the success of endoscopic third ventriculostomy (ETV) in treating patients with noncommunicating hydrocephalus. A generous preoperative interval (PPI) is generally accepted as one anatomical feature that may affect the safety and functionality of ETV. Whether a diminished PPI affects the safety or success of ETV however has not been adequately assessed.

Methods: A review was conducted on the last 100 ETV procedures. From archived preoperative MRI scans, the PPI was measured between the dorsum sellae and the basilar artery. For any patient with an interval of < 1 mm, the technical and functional success of the procedure was recorded. Technical success was defined when a surgically created fenestration was accomplished without patient morbidity. Functional success was defined as the patient not needing any additional CSF diversionary procedure within 3 months after ETV.

Results: From the entire cohort, the PPI ranged from 0-8.5 mm (mean 2.9 mm). There were 14 procedures performed when the PPI was < 1 mm. In all 14 procedures, a standard fenestration was accomplished without morbidity or vascular injury. ETV was successful in 10 patients (71%). All 4 failures occurred in children that had surgery during infancy (mean age 7.5 months).

Conclusions: Patients with an obliterated or reduced PPI can safely undergo ETV. The functional success rate appears equivalent to historical controls. Most failures in this series may be attributed to other patient characteristics, namely young age at the time of ETV.

5. Treatment Of Complex Multiloculated Hydrocephalus in Infants and Children

Timothy M. Murphy, MB (St Louis, MO)

Introduction: Multiloculated hydrocephalus (MLH) is characterized by progressive enlargement of multiple, isolated intraventricular or periventricular cysts that typically communicate poorly with the ventricular system. Treatment of this condition is difficult, often requiring multiple surgical procedures. Herein, we describe our experience with MLH with emphasis on open and endoscopic fenestration.

Methods: A review of all open and endoscopic fenestration procedures for MLH at St. Louis Children's Hospital identified 24 patients over a 10 year period. Each of these 24 patients had multiple procedures, including shunt/shunt revisions, craniotomy and open fenestration, endoscopic fenestration, or some combination thereof.

Results: Patients were followed for an average 39 months after their initial fenestration procedure. These 24 patients had an average of 4 shunting procedures prior to their initial fenestration procedure (7 prior to open fenestration, 1 prior to endoscopic fenestration). 6 patients had both open and endoscopic treatments. Eleven patients initially underwent craniotomy and open fenestration; 13 patients had endoscopic fenestration as their first fenestration procedure. Median time to further CSF diversion procedures did not differ significantly between the two groups (open: 10 days; endoscopic: 9 days)

Conclusions: Treatment of multiloculated hydrocephalus is often difficult, requiring varying surgical strategies individualized to each patient. Both open and endoscopic fenestration appeared effective in minimizing the number of subsequent shunting procedures required. In general, open fenestration was employed for extensive MLH, where the severity of the condition was judged too complex to achieve adequate fenestration with an endoscopic technique.

6. The Hydrocephalus Clinical Research Network Quality Improvement Initiative

John Kestle, MD (Salt Lake City, UT); John Wellons, MD (Birmingham, AL); Jay Riva-Cambrin, MD (Salt Lake City, UT); Chevis Shannon, MBA (Birmingham, AL); Tracey Habrock-Bach, BS (Salt Lake City, UT); William Whitehead, MD; Sheila Nguyen, MS (Houston, TX); Abhaya Kulkarni, MD; Lindsay O'Connor, MS (Canada, Toronto); Tamara Simon, MD (Salt Lake City, UT)

Introduction: The Hydrocephalus Clinical Research Network (HCRN) is a new multicenter collaboration for investigation of hydrocephalus. The network has developed a quality monitoring/improvement (QI) process for shunt surgery to track shunt infection rates. Principles of QI methodology were adopted.

Methods: A series of specific steps to be followed consistently for shunt surgery were agreed upon. These included limiting OR traffic, a specific hand scrub and skin prep, IV Ancef prior to incision and one dose post op, injection of Vancomycin and Gentamycin into the shunt, and double gloving. Surgeon specific compliance with each step was monitored. Monthly infection rates were tracked. The protocol was adopted June 1, 2007 and analysis included patients with 3 months follow-up at abstract submission. Data from IRB approved centers were included. Shunt infection was defined as growth of organisms from cerebrospinal fluid (or blood for VA shunts), wound dehiscence or abdominal pseudocyst.

Results: 662 shunt operations were included; 32 of them have resulted in infection for a network infection rate of 4.8%. Overall compliance with the individual steps of the protocol exceeded 90%. Intersurgeon variation in infection rates was observed (1- 10%). Compliance was lowest for the injection of Vancomycin and Gentamycin into the shunt (ave 92%, 88 - 99) but did not appear to adversely affect infection rate.

Conclusions: Adherence to a standardized regimen for shunt surgery has achieved a low infection rate, allowed identification of areas for

improvement, allows surgeon/center specific feedback and establishes a common baseline for future interventional trials by the HCRN.

7. Inflammation Patterns in Experimental Neonatal Hydrocephalus

James P. McAllister, PhD; Jennifer Forsyth, MS; Kelley E. Deren, MS (Salt Lake City, UT)

Introduction: Hydrocephalus causes reactive astrocytosis and microgliosis throughout the brain but the global response of pro-inflammatory cytokines and chemokines is not known. Thus we sought to characterize known inflammatory markers in a neonatal model of obstructive hydrocephalus.

Methods: Intraventricular hydrocephalus was induced in one day old Sprague Dawley rats by intracisternal injections of kaolin; aged-matched controls received saline injections. MRI was employed to characterize ventriculomegaly, and animals were sacrificed on post-natal day 21. Tissue from the frontal cortex, parietal cortex, hippocampus, midbrain, and medulla was extracted. Quantitative polymerase chain reaction (qPCR) was performed to determine changes in mRNA expression of interleukin 6 (IL-6), tumor necrosis factor alpha (TNF alpha), glial fibrillary acidic protein (GFAP), and major histocompatibility complex class II (MHC II). Protein expression was also examined in these animals by Western blotting.

Results: A significant increase of GFAP, TNF alpha, and MHC II was seen in the frontal cortex while GFAP, MHC II, and IL-6 were increased in the parietal cortex. The midbrain exhibited a significant increase in GFAP, TNF alpha, and MHC II. In contrast, the medulla only showed an increase in MHC II.

Conclusions: These results suggest that severe hydrocephalus causes inflammatory changes in the cerebral cortex and midbrain which are probably a direct consequence of ventriculomegaly. Data from the medulla suggest that kaolin itself is not directly involved in a wide-spread inflammatory response. Characterizing the time course and association with ventricular volume will provide baseline data for future studies on pharmacological interventions.

8. Occult Intracranial Pressure Elevation in Cerebral Palsy Patients: A Study Using Codman Intracranial Pressure Monitoring Prior to Baclofen Pump Placement

Nirav J. Patel, MD; Bermans J. Iskandar, MD (Madison, WI)

Introduction: Implanting baclofen pumps into CP patients carries high morbidity, with CSF leak/infection being the most common complication. Albright, et al. postulated that the incidence of CSF leak correlates with occult hydrocephalus, and performed lumbar punctures prior to pump placement on patients with ventriculomegaly. 24-hour ICP monitoring has not been performed, and the prevalence of elevated ICP in patients without ventricular dilatation has not been assessed.

Methods: 63 baclofen pump procedures were performed in CP patients between 1999-2006. Twenty were first-time pump insertions without prior diagnosis of hydrocephalus. All 20 received preoperative craniospinal MRIs, and 18 of 20 underwent Codman ICP-monitoring for 24-48 hours. Patients with elevated ICP underwent VP shunt insertion prior to pump implantation.

Results: Patients' ages ranged from 4-48 years (median 18). Five of the 18 (28%) monitored patients had elevated ICP. The ventricles were large in 2, dysmorphic in 2, and normal in 1. Of the remaining 13 patients, the ventricles were large in 4, dysmorphic in 3, and normal in 6. Elevated ICP occurred in 25% of patients without ventriculomegaly and 33% of patients with ventriculomegaly.

Conclusions: The prevalence of occult ICP elevation in the cerebral palsy patient who presents for baclofen pump placement is significant. Although our results are biased by virtue of a small series, the significant complication rate seen with baclofen pump surgery calls for change, and it seems reasonable to recommend ICP investigation prior to

ORAL ABSTRACTS

pump placement. Since we began ICP monitoring prior to pump placement, we observed a virtual elimination of CSF leaks and infections.

9. Potential Compensatory Mechanisms in Experimental Neonatal Hydrocephalus

Kelley E. Deren, MS (Salt Lake City, UT); Joon W. Shim, PhD (Boston, MA); Jennifer Forsyth, MS; Osama Abdullah, MS; Edward Hsu, PhD (Salt Lake City, UT); Joseph R. Madsen, MD (Boston, MA); Marion L. Walker, MD; John RW Kestle, MD; James P. McAllister II, PhD (Salt Lake City, UT)

Introduction: Maintenance of brain homeostasis is a critical component in the pathophysiology of hydrocephalus. In particular, vascular homeostasis, blood-brain barrier function, and water absorption mechanisms have recently been shown to be altered in clinical and experimental hydrocephalus, possibly reflecting compensatory mechanisms. However, these changes have not been elucidated in neonatal forms of hydrocephalus. Therefore, the present study sought to test the hypothesis that vascular growth factors, membrane water channels, and reactive gliosis will increase during the progression of hydrocephalus and decrease after ventricular shunting.

Methods: Intraventricular (obstructive) hydrocephalus was induced in rats on postnatal day 1 by intracisternal injections of kaolin, and severe ventriculomegaly developed over a three week period. MRI was performed to quantify ventriculomegaly on post-kaolin day 10, prior to shunt insertion and at sacrifice on postnatal day 21. Tissue from the cerebral cortex and hippocampus was processed for immunohistochemistry and quantitative real time reverse transcriptase polymerase chain reaction (qRT-PCR), using markers for vascular endothelial growth factor (VEGF), VEGF receptor 2 (VEGFR2), Aquaporin-4 (Aq4), glial fibrillary acidic protein (GFAP), and ionized calcium binding adaptor molecule 1 (IBA-1).

Results: In non-shunted hydrocephalic animals, preliminary qRT-PCR results indicate that GFAP, VEGF, VEGFR2, and Aq4 increased significantly 2-fold, 4-fold, 8-fold, and 15-fold, respectively in the parietal cortex at 21 days post-kaolin. Immunohistochemistry reflects similar increases in astrocytes (GFAP) and microglia (IBA-1) throughout the cortex and hippocampus. Data from shunted animals is forthcoming.

Conclusions: These findings suggest that vascular proliferation, modulation of water channels, and gliosis occurs in untreated neonatal hydrocephalus.

10. A Longitudinal Comparison of Pre- And Post-operative Dti Parameters in Young Hydrocephalic Children

Ellen L. Air, MD; Weihong Yuan, PhD; Scott K. Holland, PhD; Blaise V. Jones, MD; Karin Bierbrauer, MD; Francesco T. Mangano, DO (Cincinnati, OH)

Introduction: The present study longitudinally compares the integrity of white matter before and after shunting using diffusion tensor imaging (DTI) in young hydrocephalic children.

Methods: We identified nine hydrocephalic children (Age at surgery = 14.03 +/- 20.61 months) who underwent both pre-op and post-op DTI scans. Fractional anisotropy (FA) was computed in the genu of the corpus callosum (gCC) and the posterior limb of the internal capsule (PLIC). The FA value is classified into three sub-categories: normal, abnormally low, or abnormally high, based on the comparison to normal results from age-matched healthy children.

Results: In gCC, 6/9 children had abnormally low pre-operative FA values, 5 of which normalized post-operatively. All 3/9 children who had normal pre-operative FA value also had normal FA value post-op as well. In PLIC, 4/9 children had abnormally high FA values, three of which normalized post-operatively, while the other one had abnormally low post-operative FA. The remaining 5/9 children all had normal pre-op FA value but two of them became abnormally low post-

operatively. When comparing the pre-surgery frequency of abnormally low, normal, and abnormally high FA values to those post-surgery, there was a statistically significant longitudinal difference in both gCC ($p < 0.05$) and PLIC ($p < 0.02$).

Conclusions: This pilot longitudinal DTI study of young hydrocephalic children suggests that DTI anisotropy may be sensitive to both pre- and post-surgical changes in white matter. Further investigations will be targeted at understanding whether DTI after shunt surgery correlates with relief of symptoms and is predictive of WM recovery in hydrocephalic children.

11. Diffusion Tensor Imaging of Experimental Neonatal Hydrocephalus

Francesco T. Mangano, DO; Ahmed Shereen, BS; Diana M. Lindquist, PhD; Weihong Yuan Yuan, PhD; Kelley E. Deren, MS; Scott Holland K. Holland, PhD (Cincinnati, OH); James P. McAllister II, PhD (Salt Lake City, UT)

Introduction: Diffusion tensor imaging (DTI) is an advanced MRI technique used clinically to quantify white matter (WM) abnormalities in various pathologic conditions. The present study used DTI to evaluate the WM integrity in a rat model of neonatal hydrocephalus.

Methods: Obstructive hydrocephalus was induced by intracisternal kaolin injection at postnatal day 1 (P1) and compared to saline-injected controls. Animals were sacrificed at P21 and imaged ex vivo with a Bruker 7T MRI scanner. DTI was acquired in 6 directions. Fractional anisotropy (FA) values were computed in the genu of the corpus callosum (gCC), external capsule (EC), and internal capsule (IC) bilaterally. Inter-subject difference was tested for statistical significance using t-test based on the mean and standard deviation of FA values in each region of interest

Results: By P21, kaolin injected animals exhibited severe ventriculomegaly with extreme thinning and stretching of the IC. FA values were significantly reduced in the gCC and increased in the left IC, as well as the left and right EC ($p < 0.0001$) in hydrocephalus. The FA was also elevated in the right IC, but not significantly.

Conclusions: These results demonstrate the feasibility of applying DTI to study hydrocephalus in rats. The reduction in FA with hydrocephalus suggests structural and physiological impairments in the CC and IC. The findings correlate with our previous observations in hydrocephalic children. The non-invasive objective characterization of WM damage demonstrated using this model will establish DTI as an important tool in the assessment and management of hydrocephalus in both basic research and clinical application.

12. Amyloid-beta Clearance in Experimental Neonatal Hydrocephalus

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Introduction: Cerebrospinal fluid (CSF) flow impairments in hydrocephalus can affect the clearance of toxic substances from the brain. Since Amyloid-beta (AB) can cause dementia in normal pressure hydrocephalus (NPH) and Alzheimer's disease (AD), we hypothesized that impaired clearance of AB occurs in the neonatal hydrocephalic brain with accompanying alterations in its transporters; lipoprotein receptor-related protein-1 (LRP-1) and receptor for advanced glycation end products (RAGE). Furthermore, since correlations exist between glia and AB in NPH and AD, we hypothesized that astroglial changes would also occur in pediatric hydrocephalus. Therefore, we investigated changes in AB, LRP-1, RAGE, and astrocytes as ventriculomegaly progressed in a neonatal model of intraventricular hydrocephalus.

Methods: Hydrocephalus was induced in rats by intracisternal kaolin injection on postnatal day one, and severe ventriculomegaly developed over a three week period. Saline-injected and adult animals served as sham and aged controls, respectively. MRI was performed on post-injection days 10 and 21 to document ventriculomegaly. Animals were sacrificed on day 21 and the cortex and hippocampus were analyzed with immunohistochemistry and real time RT-PCR.

Results: Levels of AB, RAGE, and LRP-1 were substantially lower than those seen in aged animals; however, GFAP expression was elevated. Compared to age-matched controls, the young hydrocephalic animals exhibited no changes in AB, LRP-1, and RAGE, but GFAP was increased.

Conclusions: Minimal expression of these proteins could be attributed to the severity of hydrocephalus, under-developed clearance mechanisms in the young models, or metabolic impairments causing changes in the LRP-1 and RAGE receptors.

13. Claudin 6 is a Positive Marker for Atypical Teratoid / Rhabdoid Tumors of the Central Nervous System

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Introduction: Atypical teratoid/rhabdoid tumors (AT/RTs) are aggressive malignant central nervous system tumors of early childhood. Definitive histopathological diagnosis can be challenging and currently relies largely on immunohistochemical demonstration of loss of the INI1 protein in tumor cell nuclei. However, loss of INI1 is not completely unique to AT/RTs. We sought to elucidate additional molecular diagnostic features of AT/RTs.

Methods: 127 pediatric and adult brain tumor samples and 67 normal brain samples were analyzed for gene expression using Affymetrix U133Plus2 GeneChip microarrays. These arrays measure the expression of over 54,000 probesets, including all known human genes. The tumor samples analyzed included nine AT/RTs, as well as glioblastoma, medulloblastoma, pependymoma, pilocytic astrocytoma, rhabdomyosarcoma, and meningioma. The resulting data were examined for genes showing positive expression in AT/RTs versus little to no expression in the other tumor samples.

Results: Claudin 6, a key component of tight junctions, demonstrated very little overlap in expression levels between AT/RTs and other tumors or normal brain. Claudin 6 levels were >38 fold higher in AT/RTs versus all other tumors, and also versus normal samples. Immunohistochemical staining of 35 tumor specimens showed positive membrane staining for Claudin 6 in five of six AT/RTs, and was negative in 28 of 29 other brain tumor samples. The protein staining results closely matched the level of mRNA expression detected by microarray.

Conclusions: The combination of INI1 as a negative marker and Claudin 6 as a positive marker may be useful in further defining AT/RTs for diagnostic purposes.

14. Intraoperative and Postoperative Risk Factors for Post-Resection Hydrocephalus in Children with Posterior Fossa Tumors

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Introduction: The authors have previously developed and validated the Canadian Preoperative Prediction Rule for Hydrocephalus (CPPRH); a prediction rule for post-resection hydrocephalus for pediatric posterior fossa patients. However, intra-operative and postoperative risk factors were not evaluated in this study nor have they been accurately delineated and analyzed in a meticulous multivariate manner previously.

Methods: The previous two datasets of children with posterior fossa tumors from 1989-2003 from Toronto (n=343) and Vancouver (n=111) were combined into one large cohort (n=454). Intra-operative (ex. surgeon and dural closure) and postoperative (ex. CSF leak and bacterial meningitis) risk factors were analyzed both in a univariate and multivariate fashion with the latter including the preoperative CPPRH for context.

Results: Significant risk factors for post-resection hydrocephalus included the preoperative CPPRH (OR- 5.8 [3.0-11.2]), intra-operative hemorrhage (OR- 2.1 [1.2-3.5]), non-gross total tumor excision (OR- 4.3 [2.0-9.1]), non-closure of dura (OR- 3.1 [1.7-5.9]), postoperative pseudomeningocele (OR- 2.7 [1.6-4.5]), and postoperative bacterial meningitis (OR- 3.8 [1.5-9.6]). The two centers' shunting rates were significantly different: 31.2% (Toronto) versus 19.8% (Vancouver), and could have been accounted for by lower rates of dural closure, higher rates of postoperative pseudomeningocele, and higher rates of bacterial meningitis in the Toronto cohort.

Conclusions: Intra and post operative factors may be very important in the incidence of postoperative hydrocephalus. Careful dural closure is an easily modifiable factor which may reduce its incidence which will hopefully act downstream to prevent pseudomeningoceles and bacterial meningitis rates; which are also independent risk factors.

15. Medulloblastoma Growth Enhancement by Hgf/sf Expression in Cerebellar Neural Progenitor Cells is Suppressed by Systemic Antibody Treatment

Toba Niazi, MD; Carolyn A. Pedone, MS; Daniel W. Fufts, MD (Salt Lake City, UT)

Introduction: Aggressive, multimodality treatment of medulloblastomas results in five-year survival rates >80%, depending upon clinical risk factors. Treatment-related neurotoxicity has created a need to identify signaling molecules that can be targeted therapeutically to maximize tumor growth suppression and minimize collateral neurological injury. Studies of human medulloblastoma cells in culture and in murine xenografts demonstrate that hepatocyte growth factor (HGF) activates cell signaling, promoting the growth of medulloblastomas and making it a potential treatment target. HGF is highly expressed in human medulloblastomas, and elevated levels predict an unfavorable prognosis for patients.

Methods: We modeled the ability of HGF to induce medulloblastomas in vivo in mice using a version of the RCAS/tv-a system that allows gene transfer to cerebellar neural progenitors during their postnatal expansion phase when these cells are highly susceptible to mutations.

Results: We found a high frequency of medulloblastoma formation in mice after postnatal expression of HGF in cooperation with Shh (78%) versus Shh alone (39%, P=0.0003). Some tumors showed neurocytic differentiation similar to human medulloblastomas with activated Hedgehog signaling. In a survival study, we injected mice with RCAS-Shh and RCAS-HGF and treated them with either a systemic monoclonal antibody against HGF or an isotype-matched control monoclonal antibody. Kaplan-Meier analysis after 120 days demonstrated a survival advantage in the anti-HGF antibody versus the controls (>120 days versus 73.5 days, P=0.04).

Conclusions: These findings indicate a role for HGF in medulloblastoma initiation and growth and demonstrate, for the first time, efficacy of HGF-targeted therapy in an endogenous mouse model.

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16. The Incidence of Pineal Cysts in the Pediatric Population

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Introduction: Pineal cysts are a frequent incidental finding in radiographic imaging. In the adult population, the incidence of pineal cysts is estimated to be 1.1-2.6%. However, within the pediatric population the incidence is not well established.

Methods: We retrospectively reviewed a consecutive series of 10,821 children who underwent brain magnetic resonance imaging at a single institution over an eleven-year period. In patients identified with pineal cysts, we analyzed the images according to maximum size, signal characteristics, enhancement pattern, and evidence of local mass effect. Patients with follow-up imaging were identified, and the images were analyzed and compared. In patients with cysts, patient characteristics including demographics, symptoms, and other diagnoses were collected. The data were evaluated using univariate and multivariate logistic regression, linear regression, and Fisher's exact test and stratified based upon demographic and cyst characteristics

Results: We identified 239 pineal region cysts (2.2%). The mean age at the time of MRI for patients with pineal cysts was 8.8 years (+/-5.1 years). The incidence of pineal cysts was 1.7% in males (99 cysts in 5815 MRIs) and 2.86% in females (140 cysts in 5006 MRIs). Both female gender, $p=0.001$, and increasing age, $p<0.001$, were each independently correlated with a significantly increased incidence of pineal cysts. Increasing age was associated with a significantly greater incidence of larger cysts.

Conclusions: Pineal cysts are common in the pediatric population, with an increased incidence in girls and in older children.

17. The Role of Surgery in the Management of Optic Pathway Gliomas

Linda W. Xu, BS; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: Management of symptomatic optic pathway tumors is controversial. While gross total resection is not possible, some have advocated aggressive resection to improve outcome. The present study examines the effect of resection on outcome.

Methods: 33 patients were identified under an IRB approved protocol. 22 tumors were identified as pilocytic astrocytomas, 5 were plain astrocytomas, 4 were low-grade gliomas, and 2 were anaplastic astrocytomas. Presenting signs and symptoms included: visual symptoms (25 patients), motor abnormalities (10 pts), signs of elevated intracranial pressure (10 pts), neurofibromatosis (4 pts), and diencephalic syndrome (2 pts). Surgical indications included: diagnostic uncertainty on conventional imaging, tumor mass effect, and obstructive hydrocephalus. Biopsy was performed in 6 cases, <90% resection in 20 cases, and >90% resection in 7 cases. 20 patients received chemotherapy alone, 1 received radiation therapy alone, and 3 received both. Average time to follow up was 55 months.

Results: Average progression free survival (PFS) was 32 months. Factors associated with PFS included older age (23 month survival if under 2 years of age, 36 months if older) and the absence of preoperative hydrocephalus (28 vs 36 months). Anaplastic astrocytomas are associated with decreased PFS (8 vs 35 months). >90% resection was associated with longer PFS (58 vs 28 months). Aggressive resection improved visual and motor symptoms, but did not alter endocrine outcomes. Chemotherapy and radiation therapy were not shown to have a prolongation of PFS.

Conclusions: A greater than 90% resection of optic pathway gliomas may be associated with improved outcome.

18. Magnetic Resonance Imaging Surveillance in Cerebellar Low Grade Astrocytomas

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Introduction: Low grade astrocytomas are considered the second most common cerebellar tumor in children. These tumors can usually be completely excised and rarely recur. Despite this, surveillance brain MRIs are frequently performed and are usually negative.

Methods: The charts of 339 patients who underwent brain tumor surgery at the Children's Hospital of Eastern Ontario between 1987 and 2007 were retrospectively reviewed.

Results: 1995 brain MRIs were performed on the 339 patients. There were 121 patients with cerebellar tumors, of which 74 had MRIs. Of these, 15 had a histological diagnosis of cerebellar pilocytic astrocytoma and 13 were classified as either grade I or grade II (low grade) astrocytoma. The 28 patients had 34 surgeries, of which 23 were complete excisions and 11 were subtotal. There were 167 surveillance MRIs in the complete excision group and all were negative for recurrent tumor. There were 43 surveillance MRIs in the subtotal excision group. One of these patients went on to have a complete excision and 10 were followed: 7 had a small stable residual tumor that remained unchanged (longest follow-up was 6.5 years), one tumor regressed and two increased in size and required further surgery.

Conclusions: Children with cerebellar low grade astrocytomas that have had complete excisions do not require frequent MRI surveillance since the probability of recurrence is low. After the post-operative MRI, subsequent studies may be performed at 1, 3 and 5 years, or even less frequently. Patients with subtotal excisions, however, require closer MRI surveillance, even though 70% of small residual tumors remain stable.

19. Application of Intra-operative Magnet Resonance Imaging in Pediatric Neurosurgery

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Introduction: Over the last decade, the use of intra-operative magnetic resonance (iMR) imaging in the pediatric neurosurgical population has increasingly become accepted as an innovative and important neurosurgical tool. We summarize our experience with a 1.5-Tesla iMR mobile scanner with integrated neuronavigation.

Methods: A database has been maintained prospectively for this patient population. Ethics approval was obtained to review hospital charts and imaging results.

Results: This review identified 104 procedures performed in 97 children (49 male, 48 female) from March 1998 to April 2008. The median age at surgery was 12 years (4 months to 17 years). Ninety-nine intracranial and 5 spinal procedures were performed. All patients received preoperative and postoperative scans. There were 62 procedures for the resection of neoplastic lesions. Intra-dissection scans were performed during 84% of these surgeries to assess extent of resection with 42% undergoing additional surgery. There were 25 procedures for the treatment of epilepsy. Seven surgeries were for cavernoma and 4 for AVM.

Conclusions: Incorporation of iMR imaging into Pediatric Neurosurgery practice has been an important development. This innovative technology provides, at minimum capability, a means of quality assurance at the end of a neurosurgical operation. Its potential is greatest when it's high quality imaging ability is coupled with its superior neuronavigation capabilities. This allows for the

ability to track the extent of resection of tumors and other lesions during the surgical procedure, and provides for the opportunity to perform less invasive surgical exposures. The application of this technology to other pediatric neurosurgical disorders should be explored.

20. Gangliogliomas: Long-term Follow-up And Role of Radiotherapy, Mayo Clinic Experience

Julia J. Walker; David A. Schomas, MD; Fredric B. Meyer, MD; Nadia N. Laack, MD (Rochester, MN)

Introduction: We report our experience of 89 patients with gangliogliomas, their long term follow-up and the role of radiotherapy (RT) after subtotal resection (STR).

Methods: 89 patients with gangliogliomas diagnosed between 1970 and 2007 were reviewed. Data on clinical outcomes, and therapy received were analyzed. The Kaplan-Meier method was used to estimate progression free survival (PFS), and overall survival (OS).

Results: The median age at diagnosis was 19 years. The median potential follow-up as of June 2008 was 142 months (range 9 to 416 months). The 15-year OS was 94% while the median PFS was 5.6 years with a 10-year PFS of 37%. The PFS was dramatically impacted by GTR versus STR / biopsy alone ($p < 0.001$). 38 of 57 GTRs were temporal lobe tumors. 4 of 25 patients that underwent STR received RT, while 2 of 8 undergoing biopsy alone received RT. Post-operative RT resulted in a trend for improvement in PFS for these 33 patients undergoing <GTR with medians of 5.6 and 1.1 years, respectively ($p = 0.4$).

Conclusions: This single institution retrospective series of patients with gangliogliomas is unique given its large cohort size with long potential follow up and confirms the importance of GTR on likelihood of recurrence. Patients undergoing STR or biopsy have poor PFS. RT for these patients appears to improve PFS outcomes. This data suggests that patients with STR or biopsy may benefit from post-operative RT.

21. Bone Fiducial Markers for Fractionated Proton Beam Irradiation in Pediatric Cns Tumors: A Technical Report

Philipp R. Aldana, MD; Sameer Keole, MD; Teresa MacGregor, ARNP; Hector E. James, MD (Jacksonville, FL)

Introduction: Fiducial markers (FM) have been used in enhancing the accuracy of radiation therapy in non-central nervous system (CNS) tumors. Recently, image guidance with FM has been used in fractionated proton beam radiation therapy (FPBRT) for CNS tumors to improve accuracy. We describe a technique of placement of radio-opaque markers in children undergoing FPBRT for CNS tumors.

Methods: Records of patients undergoing FM placement for FPBRT were reviewed. Details of their tumor treatment, indications and technique of FM placement, and perioperative care were examined.

Results: 10 children, ages 4-16 years, underwent FM placement. Primary pathology was supratentorial in 5, infratentorial in 4 and one spinal. FPBRT is an option on nearly all Children's Oncology Group (COG) studies calling for radiation therapy and patients were treated on or per COG protocol. Nine patients for cranial irradiation had FM (titanium screws) placement in bilateral frontal and parietal bones. Non-colinear placement of cranial FMs is essential, to avoid superimposition of FMs on opposite sides during orthogonal xray images for targeting. 3 patients requiring spinal FPBRT had FM placement into 2-3 thoracic and lumbar spinous processes. Almost all patients were discharged on the same day with no surgery related complications.

Conclusions: FM implantation to aid the accuracy of FPBRT delivery requires placement of 4 non-co-linear titanium screws in the cranium. For spinal radiotherapy, FMs are implanted into spinous

processes. This simple, safe and short procedure can be performed at the patient's parent institution prior to treatment at specialized FPBRT centers.

22. Endoscopic Endonasal Approach in the Pediatric Population - The University of Pittsburgh Experience

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Introduction: The role of endoscopic endonasal approaches in neurosurgery has rapidly expanded, especially over the past ten years. Lesions beyond the pituitary fossa are now accessible as technology and visualization have improved. These improvements have led to an increased role of endoscopic endonasal surgery in the pediatric population.

Methods: We reviewed our experience of our initial 700 endoscopic endonasal approaches.

Results: Sixty-one pediatric patients underwent an endoscopic endonasal approach. The mean age was 14 (range 3-20). The various approaches included trans-sellar (34.4%); anterior skull base (21%); trans-clival (16.3%); coronal plane approaches (14.3%); sinus/orbit (13.1%). The most common pathologies were nasal angiofibroma (21%), pituitary adenoma (16.3%) and Rathke's cleft cysts (13%). There were no permanent neurologic complications, no deaths and only 2 temporary neurologic complications that ultimately resolved completely. Four patients had a CSF leak and one patient experienced meningitis post operatively.

Conclusions: The endoscopic endonasal approach can be used in the pediatric population to access a variety of skull base regions and to treat a variety of pathologies with a low morbidity. This data reflects our initial experience with 700 cases. We currently have performed over 1100 endonasal cases which include more than 100 pediatric cases. We are currently collecting and reviewing the additional cases and plan to present this updated data of over 100 pediatric cases.

23. Suboccipital Decompression for Chiari I Malformation: Outcome Comparison Of Duraplasty With Expanded Polytetrafluoroethylene Dural Substitute Versus Pericranial Autograft

Frank J. Attenello, MS; Vivek Mehta, BS; Giannina L. Garcés-Ambrossi, BS; Kaisorn L. Chaichana, MD; Edward Ahn, MD; Benjamin S. Carson, MD (Baltimore, MD); George I. Jallo, MD

Introduction: Treatment failure for Chiari decompression is frequently associated with scarring, intradural adhesions, and recurrent loss of hindbrain space. While autograft has been our standard for hindbrain duraplasty, we investigated whether introducing anti-adhesive synthetic GORE PRECLUDE® MVP® Dura Substitute (ePTFE graft) was associated with improved outcomes.

Methods: We retrospectively reviewed records of patients undergoing first-time suboccipital decompression/duraplasty for Chiari-I malformation utilizing ePTFE graft or pericranial autograft. MRI at last follow-up was assessed for: 1) recurrent loss of dorsal hindbrain CSF space/CSF flow (cine-MR) at duraplasty site (Figure 1), 2) pseudomeningocele, or 3) syringomyelia improvement. Symptom recurrence warranting revision surgery was compared between cohorts.

Results: Sixty-seven patients (age: 11 ± 5 years) underwent duraplasty with pericranial autograft ($n=40$) or ePTFE graft ($n=27$). Peri-operative morbidity did not differ between cohorts, Table 1. No patients receiving ePTFE graft experienced incisional CSF leak, surgical site infection, or symptomatic pseudomeningocele. At median eight months postoperatively, all (100%) patients with ePTFE graft maintained physiological CSF flow/decompressed hindbrain

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CSF space on cine-MRI versus 32(79%) patients receiving pericranial autograft($p<0.05$). Radiographic syrinx improvement occurred in 80% of patients with ePTFE graft and 52% of patients with pericranial autograft (median time to improvement: 5 vs 12 months respectively, $p<0.05$),Figure 2. At median 16 months postoperatively, 4(10%) patients with pericranial autograft required revision decompression versus 0(0%) patients with ePTFE graft ($p=0.090$).

Conclusions: Duraplasty utilizing ePTFE graft was associated with improved maintenance of hindbrain space, accelerated syringomyelia improvement, and a trend towards decreased treatment failure versus pericranial autograft. Future studies of long-term outcome are warranted to confirm observed effects. Synthetic ePTFE graft is a safe alternative for duraplasty in Chiari malformation.

24. New Findings in Children with Achondroplasia: Dynamic Cervicomedullary Cord Compression and Alterations in Csf Dynamics

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Introduction: Previous studies on children with achondroplasia have focused on static magnetic resonance imaging (MRI) to assess for cervicomedullary compression. We identified a subset of achondroplasia patients who presented with alterations in cerebrospinal fluid (CSF) dynamics and cord compression on flexion/extension cine phase-contrast MRI that were not evident on neutral MRI studies.

Methods: Fourteen achondroplasia patients (mean age 40 months; 11 females, 3 males) underwent pre/post-treatment cine phase-contrast MRI in neutral, flexion, and extension along with polysomnography studies. Pre- and post-treatment measurements were made on sagittal digital images including: 1) the spinal canal and 2) spinal cord diameter at the cervicomedullary junction in neutral, flexion, and extension, and 3) the C1-C2 anterior ligamentous complex thickness in neutral, flexion, and extension.

Results: Thirteen patients demonstrated none to moderate cervicomedullary stenosis in neutral and extension, but had a 28.6% decrease in mean canal diameter ($p=.001$) and a 13% decrease in mean cord diameter ($p=.01$) on flexion. There was a 30.1% increase in thickness of the C1-C2 anterior ligamentous complex on flexion ($p=0.001$). These 13 patients underwent surgical decompression. In the surgical group, post-operative cine MRI studies demonstrated improved CSF flow in flexion and extension. Sleep studies demonstrated moderate to excellent improvement of apnea. At follow-up (mean time 19 months), all patients reported significant improvement in pre-operative symptom.

Conclusions: there is a risk for dynamic cord compression and obstruction of CSF flow at the skull base in children with achondroplasia that may constitute an indication for surgical decompression. This phenomenon may be due to bowing of the C1-C2 anterior ligamentous complex. Cine-phase contrast MRI studies in flexion/extension is a useful tool in evaluating possible cervicomedullary compression in symptomatic achondroplasia patients who present with an otherwise unremarkable MRI study.

25. Surgical Management of Pediatric Tethered Cord Syndrome with and Without Duraplasty: Neurological Outcome and Incidence of Retethering After 115 Consecutive Cases

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Introduction: Neurological outcomes and retethering rates after first-time pediatric tethered cord release (pTCR) are incompletely understood. Large pediatric series are sparse in the literature. To clarify the incidence, time-course, and factors associated with neurological improvement and retethering, we reviewed our 10-year pTCR experience.

Methods: We reviewed 115 consecutive pTCR. Incidences of post-operative motor, pain, and urinary improvement, and symptomatic re-tethering were evaluated via Kaplan-Meier. We assessed factors associated with neurological improvement and retethering.

Results: Mean age was 5.8 ± 4.9 years. Etiology included 21(18%) lipomyelomeningocele, 26(23%) fatty filum, 19(17%) lumbosacral lipoma, 6(5%) intra-dural tumor, 5(4%) split cord malformation, 2(2%) previous lipomyelomeningocele repair, and 36(31%) previous myelomeningocele repair. By 18 months post-operatively, 74% of patients improved urinary symptoms, 75% improved lower-extremity weakness and gait, and 92% decreased painful dysesthesias. Patients with asymmetric lower-extremity weakness ($p=0.045$, HR=1.9) or perineal sensory dysfunction ($p=0.013$, HR=4.7) were most likely to experience improvement in motor and pain ($p=0.049$, HR=3.03). Thirty (26%) patients experienced re-tethering (median=31 months post-operatively). Patients with fatty filum were least likely to experience retethering ($p=0.039$, HR=0.122). Duraplasty was not associated with retethering.

Conclusions: untethering is associated with improvement in motor, sensory, and urinary dysfunction in the vast majority of patients by 6 months post-operatively. Pain resolution occurred first, followed by urinary or motor improvement. Patients presenting with perineal sensory dysfunction or asymmetric lower-extremity weakness were likely to improve, and patients with fatty-filum were unlikely to re-tether. We found no difference in rates of retethering with duraplasty. Untethering for symptomatic tethered cord in the pediatric population is safe and effective. Prospective trials are needed to further evaluate outcome after retethering; however, this retrospective study will be useful in evaluating patient populations and managing post-operative expectations.

26. What is the State of the Art in Neural Tube Defect Research in 2008?

Timothy M. George, MD, FACS; John Wallingford, PhD (Austin, TX)

Introduction: There is still a critical lack of knowledge in the formation, regulation and potential treatment targets for defects of the neural tube. Many different lines of research are being performed to help answer these questions. This paper will address the current state of the art of research.

Methods: There are four major areas of research in neural tube defects. 1. Identification of candidate genes; 2. Regulation of gene expression, protein structure, and metabolic pathways; 3. Study of cellular morphogenesis and inductive interactions; 4. Human population studies searching for candidate genes and the effects of dietary supplementation.

Results: Most recent experimental data has begun to identify two main themes. First, defects of the nervous system have to be studied in conjunction with defects affecting other organ systems to truly understand mechanisms of development. Second, gene regulation, gene-gene interactions and regulators of metabolic pathways may be more important than identifying a single gene mutation in NTD.

Conclusions: The current knowledge in neural tube development and malformations has become more complex requiring a constant reappraisal of the multiple disciplines involved in neural tube defect research.

27. A Novel Adult Rat Model of Tethered Spinal Cord

Michael H. Handler, MD; Brian Callahan, MD; Kim Ellison, BA; Stephen J. Davies, PhD (Aurora, CO)

Introduction: Tethering of the spinal cord after operation is a common occurrence. As there have been no well documented studies scarring of the cord to dura, we have developed a rat model of this process.

Methods: In 20 adult female Sprague Dawley rats, laminectomy was performed at the C4 level, and a durotomy performed with micro-scissors. A 30 gauge needle was lightly applied to disrupt the pial surface of the cord, and the dura sutured. Rats were euthanized at 10 (n=7 rats), 20 (n=4) and 30 days (n=9) for evidence of scarring by histology and immuno-histochemistry.

Results: By 10 days, there was evidence of robust scarring between the cord and dura, which increased over time. Immuno-histology revealed an adhesion of the fibronectin+ dura matter to the surface of the dorsal columns that was co-incident with a breakdown of the GFAP+ pial surface, an accumulation of activated OX42+ microglia / macrophages and reactive GFAP+ astrocytes with within adjacent white matter. Spinal cords at 20 and 30 days post surgery displayed increasing numbers of invading NG2+ / fibronectin+ leptomeningeal fibroblasts within white matter at sites of dural adhesion and a progressive increase in astrogliosis that extended away from the pial surface. Von Frey and Hotplate tests at 30 days post surgery showed robust increases in mechanical allodynia and thermal hyperalgesia respectively compared to controls.

Conclusions: This new model of post-operative cord tethering provides an experimental platform to test interventions to block dural adhesion and diminish neuropathic pain.

28. Chiari I Malformations In A Pediatric Population

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Introduction: Chiari I malformation (CM1) is defined by protrusion of cerebellar tonsils = 5mm below the foramen magnum. It can cause headaches and other neurologic symptoms although some patients are asymptomatic. The natural history of CM1 in children remains unclear.

Methods: In this retrospective cohort study, we searched radiology reports from all head and spine MRI scans (n=5248) performed on 741,815 children (0-19 years) within Kaiser Northern California from January 1997 to December 1998. We reviewed medical records to determine clinical and radiographic predictors of headache and neurologic symptoms defined as moderate to severe headache, neck pain, vertigo or ataxia.

Results: The 51 patients identified with CM1 represented 1% of children who had MRI scans performed during the study period. Headache (55%) and neck pain (12%) were the most common presenting symptoms. Of 19 (37%) patients who were asymptomatic at the time of diagnosis, three developed headaches during a mean follow-up of 6.4 years. Syringomyelia was present in six (12%) patients at time of initial diagnosis; no new syrinxes developed during follow-up. Older age at time of diagnosis was associated with increased risk of headache (OR 1.3, 95% CI 1.1-1.5) and significant neurologic symptoms (OR 1.2, 95% CI 1.04-1.4). Radiographic features were not predictive of clinical symptoms. Seven of 8

children who underwent surgery demonstrated either resolution of headaches or decreased size of syrinx.

Conclusions: While CM1 is an under-recognized cause of headaches in children, the diagnosis of CM1 is also made in asymptomatic patients. Larger studies are needed to better define the natural history.

29. En Bloc Fronto-orbital Advancement for Coronal and Metopic Synostosis

Raphael Guzman, MD; Joseph Looby, DMD, MD; Stephen A. Schendel, DMD, MD; Michael S.B. Edwards, MD (Stanford, CA)

Introduction: Fronto-orbital advancement for the correction of metopic and coronal synostosis involves reshaping of the supraorbital bar and the forehead. We describe our experience with a modification of the anterior cranioplasty procedure.

Methods: During the period 2004-2008 we performed 226 cranosynostosis surgeries. Out of those 51 underwent a "en-bloc" bilateral fronto-temporal craniotomy, bilateral osteotomies of the orbital roof and bilateral temporal osteotomies for reshaping of temporal region. Contouring of the frontal bone and bandeau is performed to achieve good symmetry regardless of single or multiple synostosis. This two-piece fronto-orbital reconstruct is kept in advanced position with resorbable plates and screws. One plate is used to secure the bandeau to the fronto-temporal bone flap, 2 plates are used to secure the zygomaticofrontal portion of the bandeau to the reshaped temporal fossa bilaterally. This technique was applied in 17 patients with metopic, 15 unilateral and 13 bilateral coronal and 6 multiple cranial synostosis.

Results: The mean age at surgery was 8.2 months (2-38 months). The mean operative time was 213 minutes, the average blood loss 170cc and the average transfusion 137cc. The median length of hospital stay was 4 days. There were no adverse events with permanent deficits; one patient had a distraction hardware failure and one patient a pneumothorax after central line placement, leading to a minor overall morbidity of 3.9%.

Conclusions: Reshaping of the orbito-frontal complex in a two-piece fashion led to a decrease in operative time, blood loss and amount of internal fixation. Excellent early postoperative and long term results are achieved.

30. Children Presenting with Acute Neurologic Deficits and Type I Chiari Malformation

Alex Powers, MD; Matthew Callen, PA-C, MS; David Limbrick, MD, PhD; T.S. Park, MD; Jeffrey Leonard, MD; Matthew Smyth, MD (St. Louis, MO)

Introduction: A subset of patients with type I Chiari malformation (CM-I) present with the acute onset of a neurologic deficit. Herein the authors summarize their experience with these patients' clinical presentation, imaging, timing of surgery, and outcome following decompression.

Methods: We reviewed clinical records, imaging studies, and operative notes from all patients undergoing posterior fossa decompression for CM-I at St. Louis Children's Hospital from 1990 to 2008. Of the 189 patients who had surgery, six were identified with the acute onset of a neurologic deficit at presentation.

Results: All six children (Ages 10-15, M:F 2:4) had syringomyelia and CM-I on initial MRI. Three presented after suffering a minor trauma, while three had no clear inciting event. Decompression was performed 13.2 ± 3.5 days after symptom onset (7.0 ± 1.6 days after neurosurgical evaluation). In one patient, symptoms had resolved prior to decompression; in the remainder, clear improvements were noted within 2 weeks of surgery, with complete (3 patients) or near-complete (2 patients) resolution of symptoms by 6 months. Repeat

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MRI scans were obtained in three patients, with each demonstrating improvement in the extent of the syrinx.

Conclusions: Children with CM-I and syringomyelia can develop acute spinal cord or bulbar deficits, either spontaneously or with seemingly trivial trauma. The prognosis for symptomatic improvement in the observed deficit is good, with all showing resolution of deficits over time. However, based on this relatively limited experience, we suggest that patients who present with an acute neurologic deficit and CM-1 be managed aggressively with early posterior fossa decompression.

31. Functional Performance Following Selective Posterior Rhizotomy: Long-term Results Determined Using a Validated Evaluative Measure

Michele Parolin, MD; Rajeet Saluja, MD; Kathleen Montpetit, MSc; Nathalie Bilodeau, MSc; Chantal Poulin, MD; Marie-André Cantin, MD; Thierry E. Benaroch, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

Introduction: Selective posterior rhizotomy (SPR) is an effective surgical procedure used to treat patients with spastic cerebral palsy. In 2002 a study on the long-term outcome (5 years), using quantitative measures was published by our group. The object of this study was to analyze the same population, obtained from the McGill Rhizotomy Database and to determine a 10 years functional outcome.

Methods: 187 children with spastic cerebral palsy were treated with selective posterior rhizotomy, at the Montreal Children's Hospital/Shriner's Hospital, McGill University. The children underwent a standardized assessment protocol preoperatively 1-, 3-, 5- and 10 years postoperatively. Quantitative determinations of the activities of daily living (ADL) were obtained using the Pediatric Evaluation of Disability Inventory (PEDI). Of this population 39 have undergone a full 10 year follow-up evaluation.

Results: Statistical analysis of the data showed significant improvement in raw, normative, and scaled scores for the self-care and mobility dimension in the functional skills domain compared to baseline values before SPR. The scaled score for the mobility domain were 56, 64, 77.2, 77.8, 82.9 respectively preoperatively and at 1-, 3-, 5- and 10-years postoperatively and the scaled score for the self care domain went from 59 preoperatively to 67.9, 81.6, 82.4 and 94.6 at the 1-, 3-, 5- and 10-years postoperative assessments, respectively.

Conclusions: The functional performance based on the PEDI evaluation post SPR shows significant and durable gains 5-years and 10-years postoperatively ensuring this cohort of adolescents and young adults a certain level of autonomy in their activities of daily-living.

32. Deep Brain Stimulation In Pediatric Patients: Long-term Outcomes

Abilash Haridas, MD; Ioannis U. Isaias, MD; Yan Epelboym; Michele Tagliati, MD; Ron L. Alterman, MD (Manhattan, NY)

Introduction: To describe the long-term clinical outcomes of pediatric patients with primary generalized dystonia (PGD) who underwent pallidal deep brain stimulation (DBS).

Methods: Of 30 pediatric PGD patients implanted to date, 12 patients (age at surgery 13 ±3 years; disease duration 9 ±2 years) have reached at least two years follow-up after pallidal stimulation. Three patients had fixed skeletal deformities (FSD, scoliosis). The Burke-Fahn-Marsden dystonia scale at baseline and at one- to six-year follow-up was used to assess clinical outcome. Nine patients were stimulated at 60 Hz; three initially at 130Hz.

Results: Ten subjects were followed for three years after DBS, 5 for four, 2 for five, and 1 for six years. Subjects without FSD showed a remarkable improvement (average >90%) at every follow-up visit. FSD patients showed a lower improvement (range 55-75%) than patients without FSD. One patient with FSD further improved after surgical correction of his scoliosis. Clinical outcome at one year was maintained at every successive examination in the 5 patients (4 PGD and 1 FSD) systematically followed for 4 years. No intraoperative complications occurred. We experienced six hardware and stimulation-related adverse events, including five infections and one lead reposition. Implantable pulse generators were replaced eight times in the three patients stimulated at higher frequency.

Conclusions: This study confirms that pallidal DBS is a safe and effective treatment for PGD in pediatric patients. Improvement was sustained for up to six years and highly consistent for at least 4 years.

33. Electrophysiologically Guided Vs Non Electrophysiologically Guided Selective Dorsal Rhizotomy for Spastic Cerebral Palsy – A Comparison of Outcomes

Paul Steinbok, MBBS, FRCS; Andrew Tidemann, MD; Stacey Miller; Tim Bowen-Roberts (Canada, Vancouver)

Introduction: The perceived need for electrophysiological guidance (EPG) during selective dorsal rhizotomy (SDR) has limited performance of SDR. The need for EPG during SDR has been questioned. At our institution, of >200 children with SDR for spastic cerebral palsy (CP), a consecutive series of 26 children underwent SDR without EPG using clinical guidance, but using electrophysiological stimulation to distinguish dorsal from ventral roots (Group1). The remainder had SDR with EPG. The purpose of this study was to compare outcomes between the groups having SDR with and without EPG.

Methods: The 26 patients in Group1 were matched with 26 controls in whom EPG was used (Group2), with respect to GMFCS and age. The 12 month outcomes with respect to motor function score, hip adductor spasticity (Ashworth), hip abduction range of motion (ROM), quadriceps power (MRC), weeFIM, QUEST and incidence of complications were compared between the 2 groups.

Results: There were no statistically significant differences preoperatively between Groups 1 and 2 with respect to GMFCS, age, gross motor function, Ashworth or MRC scores, joint ROM, WeeFIM or QUEST. At 1 year after SDR, there were no differences between Groups 1 and 2 in the incidence of complications or in any of the aforementioned outcome measures.

Conclusions: There was no advantage to doing SDR with EPG compared to no EPG. SDR can reasonably be done in centers where EPG is not available, but electrophysiological stimulation to distinguish dorsal from ventral roots may be useful in avoiding complications.

34. Cervical Dorsal Rhizotomy for Upper Extremity Spasticity

Brandon G. Rocque, MD; A Leland Albright, MD (Madison, WI)

Introduction: The purpose of this study was to evaluate the effects of cervical dorsal rhizotomy on spasticity in the upper extremities.

Methods: The records of all patients who underwent partial sectioning of three or more dorsal cervical nerve roots at the University of Wisconsin Hospital during the period from May 1, 2007 until May 31, 2008 were reviewed retrospectively. All patients had spasticity of cerebral origin in the upper extremities that was impeding care giving, impeding function, or causing contractures. Pre and post-operative Ashworth scores, caregiver and patient satisfaction, as well as operative and non-operative complications were recorded.

Results: Eleven patients ranging in age from 5 to 48 years, with a mean age of 24 years, underwent cervical dorsal rhizotomy during the study period. Complete records are available for eight patients. For most patients, C5-T1 osteoplastic laminotomies were performed for non-selective rhizotomy of C5-8. Fifty to ninety percent of the dorsal roots were divided, with a mean of 73%. Post-operatively the mean upper extremity Ashworth score decreased from 2.5 to 1.4 ($p < 0.0001$). The majority (6 of 8) of patients and caregivers were satisfied with the results of the surgery. The mean length of follow up was 20 weeks. There were no cases of hypalgesia present at latest follow up. There were no operative complications.

Conclusions: Cervical dorsal rhizotomy is a viable treatment alternative for upper extremity spasticity, and may be particularly useful in patients refractory to other treatment modalities.

35. The Oberlin Technique for Nerve Repair in Pediatric Brachial Plexus Injury

Tord D. Alden, MD; Arthur J. Dipatri Jr., MD; Shubhra Mukherjee, MD; Erik C. King, MD (Chicago, IL)

Introduction: Brachial plexus injury can result in significant disability. There are various degrees of injury ranging from pan-plexus injuries to those limited to the upper trunk. Surgical correction of these injuries, similarly, has a wide variety of interventions, often targeting nerves or tendons. We treat these brachial plexus injuries with a multi-modality approach. Patients who do not regain significant function, we offer exploration of the brachial plexus with resection of the traumatic neuroma followed by nerve transfer and cable grafting. In patients that have significant upper and middle, but no lower trunk involvement, we utilize the "Oberlin" technique of direct nerve transfer, taking part of the ulnar nerve in a direct transfer to the nerve to the biceps as part of our treatment.

Methods: We retrospectively studied patients with brachial plexus injury treated at our institution from 2006 to the present. Six patients had primarily upper and middle trunk involvement and had at least 12 months of post-surgical follow-up.

Results: The range of follow-up was from 12 to 21 months. In these 6 patients, we found that 100% had improvement in the biceps function. The return of function had a range of 8 to 16 months. As might be expected, patients with longer followup had better function, with activity against resistance at 16 to 21 months.

Conclusions: The use of the Oberlin technique of direct nerve transfer from the ulnar nerve to the nerve to the biceps is effective in return of use of the arm and limiting disability.

36. Long-term Functional Outcome after Selective Posterior Rhizotomy

Michele Parolin, MD; Rajeet Saluja, MD; Joanne Gibis, MSc; Eileen Kennedy, BSc; Christina Oesterreich, RN; Chantal Poulin, MD; Marie-André Cantin, MD; Thierry E. Benaroch, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

Introduction: In the last 20 years selective posterior rhizotomy (SPR) has proven to be an efficacious treatment of patients with spastic cerebral palsy.

This study analysed the population, obtained from the McGill Rhizotomy Database, using quantitative measure, to determine the 10 year functional outcome.

Methods: 187 children with spastic cerebral palsy were treated with selective posterior rhizotomy at the Montreal Children's Hospital/Shriners' Hospital, McGill University. The children underwent a standardized assessment protocol preoperatively, at 1-, 3-, 5- and 10-years postoperatively. Of this population, 75 patients were operated 10- or more years ago; 49 patients completed a full 10 year follow-up evaluation. Quantitative determination of lower

extremity spasticity, range of motion, developmental motor skill and gross motor function was obtained.

Results: Statistical analysis of data showed improvements in spasticity, range of motion in the lower limbs and lower extremity strength with respect to preoperative baseline. The total GMFM score was 64.6, 70.8, 80.0, 85.6, 86.4 respectively preoperatively and at 1-, 3-, 5- and 10- year postoperatively. The increment in the GMFM score was more evident in the standing and walking dimensions and particularly in independent ambulators.

Conclusions: Selective posterior rhizotomy allows important gains in overall motor function. The effect appears durable at 10 years although no further statistically significant improvement is noted after 5 years. Analysis of potential contributory factors to this plateau, such as growth, weight gain, compliance with therapy and adjuvant orthopaedic interventions during the 5 to 10 year period is ongoing and will be reported.

37. Coaptation of Radial to Axillary Nerve for Obstetric Brachial Plexus Palsy with Persistent Deltoid Weakness

Alexander K. Powers, MD; Ian G. Dorward, MD; Nicole Ladousier, PA-C; Matthew D. Smyth, MD; Jeffrey R. Leonard, MD; Tae Sung Park, MD (St. Louis, MO)

Introduction: Isolated deltoid weakness secondary to obstetric brachial plexus injury occurs in a minority cases of birth related brachial plexus palsies. Current surgical options include nerve grafting from the accessory nerve, sural nerve graft from stumps of C5 and C6 roots, or the C7 nerve root to the upper trunk or the axillary nerve. We report 3 cases of radial nerve branch to the long head of the triceps to axillary nerve neurotization.

Methods: Three patients (2 male, 1 female) were evaluated for upper extremity monoparesis and diagnosed with OBPP isolated to the C5 and C6 roots, with deltoid weakness as the most prominent motor deficit. After a period of physical therapy without any deltoid improvement, each patient underwent a radial nerve branch to the long head of the triceps to axillary nerve neurotization through a medial axillary incision.

Results: Three infants, average age 3 months, were observed for an average of 5.2 months with upper brachial plexus palsy. During observation each patient had improvements in biceps and wrist extensor function without any improvement in deltoid function. Preoperative shoulder exam in each child revealed less than 90 degrees of forward flexion and less than 40 degrees of abduction. After an average postoperative follow-up of 16 months, all patients were able to abduct their arm greater than 145 without decrement in triceps function.

Conclusions: This is the first series to our knowledge of radial nerve branch to the long head of triceps to axillary nerve coaptation for the treatment of deltoid weakness as a result of OBPP.

38. Outcome in Cerebral Palsy Patients with Baclofen Pump After Spinal Fusion for Neuromuscular Scoliosis

Michele Parolin, MD; Wilhem Strydom, MD; Jean Ouellet, MD; Jean-Pierre Farmer, MD (Canada, Montreal)

Introduction: Background. Intrathecal injection of Baclofen is an effective treatment for severely involved children with cerebral palsy. A well-known complication in patients with severe cerebral palsy is scoliosis (50-75%) that requires in numerous cases a surgical correction.

Methods: In this study we have retrospectively reviewed 18 children out of the cohort of 66 patients with Baclofen pumps for cerebral palsy who underwent spinal fusion for scoliosis. In 17 cases, the orthopaedic procedure was done after the insertion of the pump. We analysed the rate of complications, the number of revisions and the degree of correction after spinal fusion.

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Results: The rate of spinal fusion complication related to the presence of the pump was 17.6% (3/17). The number of children that required reoperation for scoliosis was 3 out of 17 (17.6%). The rate of correction based on the improvement in the Cobb angle was 66.7% (from 76° preop to 25.1° postop).

Conclusions: In this study we did not find a significant difference in the rate of complication and of reoperation post-fusion for scoliosis between our patients with baclofen pump and the quoted rates for the CP population whose scoliosis is treated primarily. The average surgical correction is the same as seen in literature for fusion in cerebral palsy patients. Complication avoidance is feasible following a few key technical steps during fusion. Even in cases where progressive scoliosis makes fusion foreseeable our team prefers, after proper intrathecal trial, to implant the pump, alleviate the spasticity and then treat the scoliosis.

39. The Infraclavicular Fossa as an Alternate Site for Placement of Baclofen Pump

Brandon G. Rocque, MD; A Leland Albright, MD (Madison, WI)

Introduction: Intrathecal infusion using an implantable pump is a common method of delivering medication for spasticity or chronic pain. The classic site for placement of the pump is in the abdominal wall. In some patients there are confounding factors that make placement of an abdominal pump impractical. The purpose of this study is to report the implantation of Synchronomed II pumps (Medtronic, Inc., Minneapolis, MN) in the infraclavicular fossa.

Methods: Three patients, ranging in age from 13 to 33, underwent infraclavicular placement of a Synchronomed II infusion pump. In one patient, severe scoliosis and hip joint contractures precluded placement of the pump in the traditional position. In another, there were several ostomies on the abdominal wall, leaving no place for the pump. In the third, a combination of scoliosis and ostomy rendered the abdomen inappropriate for pump placement. In all patients, the catheter was tunneled subcutaneously to the cervical region and inserted into the cerebrospinal fluid space via a small unilateral laminectomy.

Results: In two patients, a 20-ml pump was placed in the right infraclavicular fossa. In the third, a 40-ml pump was placed in the left infraclavicular fossa. All patients tolerated the operation well. There were no postoperative complaints of local pain or discomfort. At last follow up, the pumps were functioning well, and there were no complications with the wounds. Selected pre and post-operative photographs are presented.

Conclusions: The infraclavicular fossa is a viable alternative to the abdomen as the site for placement of an infusion pump.

40. Application of Shuntcheck Thermal Technique for Evaluation of Csf Flow in Vp Shunts in Hydrocephalic Patients

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Introduction: ShuntCheck® is an FDA approved non-invasive diagnostic device for detecting CSF flow by a thermal technique in VP shunts of hydrocephalic patients. We report preliminary experience in subjects without and with suspected shunt malfunction.

Methods: Thirty shunted patients with VP shunts were tested with the ShuntCheck Device. The first group (n=16) were without shunt malfunction and were tested during the routine follow up visits. The second group (n=14) were under evaluation of possible shunt malfunction and were tested in the emergency room. The test involves putting three sensors over the skin, and placing an ice cube over the shunt. Interpretation of ShuntCheck results was done by a

blinded algorithm, and by direct inspection of thermal curves by the operator. ShuntCheck tests were performed postoperatively in 6 out of 7 revised shunts.

Results: ShuntCheck tests probe explicit temperature convection differences in area over the shunt, indicating the presence of CSF flow. Interpretation of results by algorithm indicate CSF flow in 37% of shunts of asymptomatic patients and 43% of suspected malfunction patients. Operator's interpretation indicates flow in 81% of asymptomatic and 64% of suspected malfunction patients. Seven or 50% of suspected malfunction patients went through shunt revision surgery. Objective findings in shunts in the OR confirmed ShuntCheck results in 86% of cases. Five out of 6 postoperative ShuntCheck tests of implanted shunts showed flow.

Conclusions: The ShuntCheck thermal technique detects CSF flow in VP shunts and predicts subsequent examinations of malfunctioning shunts during shunt revision surgeries.

41. Antibiotic-Impregnated Versus Standard Shunt Systems Are Associated With Decreased Shunt Infection in High-risk Patient Subgroups

Scott L. Parker, BS; Frank J. Attenello, MS; Giannina L. Garces Ambrossi, BS; Daniel M. Sciubba, MD; Edward Ahn, MD; Jon D. Weingart, MD; Benjamin S. Carson, MD (Baltimore, MD); George I. Jallo, MD

Introduction: Though antibiotic-impregnated shunt (AIS) systems decrease shunt infections by preventing bacterial colonization, their effectiveness in populations at high risk for infection has recently been disputed. We set out to determine whether the categorical switch to AIS systems at our institution has resulted in a decreased incidence of shunt infection in high-risk pediatric patients.

Methods: We retrospectively reviewed records from all pediatric patients undergoing CSF shunt procedures at Johns Hopkins Hospital over a 10-year period between January 1997 and December 2007. Prior to October 2002, all CSF shunts included standard, non-AIS catheters. During the 4.25 years after October 2002, all CSF shunts included AIS catheters. High-risk subgroups were defined a-priori as prematurity (<35 weeks gestational age), shunts placed immediately post-meningitis, conversion of external ventricular drains to shunt, and replacement of nosocomial shunt infection in patients requiring prolonged hospital stay(>1 month).

Results: 544 pediatric patients underwent 1072 shunt placement procedures (502 AIS, 570 non-AIS). Of patients with non-AIS catheters, 64 (11.2%) experienced shunt infection, whereas only 16 (3.2%) patients with AIS catheters experienced shunt infection within the follow-up period ($p < 0.001$), Figure 1. AIS versus non-AIS was associated with decreased shunt infection in premature neonates [3(5.5%) vs. 7(20.0%), $p=0.036$], acutely following bacterial meningitis [2(5.7%) vs. 9(25.0%), $p=0.045$], when converting EVD to shunts [0(0%) vs. 4(13.3%), $p=0.047$], and in patients with prolonged hospital stay >1 month [3(5.3%) vs. 12(18.5%), $p=0.029$], Figure 2.

Conclusions: Introduction of AIS catheters into our practice reduced incidence of shunt infection in pediatric populations at highest risk. AIS catheters are effective in preventing peri-operative colonization of CSF shunt components.

42. The Association between CSF Shunt Infection Rates and Antibiotic Impregnated Catheters at a Single Institution

Hugh J. Garton; Jayson Sack, BA, MS, BS; Cormac O. Maher, MD; Karin M. Muraszko, MD (Ann Arbor, MI)

Introduction: Antibiotic impregnated shunt (AIS) systems are designed to reduce shunt infection, but published studies provide conflicting evidence for efficacy. Additional concerns exist that shunt

infections may be deferred rather than prevented, and that antibiotic resistance will increase.

Methods: Retrospective review of all pediatric patients who underwent CSF shunt procedures at our institution between January 1999-2007 with >1 year follow-up, or evidence of shunt infection prior to 1 year. The association of AIS catheter use with subsequent shunt infection and failure, adjusting for potential confounders and non-independent observations was assessed using multivariate regression analysis.

Results: Of 606 shunt procedures (408 children), 197(147 patients) had AIS catheters (Rifampin/Clindamycin). The control group was comprised of 409 procedures (261 patients). Despite being younger (0.8 vs 7.2 years), the AIS group infection rate was 5.1% vs. 14.4% in the control group ($p=0.0007$). Neither time to infection, nor proportion of late infections (>6 months) were different between the two groups although control patients had longer follow up (1.3 vs 3.1 years). After adjusting for 8 potential confounders and the variable follow-up, the hazard ratio for infection of AIS vs. Control was 0.43 ($p=0.027$). There was no difference in shunt failure rates (35%) between the two groups. Infections in both groups were commonly caused by coagulase-negative Staphylococcus (AIS: 60%; control: 39%). Increase antibiotic resistance was not observed in the AIS group.

Conclusions: AIS Catheters were associated with a significantly lower shunt infection rate, without an increase in late infections (<6 months), or increased antibiotic resistance at our institution.

43. Medical Costs Associated with Shunt Infections in Patients Receiving Antibiotic-impregnated Shunts Versus Standard Shunt Catheters

Frank J. Attenello, MS; Giannina L. Garces-Ambrossi, BS; Daniel M. Sciubba, MD; Edward Ahn, MD; Benjamin S. Carson, MD; Jon D. Weingart, MD; George I. Jallo, MD (Baltimore, MD)

Introduction: Average hospital cost for shunt infection treatment is reported to be \$50,000, making it the most financially costly implant-related infection in the US. We set out to determine whether introduction of antibiotic-impregnated shunts (AIS) into our practice has decreased incidence of shunt infection or reduced infection-related hospital costs at our institution.

Methods: Clinical and hospital billing records of all pediatric patients undergoing cerebrospinal fluid(CSF) shunt insertion at a single institution from April 2001-December 2006 were retrospectively reviewed. During 18 months prior to October 2002, all CSF shunts included standard, non-AIS catheters. During the four years after October 2002, all CSF shunts included AIS catheters. Patients were followed at least 18 months after surgery.

Results: 406 pediatric patients underwent 608 shunt placement procedures (400 AIS, 208 non-AIS). Of patients with non-AIS catheters, 25(12%) experienced shunt infection, whereas only 13(3.2%) patients with AIS catheters experienced shunt infection during follow-up ($p<0.001$), Figure 1. Total hospital cost to treat 25 non-AIS shunt infections over the first 18 months was \$1,234,928. Total hospital cost to treat 13 AIS shunt infections over the last four years was \$606,328, Table 1. Mean hospital cost per shunt infection was similar for infected AIS and non-AIS catheters (\$46,640 vs. \$49,397). However, infection-related hospital cost per 100 patients shunted was markedly lower in the AIS versus non-AIS cohort (\$151,582 vs. \$593,715).

Conclusions: Introduction of AIS catheters into our institutional practice reduced incidence of shunt infection and resulted in significant hospital cost savings. AIS systems are effective and cost effective instruments to prevent peri-operative colonization of CSF shunt components.

44. Experiences with a Gravity Assisted Valve (paediGAV) in Hydrocephalic Children

Ernst Johannes Haberl, MD (Germany, Berlin D-13 353)

Introduction: Since past comparative clinical outcome studies on valve design did not include any gravity-assisted valve, this trial evaluates the early results of paediGAV application in a pediatric population.

Methods: 169 hydrocephalic children undergoing their first cerebrospinal fluid shunt insertion (61.5%) or receiving a paediGAV substitutionally for any differential pressure (DP) valve (38.5%) were monitored for a minimum of 2 years. Outcomes were defined as valve survival (primary outcome) or shunt survival (secondary outcome) without infection, overdrainage or underdrainage requiring a revision. Endpoints were defined as valve failure from infection, overdrainage or underdrainage.

Results: Within a follow-up period of two years, the valve remained in function in 130 (76.9%) of 169 patients. 108 (63.9%) of these patients had an uncomplicated clinical course without any subsequent surgery, 22 (13%) were submitted to a valve-preserving catheter revision without further detrimental suites for the valve during the follow-up period. 39 (23.1%) patients reached an endpoint, 13 (7.7%) for infection, 8 (4.7%) for overdrainage and 18 (10.6%) for underdrainage.

Conclusions: Compared to non-gravitational shunt designs, the use of gravity assisted valves does not affect the early complication rate. Valve preserving shunt revisions do not increase the risk of subsequent valve failure. The significant impact of well-established valve design on the early complication rate in shunt surgery is not supported by any current data. Therefore, this correlation should be dismissed. As overdrainage-related complications have been shown to occur late, the presumed advantages of paediGAV remain to be shown in a long term study.

45. Variability among Pediatric Neurosurgeons in the Threshold for Ventricular Shunting in Asymptomatic Children with Hydrocephalus

Mark S. Dias, MD; Kenneth Hill, MD; Mark Iantosca, MD (Hershey, PA)

Introduction: The thresholds for inserting ventricular shunts in asymptomatic children with moderate hydrocephalus are not known and there are neither guidelines nor sufficient research to determine what degree of ventriculomegaly should be treated. We hypothesize that there is significant variability among pediatric neurosurgeons' thresholds for shunting in these children.

Methods: Absent such data, the degree of variability among practicing pediatric neurosurgeons may provide important information that guides future research. The authors propose to survey attendees of the Joint Pediatric Neurosurgery Section meeting in Spokane Washington regarding their thresholds for inserting a ventricular shunt under various clinical scenarios. All participants will receive four documents: 1) a reproduction of five CT scan slices (three slices per scan) showing increasingly severe ventricular dilatation; 2) an information sheet regarding participants' training site(s) and types of residency and (if performed) site of fellowship training, years and type of practice, and current status including geographic location and type of practice; 3) a scoring sheet; and 4) approval form from the Penn State University Human Subjects Protection Office. A number of different clinical scenarios will be presented and participants asked to indicate, in each instance, the minimum ventricular size.

Results: Responses will be analyzed to assess the degree of variability (and consensus) among participants as a whole; subgroup

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analyses will examine the effects of type and location of training, as well as type and number of years of practice.

Conclusions: No conclusions can yet be drawn until after the presentation.

46. The Role of Gravitational Valves in the Management of Complex Pediatric Hydrocephalus

Michael J. Fritsch, MD (Germany, Greifswald)

Introduction: Gravitational valves play an increasing role in the initial management of pediatric hydrocephalus. The main goal of the gravitational device is the prevention of overdrainage and its related complications. We evaluate the performance of gravitational valves in the management of complex hydrocephalus and shunt revisions.

Methods: We prospectively followed eleven pediatric patients who underwent treatment of complex hydrocephalus or shunt revision within the last two years. Children with primary shunt placement were not included. All reviewed children underwent a combined treatment consisting of endoscopic simplification of multicompart-ment hydrocephalus and placement of a gravitational valve or a gravitational shunt assistent unit.

Results: Endoscopic communication was established in all patients. Within the same operation a gravitational shunt (Paedi-GAV 04/24) was placed. Despite of large ventricles prior to the revision we did not experience clinical or radiographic signs or symptoms of overdrainage or ventricular collapse. Within this patient group no further shunt revisions were required.

Conclusions: The combination of endoscopy with simplification of a preexisting complex hydrocephalus and placement of gravitational shunt provides long lasting sufficient treatment. No overdrainage related complications occurred.

47. A Mathematical Model to Predict Success of Endoscopic Third Ventriculostomy in the Treatment of Childhood Hydrocephalus in Uganda

Benjamin C. Warf, MD (Wilmington, DE); John Mugamba, MD (Uganda, Mbale); Abhaya V. Kulkarni, MD, PhD (Canada, Toronto)

Introduction: Recent work has suggested an important role for endoscopic third ventriculostomy (ETV) and choroid plexus cauterization (CPC) in the treatment of hydrocephalus in sub-Saharan Africa. We developed a mathematical model that predicts the probability of successful ETV for an individual child with hydrocephalus in sub-Saharan Africa.

Methods: We prospectively collected data on all children treated with ETV at CURE Children's Hospital, Uganda between 2001 and 2007. A multivariable logistic regression model was built using ETV success at 6 months as the outcome. The model was derived on 70% of the sample (training set) and validated on the remaining 30% (validation set). We examined the model's predictive properties by testing model fit and discrimination.

Results: Of 979 ETV's attempted, 281 were aborted due to poor anatomy/visibility. Of the remaining 698, 310 failed during the first 6 months. Therefore, a total of 388 were successful at 6 months. The mean age at ETV was 12.6 months; 57.8% were post-infectious and 12.0% associated with myelomeningocele. We developed a logistic regression model containing the following significant variables: patient age at ETV, etiology of hydrocephalus, and whether CPC was performed. In both the training set (N=676) and validation set (N=303), the model was able to accurately predict the probability of successful ETV (Hosmer-Lemeshow p-value>0.60 and C-statistic>0.70).

Conclusions: Older age and the performance of CPC are important predictors of ETV success in Uganda. Our model will allow surgeons to accurately predict the probability of success of ETV, taking these important factors into account.

48. The Origins of Postinfectious Hydrocephalus in East Africa

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Introduction: The incidence of neonatal ventriculitis in children in rural East Africa is high (J Neurosurg (Pediatrics 1) 102:1-15, 2005). Spinal fluid sampled at the time of endoscopic ventriculostomy or shunt insertion has been uniformly culture negative.

Methods: We used a PCR-based approach to amplify bacterial 16S rDNA from samples of CSF collected at the time of ventriculostomy or shunt insertion in 25 consecutive patients under 1 year of age at the CURE Children's Hospital of Uganda.

Results: Bacterial DNA could be amplified from nearly all samples. Sequencing the products of amplification, with and without subcloning, revealed that DNA fragments recovered from 17 of 25 specimens showed close association to the 16S rDNA from *Acinetobacter* species, with *A. junii* being most prevalent. In addition, sequencing fragments of the nearby 23S gene, the intergenic segment between the 16S and 23S genes, and the beta-subunit of the RNA polymerase gene, confirmed the presence of *Acinetobacter* DNA.

Conclusions: Taken together, the data suggests that *A. junii*, or a close homolog, likely represents an important pathogen associated with postinfectious hydrocephalus in these patient populations. While previous studies have suggested that neonatal *Acinetobacter* infections are most commonly due to *A. baumannii*, and are notorious for being nosocomial, little is known of the routes of infection in a developing world setting. We speculate that close proximity to farm animals and contaminated water supplies are suspected sources. Efforts to isolate the organism from environmental sources and recover live bacteria from operative specimens are ongoing.

49. The Development and Implementation of a Pediatric Neuroendoscopic Surgery Program in the Developing World: Mali

Jay K. Riva-Cambrin, MD, FRCSC (Salt Lake City, UT); Drissa Kanikomo, MD; Luis Hector, MD; Oumar Diallo, MD (Mali, Bamako)

Introduction: Mali is a French-speaking western African country which has been deemed the third poorest country in the world by the WHO. Virtually all hydrocephalic children were previously left to die with this treatable condition because of poor education, lack of materials, or local expertise. As two newly-trained neurosurgeons have moved to Mali, it was the goal of this neurosurgical envoy to provide support for them.

Methods: The development of the neuro-endoscopic surgical program required two envoys to Mali. The first was a fact-finding envoy to determine the needs and capabilities of the medical system, the hospital, and the local neurosurgeons. The second envoy brought the materials (including basic and specialized endoscopic instruments, Midas drills, monitors, and a light source, as well as instruction from surgeon, nursing, and central processing viewpoints).

Results: The first envoy was critical in that the situation in Mali was thoroughly assessed thus enabling the success of the second envoy four months later. After the second envoy they had a working neuro-endoscopic set-up with back-ups, skills in instrument trouble shooting, three surgeons each with didactic and five or more supervised surgical cases and a functional pediatric neuro-endoscopic surgical program.

Conclusions: Many first world missions' procedures include arriving, treating a large group of patients, and leaving with the country's long-term medical situation only minimally better. In stark contrast,

we are of the mindset that neurosurgical missions to the developing world must focus on developing a permanent working, stable, and material stocked program in that country.

50. Risk of Subarachnoid Tumor Dissemination Following Endoscopic Biopsy and Concomitant Third Ventriculostomy

Neal Luther, MD (New York, NY); John C. Wellons III, MD (Birmingham, AL); Mark M. Souweidane, MD (New York, NY)

Introduction: Endoscopic biopsy with concomitant third ventriculostomy (ETV) is a well-established diagnostic and therapeutic maneuver in patients presenting with noncommunicating hydrocephalus resulting from a tumor of the posterior third ventricle. Fenestration of the floor of the third ventricle theoretically provides a conduit for subarachnoid dissemination of an intraventricular tumor.

Methods: A review was conducted of all patients for whom an ETV and simultaneous endoscopic biopsy or resection of tumor was performed between 1995-2008 at our institutions. Patients were divided by leptomeningeal metastatic potential based upon pathology into high or low risk groups. All available post-operative clinical and radiographic data, MR imaging of the brain and spinal cord, and CSF sampling were reviewed. Patients stage M1 or greater at time of surgery were excluded. A review of leptomeningeal metastasis rate in the literature was then conducted for comparison to the rate observed in this series.

Results: Twenty-seven patients satisfied criteria for inclusion. Pathology revealed 19 were high-risk for leptomeningeal dissemination. Of the high-risk patients, 2 (10%) developed new leptomeningeal disease (1 yolk sac tumor and 1 pineoblastoma). None of the 8 low-risk patients developed leptomeningeal disease. Mean clinical and MRI brain follow-up was 36 and 37 months respectively. MRI of the spine was performed in follow-up for 11 patients (mean 14 months post-operation), and CSF was available for 14 patients (mean 9 months post-operation).

Conclusions: The rate of leptomeningeal metastasis of tumors in this series of biopsy and ETV was not significantly increased when compared to known rates of metastasis for these lesions.

51. Endoscopic Management of Large Intracranial Cysts: Expectations and Outcomes in Children

R. Shane Tubbs, PhD, PA-C; Jeffrey Pugh, MD; Blake Pearson, MD; John C. Wellons, III, MD (Birmingham, AL)

Introduction: Large arachnoidal, intraventricular, and paraventricular cysts in pediatric patients present not only with impressive imaging but also often with symptoms related to raised intracranial pressure or local mass effect. Endoscopic and endoscope-assisted microsurgical approaches have become a more common means of treatment for these pathologic entities.

Methods: We reviewed the imaging and digital records of children who underwent endoscopic or endoscope-assisted microsurgical intervention for large arachnoidal, intraventricular, and paraventricular cysts for the period of 7/2002 to 3/2008 by the senior author. Pre- and postoperative symptoms and imaging results were recorded. Intraoperative video was reviewed. In addition, a survey of expectations and outcomes for intracranial cyst management was sent to a small group of experienced neurosurgical endoscopists.

Results: Eight children undergoing surgical intervention were identified in the review period: 7 underwent endoscopic intervention only and 1 endoscope-assisted microsurgery. Six children presented with symptoms from hydrocephalus or local mass effect and 5/6 (83%) had complete resolution of all symptoms by last follow up. 7/8 patients (88%) had an MRI-detectable decrease in the cyst size. None has required shunting. Median age of surgery was 5.5 years (range 4 months to 15 years). The majority of survey participants felt

that imaging improvement was not necessary for success in the face of resolution of preoperative symptoms.

Conclusions: Endoscopic and endoscope-assisted microsurgical fenestration of large arachnoidal, intraventricular and paraventricular cysts in pediatric patients can provide resolution of symptoms and improvement of imaging. The latter may not be necessary for success.

52. Surgical Failure in Patients Undergoing Hemispherectomy for Intractable Seizures

Sanjiv Bhatia, MD; Ian Miller, MD; John Ragheb, MD, FACS; Esperanza Pacheco, MD; Glenn Morrison, MD, FACS (Miami, FL)

Introduction: Acute postoperative seizures in the immediate and early postoperative period are not infrequent. However, long term surgical failure following hemispherectomy for lateralized hemispheric seizure activity is infrequent. We investigated the causes of failure to obtain good seizure control in our patient population and discuss methods to evaluate completeness of disconnection.

Methods: A retrospective analysis of the epilepsy surgery database was performed to investigate the causes of inadequate seizure control following hemispherectomy. We then analyzed the preoperative interictal and ictal electroencephalographic data to assess the extent of seizure abnormality. Particular attention was paid to the presence of contralateral abnormalities. Preoperative and postoperative magnetic resonance images were analyzed to assess the presence of contralateral structural abnormalities and the degree of interhemispheric disconnection.

Results: Since 1979, more than 600 children underwent surgery for intractable epilepsy. Eight-two (82) patients underwent hemispherectomy. Twelve (12) patients had persistent postoperative seizures. We found incomplete interhemispheric disconnection as seen on postoperative MR scans in 3 patients. Contralateral epileptiform activity was present in 6 patients. A detailed analysis of the results will be discussed.

Conclusions: Unsuccessful control of seizures following hemispherectomy may be secondary to multiple causes. These include incomplete hemispheric disconnection, contralateral morphological abnormality and multifocal epileptiform abnormalities and postoperative injury to the contralateral hemisphere.

53. Corpus Callosotomy in Multistage Epilepsy Surgery in the Pediatric Population

Jessica S. Lin, MD; Sean M. Lew, MD; Wade M. Mueller, MD; Mary L. Zupanc, MD (Milwaukee, WI)

Introduction: Patients with non-lesional, medically refractory epilepsy with bilateral epileptiform discharges represent one of the most challenging subsets of surgical epilepsy patients. Surgical outcomes in a select group of medically refractory epilepsy patients who have undergone corpus callosotomy combined with subdural EEG electrode placement as the initial step of multistage epilepsy surgery are reviewed.

Methods: A retrospective chart review was undertaken of 14 children (ages 5-18) with medically refractory epilepsy and either normal MRI scans of the brain (8 patients) or bihemispheric abnormalities (6 patients). All of the patients had frequent generalized epileptiform discharges, as well as multifocal independent epileptiform discharges on surface EEG monitoring. All patients underwent corpus callosotomy with subdural bihemispheric EEG electrode placement as the first stage of multistage epilepsy surgery.

Results: Of the 14 patients who underwent corpus callosotomy and placement of subdural strips and grids, 9 underwent subsequent surgical resections. Mean patient age was 10 years, with a mean follow-up of 29 months. Outcomes were 43% Engel Class I (seizure-

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free or only non-disabling simple partial seizures), 43% Class III (6 of 14 patients), and 14% Class IV (2 of 14 patients). Eighty-six percent of patients had improvement in quality of life (QOL), as documented on QOL surveys. There were no major strokes or deaths.

Conclusions: Reasonable outcomes can be achieved in this most difficult patient population using corpus callosotomy in combination with invasive EEG monitoring.

54. Palliative Hemispherotomy in Patients with Bilateral Seizure Onset

Alexander K. Powers, MD; David D. Limbrick, Jr, MD, PhD; Matthew D. Smyth, MD (St. Louis, MO)

Introduction: Hemispherotomy/ectomy is generally offered to patients with unilateral hemispheric dysfunction, a normal 'good' hemisphere, and medically intractable epilepsy lateralizing to the affected hemisphere. However, in some children with life-threatening status epilepticus or frequent severe seizures and neurocognitive decline, a hemispheric disconnection may be offered as a palliative measure even if the 'good' hemisphere is abnormal, with confirmed bilateral seizure onset.

Methods: We identified eight patients aged 4 months to 16 years with bilateral seizure onset by clinical presentation and EEG-video who underwent hemispherotomy at St. Louis Children's Hospital from 2003 to 2008. Peri-insular hemispherotomy was carried out by the senior author after detailed evaluation and discussion by the comprehensive epilepsy center team.

Results: All patients experienced significant seizure reduction after a mean follow up of 19.3 months, with three of the 8 seizure-free (Engel I), 4 patients with rare seizures (Engel II), and the remaining patient with worthwhile improvement (Engel III). All patients have shown improvement in cognitive function and development. One patient with Sturge-Weber developed a postoperative subdural hygroma that was successfully shunted. No patient required reoperation for resection or disconnection.

Conclusions: Hemispherotomy/ectomy may be offered in selected children with malignant seizures and bilateral hemispheric dysfunction, when the 'good' hemisphere is relatively mildly affected. While seizure freedom is not necessarily the goal, significant palliation in seizure frequency and severity can be achieved, with meaningful improvements in quality of life and neurocognitive development.

55. Temporo-parietal-occipital (tpo) Disconnection in Children with Intractable Epilepsy.

Jerard Ross; Ahmad Mohammed; Jeremy Freeman; Wirginia Maixner; Simon Harvey (United Kingdom, Liverpool)

Introduction: Temporo-parieto-occipital (TPO) disconnection is a recognised but not widely reported epilepsy surgery procedure, described mainly in infants and children with diffuse posterior cortex lesions. We report our experience with children who underwent TPO disconnections.

Methods: Retrospective review of clinical, EEG, MRI, functional imaging and pathology findings in 9 children with intractable epilepsy who had TPO disconnections at the RCH, Melbourne in the last 10 years.

Results: Seizure onset was 3 months - 2 years (9 in infancy) and TPO disconnection was performed at 5 months - 16.4 years (mean 8.4 years). All children had developmental delay. MRI showed unilateral posterior quadrant dysplasia in 2 atrophy and gliosis and HS in 2 and subtle white matter signal change with or without minor abnormalities of sulcation in 5. PET in 4 children showed lateralised TPO hypometabolism. Ictal SPECT showed relative hyperperfusion in the TPO cortex in 4. In the 5 children with no definite lesion on MRI,

localisation was based on ictal EEG and metabolic imaging. All 9 patients had TPO disconnections; 3 patients had prior surgery. After 2 months - 4.5 years follow up (mean 30 months) 6 patients are seizure free and 3 have had a 50% or greater seizure reduction. No patient had a postoperative motor deficit and 4 had evidence of new hemifield visual impairment.

Conclusions: TPO disconnection is an effective, motor-sparing epilepsy surgery procedure for children with refractory seizures and structural abnormality or functional disturbance in the posterior cortex.

56. Vagal Nerve Stimulators and Magnetic Resonance Imaging

Stephanie Einhaus, MD (Memphis, TN); Joel Chasan; Robert Davis (Memphis, TN); Michael Tobias, MD (Westchester, NY); Karen Butler, BSN, RN; James Wheless, MD; Frederick Boop, MD

Introduction: There are only a few manuscripts reporting that MRI may be safely performed in patients with VNS. As a result, this concept is still not widely accepted, and thus, many patients with VNS are denied MRI. Cyberonics specifies which coils they believe to be compatible and incompatible. Our objective was to review the safety of MRI (1.5 Tesla) on children with VNS.

Methods: We retrospectively examined patient records at LeBonheur Children's Medical Center for children with VNS implants who had an MRI (GE, 1.5 Tesla) from January 2005 to June 2008. We reviewed 27 patients (ages 2-18 years at time of scan, median age 9) who had a total of 57 MRI scans. The VNS was turned off before each exam. Of these, there were 49 brain MRI's, 4 spines, 3 extremity exams, and 1 MRI of the pelvis. The VNS was turned back on after the MRI and interrogated to ensure the settings were unchanged. All 8 of the non brain MRI's were inadvertently done with receive only coils, contradicting Cyberonics recommendations.

Results: No patient had side-effects during the MRI and no device problems occurred. Recordings of VNS settings prior to and after MRI showed no changes. Two patients presented soon after the MRI with increased seizure frequency. This increase was likely due to a shunt malfunction in one, and the other was due to medication failure.

Conclusions: We conclude that MRI can be safely performed in children with VNS, and that the devices were unaffected by these scans.

57. Epilepsy Surgery in Tuberous Sclerosis: Strategies and Results in 21 Patients

Charles B. Stevenson, MD; Ellen L. Air, MD, PhD; David N. Franz, MD; Ki H. Lee, MD; Katherine D. Holland, MD; Anna W. Byars, PhD; Kerry R. Crone, MD; Francesco T. Mangano, DO (Cincinnati, OH)

Introduction: Tuberous sclerosis complex (TSC) is an autosomal dominant disorder of cellular proliferation, differentiation, and migration. Approximately 90% of TSC patients develop epilepsy, and half of these become medically refractory. Resective surgery has been most beneficial when one or more tubers can be reliably identified as the source of seizures. We present our experience using a combination of invasive and non-invasive modalities to guide resection in a large cohort of TSC patients.

Methods: Under an IRB-approved protocol, we retrospectively reviewed the charts of all TSC patients undergoing initial epilepsy surgery at Cincinnati Children's Hospital Medical Center between 1995 and 2008. Demographic data, preoperative evaluation, treatment, seizure outcome, and available developmental and neuropsychological test results were abstracted.

Results: Twenty-one patients were treated with surgery: 10 had focused resection of an epileptogenic tuber and 11 underwent lobectomy or hemispherectomy. Follow-up ranged from three

months to 13 years. Seizure outcome was excellent (Engel Class I) in 13 patients, good (Engel II) in two, and fair (Engel III) in six. Patients demonstrated either improvement or no change in performance status on routine postoperative neurocognitive testing.

Conclusions: Epilepsy surgery in TSC can be performed safely and successfully with improved seizure control when semiology, noninvasive testing, extraoperative electrocorticography, and tuber location are concordant. Specifically, Subtraction Ictal Spect Co-Registered to MRI (SISCOM) analysis combined with invasive monitoring is particularly effective in guiding resection, and we employ these modalities whenever feasible. Continued neuropsychological follow-up will determine whether improved seizure control correlates with long-term, meaningful cognitive improvement in this unique patient population.

58. Is Surgical Intervention Beneficial in Patients with Supplementary Sensorimotor Area Seizures Caused by Cortical Dysplasia?

Keyne K. Johnson, MD (Orlando, FL); Daniel Yoshor, MD (Baylor College of Medicine, TX)

Introduction: Despite the fact that frontal supplementary sensorimotor area (SSMA) surgery represents the second most common procedure to treat intractable epilepsy, only satisfactory surgical outcomes are reported when compared to temporal lobe surgery. Worse postoperative seizure outcome has been shown when there is a combination of frontal epileptiform activity and cortical dysplasia.

Methods: Between 2003 and 2007 eleven patients with intractable seizures arising near the SSMA and cortical dysplasia were operated on at our institution. The mean age at time of surgery was 9 years. All patients underwent preoperative video EEG monitoring and intraoperative electrocorticography. Cortical dysplasia was diagnosed using magnetic resonance imaging and confirmed with histopathology. Seizure outcome was classified according to Engel's classification. The average follow-up was 33.7 months.

Results: Postoperative seizure outcome was Engel class I in 7 (63%), III in 1 (.09%) and IV in 3 (27%). Of the patients with poor postoperative seizure outcomes one was noted to have intraoperative epileptiform activity in the parietal lobe subsequent to the resection. The second Engel IV patient was only 2 years of age at the time of surgery. The third Engel IV patient remained seizure free for 6 months following surgery.

Conclusions: SSMA epilepsy and cortical dysplasia independently have demonstrated to have poor postoperative surgical outcomes. Our data however reveals favorable seizure-free results with the use of video EEG and MRI to establish diagnosis, electrocorticography to define the area of epileptogenicity and electrophysiology to localize functional cortex.

59. Evaluation of Seizure Response to Vagal Nerve Stimulation as an Outcome Predictor of Temporal Lobectomy for Patients with Medically-intractable Epilepsy.

Samer K. Elbabaa, MD (Little Rock, AR); Ethan Munzinger, BS; Dimitri Sigounas, BS; Kyle Weant, PharmD; Eldad Hadar, MD (Chapel Hill, NC)

Introduction: Temporal lobectomy (TL) for medically-intractable temporal lobe epilepsy has been shown to consistently produce initial satisfactory outcomes in most series. Vagus nerve stimulation (VNS) is an alternative to surgery for some patients. No study has evaluated whether VNS failure to reduce seizures predicts seizure outcome following subsequent temporal lobectomy.

Methods: We reviewed records of 23 patients who underwent TL for medically-intractable temporal lobe epilepsy from 2001-2006. Six of 23 patients received prior VNS which failed to improve their seizure

frequency. Seventeen of 23 patients had TL without previous VNS. We evaluated the postoperative seizure control for all patients. Improvement of seizure outcome was defined as either reduction in number of anti-epileptic agents or complete cure with no anti-epileptic agents on last follow-up.

Results: Median age for VNS placement was 38 years (19-45 years). Median age for TL was 36 years (10-55 years). Median time between VNS and TL was 73 months. Median follow-up was 32 months. Following TL, three of six (50%) patients with prior VNS and 11 of 17 (65%) patients without prior VNS had improvement ($p=0.64$). Presence of hippocampal sclerosis on pathological specimens was seen in 71% of patients with improved seizure outcome ($p<0.05$).

Conclusions: Failure of previous VNS therapy showed a trend for less favorable seizure outcome after temporal lobectomy in patients with medically-intractable temporal lobe epilepsy. There was no statistical significance in this small group. Presence of hippocampal sclerosis remains a strong predictor of good seizure outcome after temporal lobectomy. Larger series in the future may show statistical significance.

60. The Pediatric Neurosurgical Workforce: Defining the Current Supply

Susan R. Durham, MD, MS; Jessica Lane; Scott Shipman, MD, MPH (Lebanon, NH)

Introduction: The purpose of this study was to determine a reliable estimate of size, demographics and practice characteristics of the current pediatric neurosurgical workforce.

Methods: A 30-question survey was administered to pediatric neurosurgical practitioners identified through professional neurosurgical society databases.

Results: The response rate was 78.1%. There were 158 pediatric practitioners and 92 non-pediatric practitioners identified. Pediatric vs. non-pediatric practitioners: Pediatric practitioners were more likely to be female, ABPNS certified, completed a pediatric fellowship, do fewer operative cases, have a more frequent call schedule, practice in a freestanding children's hospital, be in academic practice and in need of recruiting additional faculty. Pediatric practitioners spent fewer hours per week in patient care and were less likely to have a productivity-based salary or salary incentive based on RVU production.

Age: ABNS and ABPNS certification rates increased with age among pediatric practitioners. Fellowship completion and anticipating retirement by age 65 was higher in the younger age groups. Hours spent per week in teaching and administrative duties were less in the younger age groups. Gender: Female pediatric practitioners were more likely to have completed a pediatric fellowship and do fewer operative cases per year. Academic vs. Private Practice Setting: Non-academic pediatric practitioners were more likely to have a RVU-based salary incentive, be reimbursed for call coverage and spend greater hours per week in patient care. Academic pediatric practitioners spent greater hours per week in clinical research.

Conclusions: Current practice demographics and characteristics unique to pediatrics may have important implications in future analysis of the pediatric neurosurgical workforce.

61. Recurrent Craniopharyngiomas: Aspects of Surgical Management in Children

Robert E. Elliott, MD (New York, NY); Kevin Hsieh, MD; Jeffrey Wisoff, MD, FACS (New York University Medical Center, NY)

Introduction: Optimal treatment of both primary and recurrent craniopharyngiomas remains controversial. Many authors advocate for radical resection of primary tumors but the data are unclear for recurrent tumors. We report our experience with radical resection of recurrent craniopharyngiomas in pediatric patients.

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Methods: Thirty-nine patients under the age of 21 with craniopharyngiomas underwent 54 radical resection operations from 1986 to 2008 by the senior author. One patient lost to follow-up. Mean age at surgery was 11 years and mean follow-up was 6.5 years.

Results: Twenty-six patients (67%) underwent gross-total resection (GTR) at time of recurrence. The remaining 13 patients underwent subtotal resection (STR), followed by radiation therapy (RT) in 10 and bleomycin in 1. Disease control was achieved in 79% of patients overall. However, rate of disease control was significantly higher in the GTR group (92% vs. 58%, $p=0.0052$). Nine patients died during the follow up period, 1 patient died perioperatively (1.8%) and 3 of 9 deaths were from disease progression. Diabetes insipidus occurred in 86% of patients. Worsening of vision occurred in 30%, while improvement occurred in 23%.

Conclusions: In a series of pediatric patients with long-term follow-up after radical resection of recurrent craniopharyngiomas, disease control was achieved in 79% of patients. However, GTR offered better disease control than STR with RT without increased morbidity or mortality.

62. Longitudinal Assessment of Local Delivery Methods in Rodent Brainstem Model

Akihito Kondo, MD; Stewart Goldman, MD; Marcelo B. Soares, PhD; Veena Rajaram, MD; Tadanori Tomita, MD, Prof (Chicago, IL)

Introduction: Direct delivery of chemotherapeutic agents for the treatment of brain tumors is an area of focus in the development of therapeutic paradigms since it circumvents the blood-brain barrier. Currently few studies have investigated longitudinal tumor response to this type of therapy, especially for tumors located in inoperable areas. In this study we examined the time course of tumor response to direct delivery of a chemotherapeutic agent in a rodent brainstem glioma model.

Methods: To visualize tumor response to chemotherapy, we used a bioluminescence imaging method in a rodent model. Rat 9L gliosarcoma cells expressing the luciferase gene were inoculated into the brainstems of adult male rats. Seven days following surgery the animals were randomly divided into 4 groups. Groups 1 and 2 received 0.04 mg and 0.02 mg carboplatin respectively, via a convection-enhanced delivery technique. Group 3 received 10 mg carboplatin intraperitoneally. Group 4 received no treatment. Tumor growth was correlated with luminescence levels. Measurements were taken every 3 days.

Results: Differential growth curves were observed for the 4 groups. Tumors which chemotherapy was delivered directly showed regression at an earlier phase than those treated with systemic chemotherapy.

Conclusions: This study used direct and systemic delivery of carboplatin to investigate how drug delivery method affects tumor growth. It is one of the first in vivo studies examining the time course of tumor response to direct drug delivery. Results indicate that direct drug delivery may be a good option for treating brain tumors, particularly those tumors located in inoperable areas.

63. Risk Factors for Shunt Malfunction in Pediatric Brain Tumor Patients

Melvin E. Omodon, BS; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: Complications associated with shunts placed in children with brain tumors are not well quantified.

Methods: 184 children who had brain tumors and required shunting were identified under an IRB-approved protocol. The average age was 72 months. The average follow-up time was 53 months. Tumor

types included 50 medulloblastomas, 24 ependymomas, 70 pilocytic astrocytomas, 5 astrocytomas, 21 anaplastic astrocytomas, and 14 craniopharyngiomas.

Results: 31% of the shunts (56 patients) required revisions and 10% of the shunt placements (18 patients) were complicated by infections. 42% of all malfunctions occurred within the first 6 months post shunt placement. The rate for shunt malfunction was highest in patients with anaplastic astrocytoma (37%), and lowest in patients with ependymomas (25%). Highest rates of shunt malfunction was associated with supratentorial tumor location (44%), anaplastic astrocytoma histology (47%), and an age of initial shunt placement between 2-5yrs (51%). Risk factors for distal malfunction include infratentorial location (24%). Highest rate of multiple malfunction were found in patients between the ages of 2-5 yrs (38%). Risk factors for infection included supratentorial tumor location (11% infection rate), ependymoma histology (13%), and age of shunt placement between 6 months to 2yrs (12%). The lowest infection rate was in patients with craniopharyngiomas (5%) and the highest in ependymomas (13%).

Conclusions: The risk factors for shunt failure in children with brain tumors can be quantified. Shunts placed in children with brain tumors have lower rates of malfunction and higher rates of infection than seen in the overall hydrocephalus population.

64. The Utility of Fourth Ventricular Drains Following Resection of Posterior Fossa Tumors in Children

Cole E. Denton, BA; Mark D. Krieger, MD; J. Gordon McComb, MD (Los Angeles, CA)

Introduction: The study analyzes the efficacy of intraoperative fourth ventricular drains on the need for permanent cerebrospinal fluid diversion.

Methods: 89 children with posterior fossa tumors were analyzed under an IRB-approved protocol. Age ranged from 8 months to 19 years. Tumors included 32 medulloblastomas, 41 pilocytic astrocytomas, 15 ependymomas, and 2 other tumors. Pre-operative hydrocephalus was noted in 84 (88%) of the cases. Thirteen patients required preoperative placement of lateral ventricular drains, 46 patients had intraoperative fourth ventricular drain placed, and 1 patient had both. 36 patients had no drains.

Results: Forty-one patients required placement of an indwelling shunt. This included 25 patients who could not be weaned from their drains, 6 patients who tolerated weaning but subsequently required a shunt, and 10 patients who required a shunt following a surgery wherein no ventricular drain was placed. Statistically significant ($P < 0.05$) factors associated with the need for shunting included: extent of hydrocephalus preoperatively, CSF infection, young age, midline tumor location, subtotal tumor resection, extended duration of drain presence, and drain placement itself. When CSF infection, extent of preoperative hydrocephalus, and duration of drain presence are controlled for, drain placement alone did not serve as a statistically significant predictor of need for permanent shunt ($P = 0.913$).

Conclusions: Drains may be useful in the postoperative period to monitor ICP and drain blood products. However, they are not shown to decrease the need for permanent shunting. The present study demonstrated several factors that may serve as predictors of postoperative shunt placement.

65. Biologically Active Autologous Hsp-gp96 Vaccine (hsppc-96) can be Generated From Common Pediatric Brain Tumors: A Potential Source of Tumor Specific Polyvalent Antigen for Adjunct Immunotherapy

Phiroz Tarapore, MD, PhD; Kurtise Auguste, MD; Anu Banerjee, MD (San Francisco, CA)

Introduction: Immunotherapy of pediatric brain tumor patients is an evolving adjunct to standard therapy. Techniques that rely on a single peptide to evoke immunity are unappealing because of tumor heterogeneity. In contrast, polyvalent approaches that target multiple antigens are more likely to provide long-term benefit. We investigated the feasibility of isolating clinical grade, autologous gp96 from a variety of pediatric brain tumors. Cancer cell derived heat shock protein gp96 carries tumor specific antigens, and has been shown to evoke a tumor specific immune response in adult glioma patients.

Methods: Patients ranging in age from 2 -16 years underwent standard surgical resection and tumor tissue was subsequently processed for gp96 purification. Tumor types included PNET,GBM,and ependymoma and the total tissue sent for processing ranged from 5.79to21.25 grams. Following tumor receipt, heat shock protein gp96 and associated peptides were purified from the tumor and the product filled aseptically into vials. Materials subsequently underwent preliminary quality-control testing to evaluate feasibility of production of HSPPC-96 vaccine.

Results: Surgical resection of pediatric tumor from all tumor types under investigation (PNET, GBM, and ependymoma), yielded >5g of tumor. HSPPC-96 vaccine was successfully manufactured for all tumor types in an amount sufficient to satisfy product release, regulatory retains and a minimum of 4 vaccinations.

Conclusions: It is feasible to isolate clinical grade gp96 from a variety of pediatric brain tumor types. The safety and immunomonitoring profiles of gp96 in adult brain tumor patients suggest that this vaccine is worth investigating in children. Further study within the context of a Phase-I-clinical trial is warranted.

66. Treatment of Choroid Plexus Tumors: A 20-year Institutional Experience

Chetan Bettgowda, MD, PhD; Vivek Mehta, BS; Jon Weingart, MD; Ben Carson, MD; George Jallo, MD; Edward Ahn, MD (Baltimore, MD)

Introduction: Choroid plexus tumors are rare and often surgically challenging lesions, accounting for less than 1% of all brain tumors, but are more commonly found in the pediatric population.

Methods: We performed a retrospective study of our experience from 1988-2008 in the treatment of choroid plexus papillomas and carcinomas.

Results: In analyzing 29 consecutive cases of choroid plexus papillomas treated at the Johns Hopkins Hospital, the average age of presentation was 16 years with female predominance of 63%. The average age of patients with lateral ventricular lesions was 3.5 years, while those with fourth ventricular tumors were significantly older (43 years). The most common presenting sign was hydrocephalus (41%) and eventually 21% of patients required a shunt. Gross total resection was accomplished in 86% of patients and one patient had recurrence at 67 months. There was 100% survival at 5 and 10 years in those patients who had long term follow up. In analyzing seven consecutive patients with choroid plexus carcinomas from 1988-2008, the average age at presentation was 4 years with slight male predominance (57%). Five patients had carcinomas occupying the left lateral ventricle, while two were in the right lateral ventricle. The most common presenting sign was hydrocephalus (86%) and 29% required a shunt. Five patients had a gross total resection and, of these, two had recurrence. Three patients with long term follow up

were alive at 5 years (60%) and one was alive at 10 years.

Conclusions: While choroid plexus tumors are infrequently encountered, adequate surgical resection is pivotal for patient outcome.

67. Endoscopic Biopsy and Third Ventriculostomy in Children with Third Ventricular Tumors

Sean A. McNatt, MD; Jesse Smith, BA; Corbett Wilkinson, MD; Ken Winston, MD (Denver, CO)

Introduction: Endoscopic biopsy with third ventriculostomy is an attractive initial management strategy in pediatric patients with third ventricular tumors. We reviewed our experience with attention to the diagnostic yield of endoscopic biopsy, durability of third ventriculostomy, and technical challenges and complications encountered in children treated with this technique.

Methods: Medical records of patients that underwent endoscopic biopsy of third ventricular tumors during a ten year interval were reviewed. Patients underwent attempted third ventriculostomy or septostomy and endoscopic biopsy via a single frontal burr hole.

Results: 34 patients met inclusion criteria with a median age of 9.5 years. Tissue biopsy was diagnostic in 32 (94%) of 34 cases. 20 patients with mid- or posterior 3rd ventricular tumors underwent third ventriculostomy. 7 (35%) of these subsequently required insertion of a shunt. Seven patients with anterior third ventricular tumors, including tumors exophytic from the thalamus and hypothalamus/optic pathway underwent septostomy. Four of these patients subsequently required a shunt. Complications encountered included two patients in which metal filings were shed from the working channel into the ventricle as the grasper was inserted, three patients that suffered profuse intraventricular hemorrhage, one patient who developed enterococcal ventriculitis, one patient with malignant teratoma that was misdiagnosed as pineoblastoma, and three patients with particularly challenging histopathology requiring outside review and consensus diagnosis.

Conclusions: Endoscopic biopsy is an effective diagnostic procedure for third ventricular tumors, including those exophytic from the thalamus and hypothalamus. Collective reporting of technical challenges and complications will help advance its safety and efficacy.

68. Neurofibromatosis Type I: Transition between Childhood and Adulthood

Sandrine de Ribaupierre, MD (Canada, London); Matthieu Vinchon, MD (France, Lille); Olivier Vernet, MD; Benedict Rilliet, MD (Switzerland, CHUV)

Introduction: The lesions associated with Neurofibromatosis Type I vary across the life span. For example, while optic gliomas are seen in early childhood, sphenoid dysplasia and cerebellar gliomas are developing later in childhood, and spinal neurofibromas are seen in adults.

Methods: We retrospectively studied 123 patients who were seen in the neurosurgical outpatient clinics in Lille, France and Lausanne, Switzerland, from 1961 to 2007. We reviewed the manifestation of the disease according to age, and the type of procedures needed over the years.

Results: At the time of the first consultation, 88 patients were children, while 35 patients were adults. All patients were followed over the years (mean FU: 9.5 y). 74 patients had at least one operation, while 48 were just followed. When an operation was performed, the mean age at the first operation was 12.7 years. The pediatric and adult populations differ in the type of tumor requiring surgery. The most common pathology in the pediatric population

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which required a neurosurgical procedure was an optic glioma. In the adult population, spinal neurofibromas were the most common lesions requiring surgery.

Conclusions: While in most regions, pediatric patients are regularly followed either by a pediatric neurosurgeon or by a multidisciplinary team, the resources for the follow-up in adulthood are scarcer. Even if the patients might be able to pick-up alarming signs and symptoms better as adults, a regular follow-up is essential. One of the options might be a multidisciplinary team who would follow the neurofibromatosis population irrespective of the age of the patient.

69. Surgical and Therapeutic Strategy of Pediatric Craniopharyngiomas Based on the Quality of Life Study after Growing Up

Shigetoshi Yano, MD, PhD; Mareina Kudo, MD; Jun-ichi Kuratsu, MD, PhD (Japan, Kumamoto)

Introduction: We investigated the latest quality of life of craniopharyngioma patients who had operated in their pediatric periods and discussed the best therapeutic strategy to keep mental- and physiological health good based on their amount of tumor resection and long-term follow-up.

Methods: Twenty-nine patients who were operated in Kumamoto University in their younger day than 15 years-old were enrolled in this study. Their latest quality of life was estimated by SF-36. The Karnofsky performance scale (KPS), visual function, endocrinological examination and tumor removal rate were investigated.

Results: Mean follow-up periods were 21.2 years. Latest KPS better than 80% were observed in 24 patients (82.8%). Twenty eight patients (96.6%) were applied hormonal replacement. Although tumor regrowth rate was higher in partial removal group (90.0%) than subtotal removal group (21.4%), rates of better KPS were almost same. Visual deterioration during follow-up was experienced in 8 patients whose tumors were removed subtotally. In SF36 study, patient's physiological scores were average level but emotional scores were below average level. Eleven patients (40%) were having some emotional trouble, which was seemed to be related to the growth hormone replacement.

Conclusions: Times of operation was not affected to long-term results as long as each surgery was not aggressive. Visual deterioration was most important factor of decrease KPS. Half of the patients have some trouble of emotional state during follow-up. Long term follow-up including adequate hormonal replacement is important.

70. Safety of Interstitial Infusion of 8H9-PE38 to the Pons for Application in a Glioma Model

Neal Luther, MD; Ioannis Karempeles, MD; Nai-Kong V. Cheung, MD, PhD; Ira J. Dunkel, MD; Mark A. Edgar, MD; Philip H. Gutin, MD; Mark M. Souweidane, MD (New York, NY)

Introduction: Interstitial infusion is a form of local delivery that bypasses the blood brain barrier. Monoclonal antibody (MAb) 8H9 recognizes a tumor-specific antigen expressed by gliomas and not by neurons or glia. The distribution of MAb 8H9, as well as the safety and efficacy of 8H9-PE38 in parenchyma and a supratentorial brain tumor model following administration via interstitial infusion, have been previously characterized by our laboratory. Interstitial delivery of 8H9-PE38 is investigated in the rodent brain stem for potential treatment of diffuse pontine gliomas.

Methods: The recombinant immunotoxin 8H9-PE38 or sterile PBS was delivered in increasing doses of 1.2 mcg, 1.8 mcg, and 2.4 mcg in a 5 microliter volume to groups of 5 animals each via interstitial infusion in the pons. Animals were examined for clinical toxicity and brains were harvested to evaluate for cellular evidence of toxicity. A maximum tolerated infusion dose (MTiD) was determined and

planned for implementation in efficacy trials for rats harboring U87 xenografts in the brain stem.

Results: Doses of 1.2 and 1.8 mcg of 8H9-PE38 delivered via interstitial infusion to the rat brain stem were clinically well tolerated. Two animals in the 1.8 mcg group showed evidence of mild neuro- and histotoxicity. At dose escalation to 2.4 mcg four out of five animals suffered significant weight loss with debilitating neurological deficits.

Conclusions: Interstitial infusion of 8H9-PE38 was well tolerated in the brain stem at an MTiD of 1.8 mcg. This dose was selected for use in an efficacy trial for the treatment of U87 brain stem xenografts.

71. Aggressive Surgery for Recurrent Craniopharyngioma.

Timothy M. George, MD, FACS; Nicole Higginbotham, NP, MS (Austin, TX)

Introduction: Due to significant morbidity, there has been a recent impetus to be less aggressive in the surgical management in childhood craniopharyngioma. However, less is written concerning the management of recurrent disease. In particular, what is the best strategy for disease control particularly when there is pre-existing hypothalamic/endocrine dysfunction.

Methods: We studied children reoperated for recurrent craniopharyngioma. All children in this cohort had evidence of endocrine dysfunction. Over a two year period, there were 6 children presenting with recurrent craniopharyngiomas. All had a significant solid component. One had an associated large basilar artery aneurysm. One was suggested that it progressed in response to growth hormone supplementation. All were treated with a variety of surgical approaches depending on the location of the recurrence.

Results: All had complete resections of the tumor. There were no additional morbidities exempt the presenting endocrinopathy. All had improvement in their preoperative symptoms. The patient with the associated aneurysm underwent successful clipping. There were no deaths.

Conclusions: Reoperation for recurrent craniopharyngioma is an efficient method for tumor control and should be proposed whenever the recurrent tumor is solid. Morbidity can be limited when the appropriate surgical technique is used.

72. Endoscopic Management of Third Ventricular Colloid Cysts in Children

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Introduction: Colloid cysts are rare benign tumors which can present with acute hydrocephalus and sudden neurologic deterioration. Endoscopic management of colloid cysts has shown promising results. However, there is no literature regarding endoscopic excision of colloid cysts in children.

Methods: The records of five children out of a total of 43 patients with third ventricular colloid cysts who underwent endoscopic management from 1999 to 2006 were retrospectively analysed. A prerequisite for endoscopic excision was a dilated ventricular system on imaging.

Results: Male: Female ratio was 2:3 with a mean age of 11.6 years (range: 5 to 17 years). Headache and vomiting were the most common presenting symptoms. Other symptoms included drop attacks, seizures, diplopia and visual deterioration. Endoscopic complete and partial cyst excision was performed in 3 and 2 children respectively. Simultaneous septostomy and ETV was done in one patient each. Mean hospital stay following surgery was 3 days. Post

operatively, ventricle size normalized in all and these children were symptomatically relieved. One child had aseptic meningitis and was managed conservatively without sequelae. Mean follow up was 40.2 months with one child lost to follow up after discharge. All children were found to be asymptomatic with no recurrence at last follow up. There is no long term morbidity or mortality.

Conclusions: Similar to adults, endoscopic colloid cyst excision is a minimally invasive, highly effective treatment modality in children and can be adopted as the primary option in experienced hands. However, a still longer follow up is required to assess the true incidence of cyst recurrence.

73. Noninvasive Icp and Brain Compliance Monitoring--clinical Physiologic Tests of Verification and Applications

Kim H. Manwaring, MD (Phoenix, AZ); Preston K. Manwaring, MS (Hanover, NH); Katie Klas, NP, MS (Phoenix, AZ); Jimmy Nguyen, MD (Tucson, AZ)

Introduction: Clinical management of trauma and hydrocephalus can be improved by a method of noninvasive ICP and brain compliance monitoring. We have previously described a method based on phase delay of the pulse waveform of the supraorbital artery (SOA) against an extracranial timing reference such as the finger pulse. We now describe established physiologic methods of clinical alteration of ICP and brain compliance in verification of this approach.

Methods: Six normal subjects underwent repeated maneuvers to alter ICP and brain compliance compared to a database of 51 normal subjects tested on a tilt table to methodically increase ICP. Six patients with hydrocephalus or cranial constraint underwent comparative tests. Two patients were studied for effects of anesthesia induction and wake-up. Tests included tilt table inversion, hyperventilation to expired pCO₂ of 25 and hypoventilation to pCO₂ of 50.

Results: All subjects showed predictable alteration in brain compliance with inversion as demonstrated by prolonged SOA phase delay. Hyperventilation can consistently reverse brain compliance to normal temporarily. Hypoventilation worsens brain compliance consistently. ICP manometer testing in shunted patients correlates to demonstrated altered brain compliance. Anesthetic induction, wake-up, and prone positioning worsen brain compliance and increase ICP. Cranial expansion surgery normalizes abnormal compliance.

Conclusions: Noninvasive ICP monitoring is a valuable guide to trauma management triage, outpatient assessment of hydrocephalus, and useful in anesthesia of patients at risk with altered brain compliance. Slit ventricle syndrome and craniostenosis may be associated with abnormal compliance; effective treatment is demonstrated to normalize compliance.

74. Critical Evaluation of Decompressive Craniectomy in Infants and Toddlers

Matthew Adamo, MD; Doniel Drazin, MA; Caitlin Smith, BS; John Waldman, MD (Albany, NY)

Introduction: Infants with severe traumatic brain injury represent a challenge. This report presents seven cases of decompressive craniectomy in infants and toddlers.

Methods: We reviewed charts of brain-injured infants presenting to Albany Medical Center Hospital from January 2004 to July 2007, focusing on age, admission physical exam, positive imaging findings, surgery, complications, postoperative interventions, and physical exam at discharge and outpatient follow-up using King's Outcome Scale for Childhood Head Injury (KOSCHI).

Results: Seven infants met the criteria. Six had non-accidental trauma; one had hemorrhagic conversion of a large MCA infarction. At admission, all were minimally responsive, four had equal and minimally reactive pupils, three had anisocoria with the enlarged pupil ipsilateral to the lesion, and all had right-sided hemiparesis. Six patients received left hemicraniectomy; one received left frontal craniectomy. In all cases, bone was cultured and stored at the bone bank. Post-operatively, three patients needed external ventricular drains. After prolonged CSF drainage and wound care, these patients all developed epidural and subdural empyemas necessitating surgical drainage and debridement. All patients developed hydrocephalus necessitating a ventriculoperitoneal shunt. All had their bone replaced one to six months post-op. Two patients required re-operation due to bone reabsorption. At outpatient follow-up visits, all had KOSCHI scores of 3 or 4. Each was awake, interactive, and could sit/crawl/walk with assistance. All had persistent, improving right-sided hemiparesis and spasticity

Conclusions: Despite poor initial exams, infants with severe traumatic brain injuries can safely undergo decompressive craniectomy with reasonable neurological recovery. Post-operative complications must be anticipated and treated appropriately.

75. Scaled Cortical Contusion in Immature Swine: Effect of Age and Gender on Lesion Volume

Symeon Missios, MD; Brent T. Harris, MD, PhD; Patricia B. Quebada, MD; Carter P. Dodge, MD; Simon C. Hillier, MD; Beth A. Costine, PhD; Michael K. Simoni, BS; Rachel Curtis, BS; Leslie Adams; Ann-Christine Duhaime, MD (Lebanon, NH)

Introduction: The piglet scaled cortical contusion model creates a cortical/subcortical contusion using a skull-mounted, spring-loaded blunt indentation device placed directly on the brain surface. The system is scaled for the size of the brain so identical forces are delivered to comparable brain structures in subjects of different ages.

Methods: 87 subjects including infant (5-7 day-old), toddler (one month-old) and early adolescent (four month-old) piglets underwent scaled cortical impact injuries under strict anesthetic protocol and histologic and radiologic analysis one week later. Blunt trauma was delivered to the rostral gyrus. One week after injury, the subjects underwent 3T MRI and brain harvest. Lesion size was determined by histologic analysis and the ratio of the lesion area over the area of the contralateral hemisphere (% hemisphere injured) was calculated.

Results: Data were available for 51 of the 87 subjects. Adolescent subjects showed lesions which measured 9 times larger than infants ($p < 0.0001$). Lesion volumes were larger in toddlers than infants but this difference was only significant for males ($p < 0.029$). Adolescent females had larger lesions than males at that age ($p < 0.001$). Adolescent subjects had higher average temperatures, averaging 1.5oC warmer. There was no difference in temperature between males and females and no correlation between temperature and lesion volume within any age group.

Conclusions: In this model, age was the most robust predictor of lesion. Gender differences were observed and were age-dependent. Use of protocols for strict control of physiologic variables have reduced intersubject variability and treatment trials for subjects at different stages of maturation now appear feasible.

76. Folic Acid Supplementation Enhances Cns Regeneration In Vitro

Krista Stewart; Sarah Bassiouni; Brenton Meier, BS; Nithya Hariharan, MD (Madison, WI); Elias Rizk, MD (Hershey, PA); Bermans J. Iskandar, MD (Madison, WI)

Introduction: We have previously shown that folic acid supplementation significantly enhances regeneration of the injured

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CNS in vivo. To determine whether folate acts at the level of the neurons or glia, we studied the behavior of folate in an in vitro model of neuronal regeneration.

Methods: Sprague-Dawley rats were subjected to bilateral C3 dorsal column transaction. Half the rats were pretreated with intraperitoneal folic acid (80ug/kg), the dose optimal for spinal regeneration in vivo. The lumbar DRGs, which contain the cell bodies corresponding to the injured spinal axons, were removed 3 days postoperatively, dissociated, then placed in a culture medium permissive for growth. Neurons were fixed/plated at time intervals 5-48 hours after culture initiation. Axonal elongation was assessed blindly using ImageJ software.

Results: After 24 hours of growth, the DRG neurons of folate-pretreated animals produced a significantly greater percentage of long axons (>300µm) than those in the untreated group (22% compared to 7%, $p < 0.05$). In addition, growth of folate-treated neurons occurred 20 hours earlier than the controls. At all time points, folate-treated neurons exhibited longer axons.

Conclusions: Folic acid enhances CNS regeneration through a direct effect on the neuron. A concomitant effect of folic acid on the inhibitory glia cannot be ruled out. Nonetheless, the neuronal effect is very significant and might impact not just our understanding of repair processes in the mature CNS, but also the growth/developmental mechanisms that lead to congenital defects such as spina bifida. This could lead to novel treatment and prevention measures for patients with degenerative and developmental CNS problems.

77. Surgical Treatment of Arachnoid Cysts in Children

George A. Alexiou, MD; Maria Varela, MD; Neofytos Prodromou, MD, PhD (Greece, Athens)

Introduction: The optimal treatment of symptomatic arachnoid cyst remains controversial. We present a single institution experience on surgical treatment of arachnoid cysts.

Methods: Between January 1983 and January 2008, 92 patients with symptomatic arachnoid cysts underwent surgery in our institute. All patients had been evaluated with CT and/or MRI and had been operated upon and had regular follow-up examinations.

Results: There were 60 males and 32 females. The mean age was 3.6 years (range 2 days to 14 years). Forty-eight cysts (52%) were within the Sylvian fissure, 16 (17%) in the cerebral convexity, 15 (16%) infratentorial, 10 (11%) in the interhemispheric fissure and 3 (4%) cysts were parasellar. Cysto-peritoneal shunt was placed in 67 (73%) patients, ventricular drainage alone was performed in 14 (15%) patients and combined drainage of the ventricular system and cyst, using a three way connector, in 8 (9%) patients. Craniotomy and fenestration of the cyst was performed in 2 (2%) patients, whereas total excision of the cyst was performed in one patient. Shunt revision for various reasons was performed in 34 patients (39%), whereas 13 (14%) patients required more than one revision. Complete alleviation of symptoms was achieved in all patients after treatment, regardless of cyst reduction. After a mean follow-up of 102.6 months no symptom recurrence or further enlargement of the arachnoid cysts was noted.

Conclusions: We conclude that shunt placement is a safe and effective surgical treatment of symptomatic arachnoid cysts in children.

78. Pial Synangiosis for Moyamoya Syndrome: The Hospital for Sick Children Experience.

James A. J. King, MBBS, PhD; Peter Dirks, MD, PhD (Canada, Toronto)

Introduction: We review cranial revascularization in children with moyamoya syndrome at The Hospital for Sick Children (HSC) in Toronto, with particular emphasis on analysis of post operative complications, endeavouring to identify at risk patients and develop measures to avoid such complications.

Methods: The clinical and radiologic records obtained in a consecutive series of moyamoya patients, as identified by interrogating the neurosurgical database, were reviewed. Patients were 16 years or younger undergoing revascularization surgery for moyamoya from May 1996 to March 2008.

Results: 28 patients (17 female and 11 male) undergoing a total of 44 craniotomies were identified. 12 patients were Asian, 4 with Neurofibromatosis type 1, 2 with previous cranial irradiation and 2 with Down syndrome. Stroke had occurred in 61% of patients and transient ischaemic attacks (TIAs) in 43% prior to surgery. 74% of hemispheres surgically treated exhibited excellent revascularization (Matsushima Grade A) on angiography and there were no strokes documented in any patients greater than one month from surgery, in long term follow up of mean 4.4 years. There were five episodes of perioperative stroke (11.4% per treated hemisphere and 17.9% per patient) and these patients experienced a greater reduction in systolic blood pressure and a lower mean PaCO₂ intraoperatively.

Conclusions: Pial synangiosis is an effective and durable treatment for moyamoya syndrome. Those patients with recent stroke and/or frequent TIAs are at the greatest risk for post operative stroke. The strictest adherence to measures that maintain cerebral blood flow in the perioperative period in these patients is critical to minimize such events.

79. Urinary Biomarkers Predict Presence of Moyamoya Disease

Edward R. Smith, MD; David Zurakowski, PhD; R. Michael Scott, MD; Marsha A. Moses, PhD (Boston, MA)

Introduction: A major difficulty in treating moyamoya is the lack of effective methods to detect novel or progressive disease prior to the onset of disabling stroke or hemorrhage. An "early warning system" for identifying at-risk patients could improve patient outcomes. In this study, we have evaluated the efficacy of urinary matrix metalloproteinases (MMPs) as diagnostic biomarkers for moyamoya.

Methods: Urine, cerebrospinal fluid and tissue specimens were collected from patients with moyamoya. Zymography, ELISA and immunohistochemistry were used to characterize the presence of MMP-2, MMP-9, MMP-9/NGAL and VEGF. Results were compared to age and sex-matched controls and subjected to statistical analyses.

Results: Evaluation of a specific panel of urinary biomarkers by ELISA demonstrated significant elevations of MMP-2, MMP-9, MMP-9/NGAL and VEGF (all $P < 0.005$) in samples from moyamoya patients compared to controls. ROC curves for individual and multiplexed biomarkers showed excellent discrimination, with sensitivity of 87.5%, specificity of 100% and accuracy of 91.3%. Immunohistochemistry identified these same proteins in the source tissue.

Conclusions: We report, for the first time, identification of a panel of urinary biomarkers that predicts the presence of moyamoya. These biomarkers correlate with presence of disease and can be tracked from source tissue to urine. These data support the hypothesis that urinary MMPs and associated proteins are useful predictors of the presence of moyamoya and may provide a basis for a novel, non-invasive method to identify new disease and monitor known patients following treatment.

80. Normal Deep Venous Drainage in Vein of Galen Aneurysmal Malformations: Clinical Implications in Treatment Strategies

Edward S. Ahn, MD; Ingrid Burger, MD, PhD; Rachel Lagos, MD; Juan Gomez, MD; Lydia Gregg, BA; Philippe Gailloud, MD (Baltimore, MD)

Introduction: The treatment of vein of Galen aneurysmal malformations (VGAM) has dramatically improved with endovascular techniques. Traditionally, it is thought that VGAMs are not connected to the normal deep draining veins. However, we present a series of patients with radiographic demonstrations of normal deep veins draining into the malformation after endovascular treatment.

Methods: Retrospective review of patients who underwent endovascular treatment for VGAMs.

Results: Three patients (age range: 5 days - 8 years) demonstrated one or more normal deep draining veins after endovascular treatment of VGAMs. All three presented with various degrees of high output cardiac failure. Endovascular treatment consisted of staged embolization with N-butyl cyanoacrylate (NBCA) alone or in combination with detachable microcoils. Two patients underwent staged transarterial embolization with complete elimination of flow in the lesions. The third child underwent a combination of transarterial and transvenous embolizations. On follow-up imaging, the first two patients demonstrated evidence of one and two internal cerebral veins, respectively, draining into a shrunken vein of Galen. The third patient demonstrated a varicose basal vein of Rosenthal draining into a residual VGAM.

Conclusions: These cases demonstrate, unequivocally, connections between the deep venous system and the venous aneurysm of VGAMs. Their presence may explain complications after coiling of the venous aneurysm, such as intraventricular hemorrhage and basal ganglia strokes. Based on these findings, staged glue embolization of arterial feeders and, if necessary, venous coiling are the treatments of choice; however, venous coiling should be staged in order to decrease the risks of drastic venous flow modifications.

81. The Association between Moyamoya Syndrome and SCA Does not Correlate with Common Laboratory Values and Transcranial Doppler Ultrasound Results

Todd C. Hankinson, MD, MBA; Matthew Balatbat; Jason Wade; Robert Starke, BS; Monica Bhatia, MD; Margaret Lee, MD; Maureen Licursi, MSN, ACNP; Neil A. Feldstein, MD; Richard C.E. Anderson, MD (New York, NY)

Introduction: Approximately 11% of children with Sickle Cell Anemia present with ischemic cerebrovascular events. Some of these patients demonstrate moyamoya like changes on cerebrovascular imaging and can be effectively treated with Pial Synangiosis. Although SCA patients undergo frequent laboratory testing and often require exchange transfusions, no known parameters predict the presence or development of moyamoya syndrome prior to clinical presentation.

Methods: We retrospectively reviewed pre-transfusion laboratory and non-invasive vascular imaging data in 3 age-matched cohorts of SCA patients. Group A (6 patients) suffered no cerebrovascular events, group B (7 patients) suffered an ischemic CVA but demonstrated no moyamoya-like vasculature, group C (5 patients) demonstrated moyamoya syndrome and was treated with Pial Synangiosis. Laboratory data included mean WBC, hemoglobin, hematocrit, platelet count, reticulocyte count, ferritin level, Total and Direct Bilirubin levels, and HbS fraction. Imaging data included MR angiography in all patients and transcranial Doppler ultrasound in 13 patients.

Results: No single laboratory value or combination of values demonstrated a statistical difference between groups. TCD velocities

did not correlate with the presence of cerebrovascular pathology.

Conclusions: Commonly assessed laboratory values in the SCA population do not correlate with the presence or development of moyamoya syndrome in patients with or without cerebrovascular pathology. Elevated peak velocities as measured by transcranial Doppler ultrasound are not specific for the presence of moyamoya syndrome. Screening Magnetic Resonance Angiography should be considered in all patients with SCA.

82. Surgical Treatment of Moyamoya with Pial Synangiosis Provides Independence from Exchange Transfusions in Sickle Cell Disease

Edward R. Smith, MD; Matthew R. Naunheim, BA (Boston, MA)

Introduction: A large percentage of children with sickle cell disease (SCD) and elevated transcranial Doppler (TCD) velocities have moyamoya disease, with approximately 11% of these children suffering a stroke by age 20. Though recent trials demonstrate that exchange transfusions may reduce the risk of stroke in some children with SCD, the potential for significant complications exists, including iron overload, hemosiderosis, transfusion-transmitted diseases, immunologic reactions, catheter-related thrombosis and infection. Any treatment capable of decreasing reliance on exchange transfusions in this population would be useful in reducing these risks.

Methods: Case report.

Results: A 10 year-old boy with SCD and concomitant moyamoya experienced multiple crescendo strokes in the months prior to treatment and was dependent on exchange transfusions, which were only partially successful in reducing his symptoms. His moyamoya was subsequently treated by revascularization with pial synangiosis. Following an uncomplicated surgery, he has been free from ischemic events for 18 months despite persistent elevated TCD velocities (>300 cm/sec) and MRA findings indicating progression of his moyamoya disease. Importantly, following surgery, he has also been completely weaned from exchange transfusions.

Conclusions: This report highlights the potential for pial synangiosis as a therapeutic technique for reducing the risk of stroke in sickle cell patients and - for the first time - documents the feasibility of surgical treatment of moyamoya to free SCD patients from transfusion therapy and its attendant risks. These findings are important to both neurosurgeons and hematologists caring for this substantial population.

83. Endoscopic Management of Intracranial Arachnoid Cysts

Rohit K. Goel, MD, MS; Ananth K. Vellimana, MD; Ashish Suri, MD; P Sharat Chandra, MD, MS; Rajendar Kumar, MD, MS; Bhawani S. Sharma, MD, MS (India, New Delhi)

Introduction: Arachnoid cysts are benign congenital collections of cerebrospinal fluid in areas rich in arachnoid matter. Various operative alternatives are available for their management. Endoscopic treatment has now emerged as an attractive option.

Methods: A retrospective analysis of the records of 24 children with intracranial arachnoid cysts who underwent endoscopic management from 1999 to 2006 was undertaken.

Results: There were 14 males and 10 females with a mean age of 4.85 years (range: 2 months to 17 years). All patients were symptomatic. Progressive enlargement of the head and seizures were the most common presenting symptoms. Other symptoms included delayed milestones, headache, vomiting, visual deterioration, gait ataxia, amenorrhea, feeding difficulties and apneic spells. The location of the cysts were- Posterior fossa (n=9), Temporal (n=5), Suprasellar (n=5), Cerebellopontine angle (n=3) and Interhemispheric (n=2). The endoscopic procedures performed include Cystocisternostomy (n= 12), Cystocisternostomy and ETV

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(n= 6), Cystocisternostomy and ETV with aqueductoplasty (n=1), Cystocisternostomy and Cystoventriculostomy (n= 4), Cystoventriculostomy and ETV (n =1). Post operatively, size of the cyst decreased in all children. Improvement of symptoms was seen in all cases. Two children had CSF leak and the wound was re-sutured. There were no other complications. Mean duration of follow-up was 27 months (range 4 - 79 months). Three were lost to follow up. None of the children required any further treatment and had no recurrence at last follow-up.

Conclusions: Endoscopic management is a highly effective, minimally invasive and safe treatment option for arachnoid cysts and can be adopted as the first line of treatment in experienced hands.

84. Management of Pediatric Brainstem Cavernous Malformations: The Past 20 Years of Experience at Hsc

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Introduction: Brainstem cavernous malformations (CM) pose a formidable challenge due to their location. The optimal management of these lesions requires astute neurosurgical judgment.

Methods: We have performed a thorough retrospective chart review on pediatric patients who have been diagnosed with brainstem CM at the Hospital for Sick Children over the past twenty years.

Results: Twenty patients (n=20) were diagnosed with brainstem CM, and the mean age at diagnosis was 8.8 +/- 5.4 years (13 males: 7 females). The mean size of the CM was 13.9 +/- 10.7mm. They were evenly distributed on the right and left sides, and their locations were as follows: 4 midbrain, 13 pontine, and 3 medullary. Seven patients (n=7) underwent surgery for the management of their CM, with mean age at presentation of 6.2 years and mean CM size of 19.9 +/-8.3 mm. Of note from the surgical group, 2 patients had a positive family history of CM, 2 lesions were medullary, 6 out of 7 patients had pial/CM contact, and 6 out of 7 lesions were located on the right. The mean age at presentation of the non-surgical group (n=13) was 10.1 years and the mean CM size was 10.6 +/- 10.7mm. Seven of these patients had a prior history of radiation and only 3 patients had pial/CM contact.

Conclusions: Multiple important factors seem to be key in determining patient management. One hopes to improve future clinical outcomes of these challenging lesions by the careful evaluation learned from past experiences.

85. Fusion Rates Following Rigid Internal Fixation of the Occiput to C2 are Equivalent with or without C1 Instrumentation

Richard C.E. Anderson, MD; Todd C. Hankinson, MD, MBA (New York, NY); David Pincus, MD, PhD (Gainesville, FL); Luis Rodriguez, MD (Tampa, FL); David Harter, MD (New York, NY); Douglas Brockmeyer, MD (Salt Lake City, UT)

Introduction: Recent advances in rigid internal spinal fixation include pediatric occipitocervical constructs. Adult clinical and biomechanical studies suggest that increasing points of spinal fixation correlates with construct rigidity and increased fusion rates. Smaller anatomic size and frequent congenital anomalies make pediatric screw placement challenging. We assessed whether rigid fixation at C1, C2, both levels, or unilaterally correlated with outcome in children undergoing O-C2 fusion.

Methods: We reviewed 61 cases, from 5 pediatric centers, of O-C2 fusion using rigid internal fixation and bone grafting. Patients were divided into 5 groups based on construct fixation points: C1 only, C2 only, both C1 and C2, any C1-C2 transarticular screw (TAS), or unilateral. Outcomes included radiographically confirmed fusion and operative complications

Results: Thirty-five cases (57.3%) included C1-C2 TAS placement, 13 cases (21.3%) included fixation at C1 and C2 and 13 cases (21.3%) included C2 only. No cases included O-C1 or unilateral fixation only. One patient underwent halo immobilization following bilateral C2 only fixation. All cases utilized autograft bone. In 59 of 61 cases (96.7%), fusion was confirmed. The remaining 2 patients (1 TAS, 1 C1 and C2 fixation) are awaiting imaging. Complications included vertebral artery injury during TAS placement in 2 cases (5.7%) without clinical sequelae.

Conclusions: In children undergoing O-C2 fixation, fusion rates were similar whether fixation included points at C2 only, both C1 and C2, or transarticular fixation. Complication rates were similarly low in all groups. Fixation may not be required at every level for stabilization in these patients. Instrumentation should be individually tailored.

86. Incidence of Cervical Spine Injury in Infants with Head Trauma

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Introduction: Guidelines for management of traumatic brain injury should rule out a cervical spine injury (CSI), but are difficult to apply to the smallest children. We studied CSI in children under one year of age with head trauma without a major mechanism, to determine when aggressive investigation might be warranted, and when not.

Methods: We reviewed our trauma data base and medical records from 1993 - 2007. Children with all head injuries were selected, excluding motor vehicle accidents and known falls greater than 10 feet. Children with an unclear history and non-accidental trauma (NAT) were included. Imaging of the head and cervical spine was reviewed. When appropriate, autopsy reports were reviewed.

Results: 905 patients under a year of age had head trauma. 557 had normal cervical spinal imaging, and 903 patients had no clinical or radiographic evidence of CSI. 1 patient with NAT had a C4 laminar fracture on CT, requiring no specific treatment. One patient with severe NAT, brain dead at admission, had no evidence of spinal injury on CT, but pneumomediastinum with extension to the neck. She had a ventral spinal epidural hematoma at autopsy. No patient had late symptoms of CSI on follow up.

Conclusions: In 905 patients less than a year of age with head trauma without a major mechanism, only 2 cervical spine injuries were detected, both in patients with NAT. Aggressive investigation for cervical spine injury is not warranted in very young patients, without specific clinical indications beyond the mere occurrence of the head injury.

87. Use of Iso-c And O-arm for Image Guided Spinal Fixation Screw Placement in Children

David W. Pincus, MD, PhD; Leigh Ann Perkins, ARNP, MSN; Frank Bova, PhD; Mu Yang, MS; Jeffrey Bennett, MD; J. Bridger Cox, MD (Gainesville, FL)

Introduction: The placement of spinal fixation screws can be technically demanding particularly in small children. A variety of techniques may be employed including anatomic, fluoroscopic or stereotactic guidance. Isocentric fluoroscopy and portable cone beam CT allow the incorporation of intraoperative imaging into a 3-dimensional stereotactic workstation. Instruments can be tracked for placement of fixation screws in any spinal level.

Methods: An IRB-approved retrospective chart review of all pediatric spinal fixation procedures by the senior author between 2001 and 2008 was performed. Thirty-one children 16 years old or younger had screws placed with intraoperative image-guided navigation. Bony fusion and screw position was evaluated with CT for all occipital-cervical and atlanto-axial procedures and CT or plain radiographs for thoracolumbar procedures. Studies were reviewed by a neuroradiologist

Results: The mean age for patients who underwent stereotactic screw placement was 10 years (range 2 to 16). Indications included trauma (21), congenital anomaly (9), and tumor reconstruction (1). A total of 48 cervical screws and 104 thoracolumbar screws were placed. No patients suffered hardware related complications. Bony fusion and satisfactory screw placement were seen on CT for all O-C and C1-2 operations, and CT or plain radiographs for all thoracolumbar procedures.

Conclusions: Stereotactic guidance with intraoperative imaging is a valuable method for the placement of spinal screws. It provides a high degree of accuracy and increased confidence in hardware placement, particularly with small bony structures or aberrant anatomy. It is also an excellent teaching tool for surgeons new to spinal fixation.

88. CT Morphometric Analysis for Pediatric C1

Lateral Mass Screw Placement

Roukoz B. Chamoun; William Whitehead, MD; Daniel Curry, MD; Thomas Luerssen, MD; Andrew Jea, MD (Houston, TX)

Introduction: C1 lateral mass screws provide an alternative to C1/2 transarticular screws. However, these screws are challenging in the pediatric spine.

Methods: CT morphometric analysis was performed on 76 pediatric cases. Measurements were determined for screw entry points, trajectories, and lengths for application of the technique described by Harms and Melcher.

Results: The mean height and width for screw entry on the posterior surface of the lateral mass were 2.6 and 8.5 mm, respectively. The maximum medially angled screw trajectory from an idealized entry point: 4 to 27 degrees (mean, 16 degrees). The mean maximal screw depth: 20.3 mm. The overhang of the posterior arch averaged 6.3 mm (range, 2.1 - 12.4 mm). The measurements between the left and right lateral masses was significantly different for the maximum medially angled screw trajectory ($p = 0.003$) and the maximum inferiorly directed angle ($p = 0.045$). Differences in measurements in children < 8 years of age and ≥ 8 years of age was statistically significant for the entry point height ($p = 0.038$) and maximum laterally angled screw trajectory ($p = 0.025$).

Conclusions: Significant variations in the morphology of C1 exists, especially between the left and right sides and in children $<$ and ≥ 8 years of age. The critical measurement of whether the C1 lateral mass could accommodate a 3.5-mm-diameter screw in a child is the width of the lateral mass and its proximity to the vertebral artery. Only 1 out of 152 lateral masses studied could not accommodate a lateral mass screw.

89. Hybrid Spinal Constructs Using Sublaminar Polyester Bands in Posterior Instrumented Fusions in Children: A Series of 5 Cases

Andrew Jea, MD; Ashwin Viswanathan, MD; Keyne K. Johnson, MD; William E. Whitehead, MD; Daniel J. Curry, MD; Thomas G. Luerssen, MD (Houston, TX)

Introduction: The authors report the novel use of sublaminar polyester bands in posterior instrumented spinal fusions of the thoracic and lumbar spines and sacrum in 5 children. This report represents the first reported use of polyester bands in spine surgery in the United States.

Methods: The authors retrospectively reviewed the demographics and procedural data of five children, ranging in age from 9 months to 18 years, who required and underwent posterior instrumented fusion for post-trauma kyphotic deformity (1 patient), congenital scoliosis from hemivertebra anomaly (3 patients), and neuromuscular scoliosis associated with spina bifida (1 patient).

Results: There was one instance of lamina fracture with application and tensioning of the polyester band, and one instance of transient worsening of proprioception with sublaminar passage of the polyester band. The lessons learned from these complications are discussed. There were no complications in long-term follow-up. Arthrodesis with cancellous morselized allograft and bone morphogenic protein was achieved in all patients.

Conclusions: Pedicle screws, laminar/pedicle/transverse process hooks, and sublaminar metal wires have been incorporated into posterior spinal constructs and widely reported and used in the thoracic and lumbar spines and sacrum with varying success. This report demonstrates the successful results of hybrid posterior spinal constructs that include sublaminar polyester bands that promise the technical ease of passing sublaminar instrumentation with the immediate biomechanical rigidity of pedicle screws and hooks.

90. Management of Osteblastoma and Osteoid Osteoma of the Spine in Childhood

Sasha C. Burn, FRCS; W C. Halliday, MD; R Zeller, MD; J M. Drake, MD, FRCSC (Canada, Toronto)

Introduction: Osteblastomas and osteoid osteomas are rare lesions in childhood and management strategies have changed. We reviewed our recent experience in these two lesions to elucidate current treatment modalities and outcomes.

Methods: Case records and radiographic images of all patients with the diagnosis of osteblastoma and osteoid osteoma from 1993 - 2008 were retrospectively reviewed including those managed non-operatively.

Results: 30 cases were identified, 22 surgical, 8 non-surgical management. Mean age at presentation was 13 years (range 3-17 years). 29/30 (97%) patients presented with pain. 7/30 (23%) patients had scoliosis at presentation. 12/30 (40%) patients experienced relief with NSAIDs. Of the patients who underwent surgery, 7/22 (32%) were diagnosed with osteoid osteoma and 15/22 (68%) with osteblastoma. 9/22 (41%) underwent fusion (bone only or instrumentation) at the time of surgery. Pain relief off medication was achieved in 16/22 (73%) of the surgical group at a mean of 28 months follow up (range 2-75 months). 4/8 (50%) of the non-surgical group were pain free at a mean follow up of 33 months (range 24-51 months).

Conclusions: Osteblastomas and osteoid osteomas can be challenging management problems in pediatric patients. In those where conservative therapy fails, or where pathological diagnosis is required, surgery using modern intraoperative imaging and spinal instrumentation can provide symptom relief and tumour control in the majority of patients.

91. Ventriculoperitoneal Shunt Failure Following Intradural Spinal Surgery

Jeffrey Pugh, MD; Chevis N. Shannon, MBA; R S. Tubbs, PhD; J C. Wellons III, MD; J P. Blount, MD; W J. Oakes, MD (Birmingham, AL)

Introduction: Many patients with shunted hydrocephalus have comorbidities that necessitate intradural procedures of the spine (e.g. cord detethering of a patient with myelomeningocele closure at birth who has shunted hydrocephalus). We have previously reported case reports of shunt failure in patients undergoing spinal procedures where the dura is opened and hypothesized that such failures may be due to transient changes in cerebrospinal fluid dynamics. To elucidate further this potential association, the present study was performed.

Methods: We retrospectively reviewed 326 electronic medical records to identify pediatric patients with spina bifida and cerebral palsy and concomitant shunted hydrocephalus who underwent intradural spinal procedures between 2002 and 2008.

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Results: We identified 53 patients with shunted hydrocephalus who went on to have spinal cord untethering, baclofen pump insertion, or partial dorsal rhizotomy. Twenty one of these 53 (39%) required shunt revision within 3 months. Six (11%) and nine (15%) of the patients required additional shunt revisions at 6 and 12 months, respectively. The majority of revisions were due to ventricular catheter obstruction. However, 3 patients acquired infections 3-months post spinal procedure resulting in a shunt revision procedure.

Conclusions: Identifying factors that are predictive of shunt failure in patients with hydrocephalus continues to be a challenge. Our data demonstrate that intradural spinal surgery is temporally and statistically associated with an increased rate of shunt failure. Proposed mechanisms by which this occurs will be discussed.

92. The Adult Hydrocephalus Clinic: A Paradigm Shift for Management of Adult Hydrocephalus Patients by Pediatric Neurosurgery

Mark G. Hamilton, MD, FRCSC (Canada, Calgary)

Introduction: The population of adult patients with hydrocephalus is increasing as diagnostic and therapeutic techniques enhance identification and survival of treated patients. Hydrocephalus patients are usually assessed and cared for by individual physicians in an unstructured and unfocused clinic environment.

Methods: In 2001, the University of Calgary Adult Hydrocephalus Clinic was established by and run by Pediatric Neurosurgery with the goal to standardize and enhance the care for patients with hydrocephalus. Investigative and management protocols were established and a patient database was initiated.

Results: In 2008 there are approximately 1000 patients followed or tracked by the Adult Hydrocephalus Clinic. This population includes patients who initially had a diagnosis of hydrocephalus as a child, adults with acute/subacute hydrocephalus, patients with long-standing overt ventriculomegaly (LOVA), and patients with idiopathic Normal Pressure Hydrocephalus (iNPH). Approximately 8% of the active patients have had no treatment for their hydrocephalus and are being monitored with clinical, MRI, and neuropsychological evaluations. This clinic also provides opportunity to better understand the natural history of patients with untreated hydrocephalus. Treatment modalities have included shunting and endoscopic third ventriculostomy (ETV). Approximately 95% of patient complaints related to their hydrocephalus are investigated on an outpatient basis, avoiding Emergency Room utilization.

Conclusions: This approach to focus the care of adult patients with hydrocephalus in a specialty clinic by Pediatric Neurosurgeons represents an important evolution. Pediatric Neurosurgeons can take the lead in managing the transition care of Pediatric patients with hydrocephalus and should apply their expertise to management of the adult patient with treated and untreated hydrocephalus.

93. Assessing the Early Results of a Multidisciplinary Adult Spina Bifida Transition Clinic

Julian J. Lin, MD; Brandon Bond, BA; Lynn Lyle, RN (Peoria, IL)

Introduction: Despite the success of the multidisciplinary pediatric spina bifida clinic model, the challenge of care for this population as they enter adulthood is unmet. We present the early results of a new clinic designed to provide transition of care into adulthood.

Methods: Forty-two (24 male) patients age 16 and over (average 24) were transitioned into the adult clinic which convenes quarterly. The clinic is staffed by a fellowship trained pediatric neurosurgeon, fellowship trained pediatric urologist, physiatrist, and internist. Patients' charts were reviewed for general information and clinical conditions/treatments (shunt independence/dependence, ambulatory status, lower urinary tract management technique, health issues, referral vectors, therapies, etc).

Results: There were 7(17%) patients without shunt and 13(31%) were shunt independent. Only two patients underwent shunt revision in the past 7 years. Three patients required recent spinal cord detethering. All patients required persistent urological and renal monitoring. Orthotic and wheelchair adjustments/upgrades were recurrently indicated. None of the patients required orthopedic referrals. Psychosocial intervention was also important given the prevalence of emotional, educational, vocational, sexual, and independence challenges. Other details and patient survey result will be presented.

Conclusions: Coordinated care for spina bifida patients at the adult-end of the healthcare continuum is necessary to mitigate against the inefficient and ineffective delivery of a patchwork of healthcare services. Based on treatments and referral vectors, the goals of health maintenance, proactive treatment, and prevention of derivative disabilities are effectively being met by the transition clinic. Moreover, the single point-of-care setting versus disparate specialist appointments provided a high level of patient convenience.

94. Rare Vascular Anatomy in a Child with Onset of Trigeminal Neuralgia

Malini V. Narayanan, MD, MS; Healy A. Michael, MD (Toledo, OH)

Introduction: Trigeminal Neuralgia is rare in the pediatric population. The etiology in the pediatric population is more likely to be a venous compressive component. We report a case of pediatric trigeminal neuralgia of unique vascular anatomy and, to our knowledge, not reported elsewhere.

Methods: Retrospective case analysis with 9 year follow-up. MD was a 10 year girl who presented with severe left trigeminal neuralgia (V2 & V3) and failed 6 weeks of aggressive medical management. MRI with gadolinium was negative. Pt underwent a retrosigmoid approach for a microvascular decompression.

Results: The superior cerebellar artery was identified, tracking superiorly and coming into contact with the trigeminal nerve about 5mm from its origin at the brain stem. About 3mm from Meckel's cave, the artery fenestrated the nerve. Mobilization could not be done, secondary to the penetration of the nerve by the artery. Finally, teflon sponges were used above and below the compression. In addition, a ventriuloperitoneal shunt tubing was cut longitudinally to cover the artery and prevent pulsations on the nerve where the fenestration occurred.

Conclusions: The patient, nine years in follow-up, has remained medication free and pain free. This is a rare pediatric case of trigeminal neuralgia caused by the superior cerebellar artery. The fenestration of the nerve was most likely a congenital anomaly. Careful inspection of the entire length of the nerve is important to identify compression syndromes. Finally, early operation should be considered as it may prevent permanent alteration in the nerve due to compression or pulsations.

95. Ventriculo-peritoneal Shunt Infection from Brucella Melitensis

George A. Alexiou; Ilias Manolagos, MD; Neofytos Prodromou, MD, PhD (Greece, Athens)

Introduction: Infection constitutes a significant problem in shunt procedures. Coagulase negative Staphylococcus is the most common isolated organism. We report on a rare case of ventriculo-peritoneal shunt colonization with Brucella melitensis.

Methods: A 2-years-old boy presented in our institute with high fever and signs of meningitis. The patient had been operated at 6 month of age due to a choroids plexus papilloma and a ventriculo-peritoneal shunt was placed due to secondary hydrocephalus.

Results: Externalization of the ventricular catheter was performed, in combination with intraventricular and systemic administration of antibiotic medication. Cultures of cerebrospinal fluid and shunt yielded a growth of Brucella melitensis but not the blood cultures. The past history of the patient revealed consumption of unpasteurized cheese. The patient received the proper antibiotic medication and after 6 weeks a new ventriculoperitoneal shunt was placed. On follow-up examinations the patient was in excellent condition.

Conclusions: Shunt infection from brucella is extremely rare. Nevertheless, clinicians should meticulously sought patient's previous history for unexpected pathogens.

96. Frontal Encephaloceles Arise Embryologically after Telencephalic Cleavage

Mark S. Dias, MD (Hershey, PA)

Introduction: Encephaloceles are thought to arise embryologically as post-neurulation malformations, involving an intrinsic mesenchymal insufficiency that leads to herniation of neural tissue

through the defective neurocranium.

Methods: Case report of an infant with a frontal encephalocele

Results: At surgery the encephalocele sac contained only a single frontal lobe; the remaining frontal lobe had remained within the calvarium and was grossly normal.

Conclusions: This case supports a post-neurulation mechanism for frontal encephaloceles, and further refines the embryological time line for these malformations to a period beyond embryonic telencephalic cleavage, which begins at Stage 14 of O'Rahilly and Müller (post-ovulatory day 32) and is completed by Stage 18 (post-ovulatory day 44).

97. Experience of Repairing Huge Myelomeningocele

Farideh Nejat, MD (Iran, Islamic Republic of, Tehran)

Introduction: Myelomeningocele (MMC) is a common central nervous system abnormality in developing country. Low socio-economical state of most families, poor diet and delayed prenatal diagnosis associated with and lack pregnancy termination after prenatal diagnosis, the number of neonates born with MMC is still high and the parents seek any help to manage the problem. Sometimes the defects are very large and skin closure is very difficult with greater chance of wound dehiscence after primary closure.

Methods: From 512 cases of MMC in 7 years practice, we encountered several cases of wound dehiscence at first years that during time we learned from the complicated cases some lessons to manage the similar wound in a way to decrease the chance of wound problem in huge MMC cases.

Results: In recent years 57 cases with huge MMC were repaired according to the proposed ways. We had only one wound breakdown in spite of using all proposed ways to close the wound.

Conclusions: We use all hairy skin around the MMC for repairing even the color is red or purple. In cases threatened to dehiscence associated with tension on the center of the approximated edges of the wound, incision on one or two flanks until the fascia is helpful.

When tension is on the edges and flank incision is used, the pale edges of the incision will be better after flank incision. Simultaneous CSF shunting is another helpful task.

98. Shunt Independence Following Prolonged Cerebrospinal Fluid Shunt Placement.

Wajid N. Al-Holou, BS; Jayson Sack, BS; Cormac O. Maher, MD; Karin M. Muraszko, MD; Hugh J. Garton, MD (Ann Arbor, MI)

Introduction: A small percentage of all children with cerebrospinal fluid shunts may benefit from shunt removal.

Methods: We retrospectively analyzed 661 patients with hydrocephalus treated over a ten-year period at a single institution. In 19 patients, a systematic method was attempted to discontinue the cerebrospinal fluid shunt. Patients who underwent successful endoscopic third ventriculostomy or in whom weaning was attempted within 3 months of shunt placement were excluded. We analyzed patients who were successfully weaned to the group of patients who failed weaning as well as to the general population of patients with shunted hydrocephalus.

Results: Of the 19 patients who underwent an attempt at shunt weaning, 3 patients were excluded who underwent an ETV and 5 were excluded due to the short interval from initial shunt placement to the time of the shunt weaning attempt. Of the 11 remaining patients, 8 were successfully weaned from their shunts, while 3 failed shunt weaning attempts. Of the patients successfully weaned, the average age at initial shunt placement was 2.6 years, and the average age at the time of the weaning attempt was 15.4 years. In this group, the indication to attempt shunt weaning was

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recurrent complications and infections requiring multiple shunt externalizations and revisions in 4, asymptomatic shunt disconnection in 2, and symptomatic overdrainage in 2.

Conclusions: A small number of patients with shunted hydrocephalus may potentially become shunt independent with a systematic weaning protocol.

99. Histologically Proven Low Grade Brainstem Gliomas in Children: 30 Year Experience at Mayo Clinic

Nicholas M. Orme, BS; David A. Schomas, MD; Fredric B. Meyer, MD; Nadia N. Laack, MD (Rochester, MN)

Introduction: To evaluate long-term overall survival (OS) and progression-free survival (PFS) outcomes in pathologically proven low-grade gliomas of the brain stem (BS-LGG) in children.

Methods: The Mayo Clinic tumor registry identified 49 consecutive children (≥ 20 yrs) with biopsy proven BS-LGG treated at Mayo Clinic between 1971 and 2004. Charts were retrospectively reviewed. For analysis, patients were censored at the time of recurrence, death, or last follow-up.

Results: The median age at diagnosis was 12 years with a median follow-up of 7 years. The majority were grade I (65 %) and astrocytomas (94%). Gross total resection was obtained in 4 (8%), subtotal in 18 (36%) and 27 (55%) were biopsied only. Post-operative radiotherapy (RT) was employed in 28 (58%) patients. Median OS for the entire group was 13.7 years with a 1, 5, and 10 year OS of 81%, 63% and 56%, respectively. Median PFS for the entire group was 5.7 years. Improved OS was associated with undergoing resection versus biopsy-only (29.1 vs. 4.0 yrs; $p=0.008$) and having grade I versus grade II disease (13.7 vs. 1.8 yrs; $p=.09$). Thirteen (27%) were diffuse pontine gliomas (DPGs). DPGs had an OS of 1.8 years with a worse median PFS than non-DPGs (1.8 vs. 5.7 yrs; $p=.04$). RT was not associated with improved PFS or OS outcomes; however RT was employed preferentially in patients with poor prognosis; biopsy-only (19/28) and DPGs (9/13).

Conclusions: OS in this single institution retrospective study in pathologically proven BS-LGG with extensive follow-up displayed favorable long-term outcomes. Improved outcomes were associated with more aggressive resections.

100. Using Non-penetrating Clips for Dural Closure in Pediatric Spinal Surgeries

Anne Matthews, PA-C; Bruce Kaufman, MD; Sean Lew, MD; Marike Zwienenberg-Lee, MD (Milwaukee, WI)

Introduction: Obtaining a water tight dural closure has been considered an important component to prevent the complication of post-operative cerebrospinal fluid (CSF) leakage for intradural spinal surgery. Recent reports have described the use of titanium non-penetrating clips (Anastoclip Vessel Closure System) for spinal dural closure in adults, but there has been little data describing clip usage in pediatric patients.

Methods: After obtaining IRB approval, a retrospective single institution chart review was undertaken. Hospital and clinic records were analyzed for patient demographics, diagnosis, surgical procedure, durotomy length, use of adjunctive material for dural closure, post-operative complications and follow-up duration.

Results: The series included 15 patients ranging in age from 4 months to 17 years. Pre-operative diagnoses included fat-infiltrated thickened filum terminale, syringomyelia, arachnoid cyst, lipomyelomeningocele and neoplasm. The lumbosacral spine was the most common surgical level, with two cases occurring in the thoracic spine. The microscope was utilized in a majority of cases, with durotomy length frequently less than 2 cm. With a mean

follow-up duration of 6 months, there were no reported cases of CSF leak, pseudomeningocele formation, wound infection or dehiscence. In the patients requiring post-operative MR imaging, the use of clips has not compromised the integrity of the image quality.

Conclusions: The use of non-penetrating clips has been previously reported to be a rapid and easy technique for spinal dural closure in adults. This small series supports similar use in pediatric patients, with no reported wound complications.

101. Transtubular Microendoscopic Approach for Resection of a Choroidal Avm in a Child: Technical Note

Daniel K. Fahim, MD; Vikram A. Nayar, MD; Benjamin D. Fox, MD; William E. Whitehead, MD; Daniel J. Curry, MD; Thomas G. Luerssen, MD; Andrew Jea, MD (Houston, TX)

Introduction: We describe the novel use of a table-mounted tubular retractor system (MetRx; Medtronic Sofamor Danek, Memphis, TN USA), originally designed for minimally-invasive spine surgery, in the resection of an intraventricular AVM in a 12-year-old child. The tubular retractor system may have several advantages over traditional Greenberg or Leyla retractors in selected intracranial procedures.

Methods: In our case illustration, the low-profile 4 cm x 22 mm tube and fixed table attachment offered excellent exposure of the trigone of the lateral ventricle where the choroidal AVM was located and completely resected.

Results: Immediate postoperative cerebral angiography confirmed that the entire AVM had been resected. The patient suffered no new neurological deficits as a result of the retractor system or the exposure that it afforded.

Conclusions: Although the good clinical results of a single case reported herein cannot be directly compared to other open techniques of intracranial surgery in larger series, microendoscopic surgery of the brain is an alternative to the other techniques and may be recommended as a time-saving, trauma-reducing technique with the potential to improve postoperative outcomes.

102. A Dolichoectatic Basilar Artery Aneurysm in a Pediatric Patient

Thomas P. Lo Jr., MD; Alexander Zouros, MD; George Luh, MD; Frank P. K. Hsu, MD, PhD (Loma Linda, CA)

Introduction: Posterior circulation dolichoectatic aneurysms represent 17% of pediatric aneurysm cases, and are challenging to manage with clear guidelines as of yet undelineated, considering their anatomy and case rarity. Good clinical outcome with treatment has been estimated at 40-92%. We present our experience in treating a 17-year-old male complaining of 3 weeks of headache found to have a 1.6cm diameter thrombosed basilar aneurysm.

Methods: Two balloon occlusion trials were performed with its placement in the basilar artery distal to the vertebral arteries (sequestering both AICAs) and the second attempt with balloon positioning proximal to the VAs, which allowed for retrograde flow through the BA into AICA (right>left). Despite 2 failed trials, a definitive clipping via left far lateral craniotomy was completed.

Results: Post op angiogram showed lesion occlusion just superior to the takeoff of the right AICA, with a miniscule portion remaining patent and its tip receiving collateral flow via bilateral Pcomms and a patent right AICA; Head CT performed one week later showed a small right posterior and larger left anterior pontine infarct. Despite initial right hemiparesis, facial droop and other associated cranial nerve 6-10 deficits, he made a remarkable recovery, is now ambulatory with assistance and cares for himself. No associated systemic illness component was identified.

Conclusions: This case study with literature review stresses the importance of individualized treatment and its challenges; the latest information on pediatric basilar aneurysm epidemiology,

pathophysiology, symptomatology, diagnostics, treatment and outcomes is presented and we illustrate that a successful definitive surgical outcome may be realized despite failed simulation.

103. Cerebral Artery Vasospasm Complicated by Vasopressin Use for Diabetes Insipidus after Craniopharyngioma Resection

Rachana Tyagi, MD; Colin R. O'Reilly, DO; Carla P. Cangemi, MD (New Brunswick, NJ)

Introduction: Vasopressin infusion remains the mainstay of treatment of Diabetes Insipidus (DI). Its role in the exacerbation of cerebral artery vasospasm has previously been explored after subarachnoid hemorrhage in the rat model. We present the first reported case of vasospasm and DI after craniopharyngioma resection with subarachnoid hemorrhage caused by a pseudoaneurysm.

Methods: Retrospective chart review to evaluate clinical course, effects of changing treatment strategies on intravascular volume, sodium levels, neurologic exam and radiographic results

Results: A 17 year-old female presented with hydrocephalus secondary to craniopharyngioma. At surgery, arterial bleeding was encountered, but initial postoperative imaging showed no arterial abnormalities. The patient was started on vasopressin for DI on postoperative day one. On postoperative day five, she became lethargic and imaging showed evidence of bilateral ACA territory ischemia. Further studies showed a PCA pseudoaneurysm and severe vasospasm throughout the arterial system which ultimately lasted seven days. Serum sodium levels throughout hospital course ranged from 125-160mg/dl. Management strategies to balance the DI and vasospasm included liberal free water replacement, with lower dosed vasopressin infusion, as well as multiple arterial injections of Verapamil after coil embolization and stenting.

Conclusions: Treatment of DI with Vasopressin in a patient with cerebral artery vasospasm warrants further exploration. The risk of exacerbation of vasospasm must be weighed against the risk of fluctuation in volume status and sodium balance, both of which direct effects on cerebral perfusion and the development of cerebral edema.

104. Postlaminoplasty Kyphotic Deformity in the Thoracic Spine: Case Report and Review of the Literature.

Hassan Amhaz, MS; Benjamin Fox, MD; Keyne Johnson, MD; William Whitehead, MD, MPH; Daniel Curry, MD; Thomas Luerssen, MD; Andrew Jea, MD (Houston, TX)

Introduction: The risk for kyphosis in the cervical and thoracic spine is increased in pediatric patients following laminectomies. Laminoplasty was developed to reduce the incidence of postoperative deformities. We report a patient who had a symptomatic extradural spinal arachnoid cyst resected via a multilevel en-bloc thoracic laminoplasty. This patient developed severe, rapidly progressing thoracic kyphosis three months after surgery. To the best of our knowledge, this is the first reported case of postlaminoplasty kyphosis of the thoracic spine.

Methods: An 11-year-old girl presented with a one year history of progressive bilateral lower extremity weakness, falls, and myelopathy. She was found to have a T5-T10 extradural, arachnoid cyst associated with cord compression. A facet and pars-sparing, en-bloc laminectomy was performed, the arachnoid cyst was resected, then the laminae were resecured completing the laminoplasty. She was discharged with a TLSO brace.

Results: On follow-up, she complained of progressive back pain and had a rapidly progressing kyphotic posture. Standing spine x-

rays at 3 months revealed worsening kyphotic angulation (73 degrees centered at T8). We performed a posterior instrumented thoracic fusion with Smith-Peterson osteotomies; correcting her deformity to 50 degrees.

Conclusions: Although this may be the first report explicitly describing thoracic kyphosis associated with laminoplasty, we believe this complication is more common. In the growing spine, post-laminoplasty deformity can be similar to those seen in laminoplasty. These risks must be discussed with the patient and family prior to surgery. Follow-up with serial x-rays until skeletal maturity is essential and deformity correction should be considered if a significant deformity occurs.

105. Subdural Hematoma Following Intracystic Hemorrhage and Arachnoid Cyst Rupture: Case Report and Review of the Literature

Hassan Amhaz, MS (Houston, TX); Benjamin Fox, MD (Baylor College of Medicine, TX); Keyne Johnson, MD; Andrew Jea, MD; Daniel Curry, MD; Thomas Luerssen, MD; William Whitehead, MD (Houston, TX)

Introduction: Arachnoid cysts are commonly found in the middle fossa. Serious complications have been reported due to arachnoid cyst rupture/hemorrhage. We present a rare case of a 14-year-old boy who acutely decompensated due to a post-traumatic rupture of a left middle fossa arachnoid cyst which was masked on initial presentation.

Methods: 14-year old boy with acute neurologic deterioration and a remote history of trauma 2-months prior was transferred emergently to our facility. One week prior to presentation he began having increased headaches, nausea, and lethargy. This progressed and he became comatose with a fixed and dilated left pupil. CT imaging demonstrated a 2cm left-sided subdural hematoma with 9mm of left-to-right shift. Upon arrival, the patient was taken emergently to the operating room for burr-hole drainage.

Results: Post-operative CT scan demonstrated evacuation of the subdural hematoma and resolution of the midline shift. Interestingly, a previously masked middle fossa arachnoid cyst was now apparent. Follow-up imaging showed no reaccumulation of fluid in the subdural space, no new hemorrhage, and arachnoid cyst decompression.

Conclusions: Subdural hematoma following intracystic hemorrhage into a ruptured arachnoid cyst is rare but even rarer is a subdural hematoma masking an arachnoid cyst of which there have been only 3 prior cases reported in the literature. Emergent treatment of the subdural hematoma is the initial treatment modality. The recurrence rate is significant and requires serial follow-up examination and imaging. In general, the majority of patients do well and will need no further intervention.

106. Pneumothorax Complicating Thoracic Pedicle Screw Placement in a Child: Case Report and Literature Review

Ashwin Viswanathan, MD; William E. Whitehead, MD; Daniel J. Curry, MD; Thomas G. Luerssen, MD; Andrew Jea, MD (Houston, TX)

Introduction: Spontaneous pneumothorax after posterior fusion for adolescent idiopathic scoliosis has been reported in the orthopedic literature; however, to the best of our knowledge, pneumothorax directly related to pedicle screw placement for spinal deformity has not been previously described.

Methods: We describe a rare case of pneumothorax as a complication of the "in-out-in" technique of thoracic pedicle screw placement in an 11-year-old girl undergoing posterior segmental instrumentation for kyphotic deformity. Anatomic and technical

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aspects leading to this complication are discussed along with a review of the pertinent literature.

Results: Screw placement in the smaller thoracic pedicles can be more technically demanding than in the thoracolumbar, lumbar, and lumbosacral spine. Because of a more lateral entry point associated with the “in-out-in” technique for thoracic pedicle screw placement, there is less risk to the spinal cord, but a greater risk to vascular structures, viscera and their coverings. Consequently, an incorrect, or even slightly more lateral, instrument or screw placement may result in pleural perforation or lung injury, resulting in pneumothorax.

Conclusions: This case can serve as a reminder for spine surgeons, particularly pediatric spine surgeons, to be aware of this complication and to include pneumothorax in preoperative discussions with the patient, the family, and the other members of the surgical and anesthesia team.

107. Laboratory Measured Quantitative and Qualitative Improvement of Gait Following Tethered Cord Release in an Adult

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Introduction: Optimal management of tethered cord syndrome (TCS) in the adult population remains controversial. Lack of objective measures of cord tethering and operative success has impeded acceptance of surgery as the appropriate intervention. We report, a 27-year-old woman who presented with symptomatic TCS. Preoperative gait laboratory assessment documented gait deficits, these deficits improved or resolved following surgical intervention.

Methods: Preoperative multichannel gait laboratory analysis revealed abnormalities in the symmetry of the temporal spatial parameters of locomotion, asymmetry in some of the kinematic and kinetic parameters with evidence of left-sided abnormalities particularly evident at the hip, knee, and ankle. Exploration and release of tethered cord was undertaken following medical clearance for a hypercoagulable state and leukocytosis.

Results: Gait analysis performed four months postoperatively showed improved symmetry of the temporal spatial parameters of locomotion and improved symmetry of the kinematic and kinetic parameters. Hip data demonstrated improved symmetry of motion for hip displacement when compared to the preoperative condition. Hip strength increased bilaterally from 4/5 preoperatively to 5/5. Impaired inversion motion of the left ankle noted in preoperative analysis was corrected. Kinetic data demonstrated improved symmetry of hip flexor and ankle plantar flexor moments. Ground reaction force analysis demonstrated improvement in the symmetry of the anterior, posterior and vertical ground reaction forces.

Conclusions: Gait abnormalities may reflect objective measure of cord tethering, revealing the success of surgical intervention. A prospective study to correlate the value of gait analysis data with the success of operations for TCS is warranted.

108. Intraoperative Mapping in Epilepsy Surgery. Indications and Our Institutional Experience

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Introduction: The outcome of Epilepsy Surgery depends on multiple factors. One of the most important factors in determining the success of these cases is the ability to identify the precise

location of the seizure focus. Once this has been accomplished it is up to the expertise of the Neurosurgeon to excise the focus in a complete fashion.

Methods: Cases of Epilepsy where the focus was located in eloquent areas of the brain will be demonstrated. In those cases, the decision to do a wide resection of a focus where speech or motor function is located would be affected by the possible devastating neurological deficits. With the assistance of intraoperative mapping we could achieve total excision of the seizure focus without causing functional harm to the patient. This had enormously affected our results and had allowed us to do what we thought was inoperable in conventional thinking.

Results: Patients had a significant improvement in seizure control as a result of focal epilepsy surgical resection, as well as with patients that had extensive temporal lobectomies as a direct result of intraoperative mapping.

Conclusions: Intraoperative mapping for epilepsy surgery cases where the resection is focused on eloquent areas of the brain is evolving as the standard of care. Not only it does make it feasible to do extensive resection as mandated to cure epilepsy but it certainly reduces the incidence of neurological deficits significantly.

109. Cranial Expansion by Calvarial Thinning as a Treatment for High Intracranial Pressure Slit Ventricle Syndrome

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Introduction: Hyperostosis is frequently encountered in patients shunted without antisiphon devices for long periods of time. In some cases this results in shunt dependent patients with slit ventricles and high intracranial pressure. These patients are often difficult to shunt as their proximal catheters become quickly clogged secondary to collapse of the ventricular wall around the catheter. Strategies to overcome this often involve shunting the cistern magna or the lumbar cistern, or cranial expansion using sub-temporal decompression. We report on a 22 year old female with hyperostosis, increased intracranial pressure and slit ventricle syndrome. She had undergone a total of 78 surgeries in her lifetime including 67 shunt revisions. She had failed lumbar shunting, and a cistern magna shunt was not possible.

Methods: A cranial expansion procedure was performed which involved removing a large bifrontal and biparietal bone flap and drilling off the inner table.

Results: The intracranial volume was expanded by a total of 125 cc. Seven months post-op this patient has re-expanded her ventricles to normal size. She has had two shunt failures in 7 months compared to almost weekly failures in the six months prior to surgery.

Conclusions: Slit ventricle syndrome is a complicated entity frequently seen in neurosurgical practices. When accompanied by high intracranial pressure alternate shunting strategies such as lumboperitoneal and cistern magna shunting should be attempted. When these fail, a cranial expansion procedure may be beneficial. The advantages of thinning a thickened calvarium are that it allows for cranial expansion without cranial defects while still preserving good cosmesis.

110. Thoracic Spinal Cord Tethering Resulting from an Exophytic Hamartoma

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Introduction: We present a unique case of a spinal cord hamartoma causing tethering of the thoracic spinal cord.

Methods: This is a retrospective case report.

Results: An 18-year-old female presented with intermittent upper back pain and progressive loss of right lower extremity pain and temperature sensation. Magnetic resonance imaging showed the spinal cord to be tethered anteriorly at T5 by an exophytic mass. The lesion was isointense to the spinal cord and did not enhance with contrast administration. The patient was taken to surgery where a T5 laminectomy was performed and the exophytic lesion was debulked and untethered from the dura mater anterior to the cord. Histological examination showed a neuroglial hamartoma with reactive gliosis, focal axonal swelling, clusters of macrophages, and occasional perivascular lymphocytic aggregates. Immunohistochemical analysis was positive for glial fibrillary acidic protein, neurofilament triplet protein, neuron-specific nuclear protein, and synaptophysin. Postoperatively there was no improvement in the patient's right lower extremity sensory deficit.

Conclusions: Anterior thoracic spinal cord tethering by a hamartoma produced a progressive neurological deficit in this patient.

111. Composite Anaplastic Pleomorphic

Xanthoastrocytoma-ganglioglioma. Report of a Case

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Introduction: Composite pleomorphic xanthoastrocytoma-ganglioglioma (PXA-GG) is a rare recently recognized entity. Only 16 cases have been documented so far. We report a case of a child harboring an anaplastic PXA-GG.

Methods: A 3-year-old boy presented with an 1-week history of headache and seizures. The patient was initially evaluated by CT that revealed a lesion measuring approximately 13x10.2mm in the right parietal-occipital lobe. A MRI study was performed and revealed a solid mass with low signal intensity on T1 and T2-weighted images and homogeneously enhancing after gadolinium administration. The patient was operated upon via a parietal-occipital craniotomy.

Results: The tumor was totally resected. Postoperative the patient was neurological intact. Histology revealed the presence of an anaplastic PXA-GG. Immunohistochemistry revealed that the spindle cells were positive for glial fibrillary acidic protein whereas the cells with ganglionic features were positive for synaptophysin, neurofilaments and chromogranin A. There were few mitotic figures. The Ki-67/MIB-1 index was 5-10%. The p-53 index was 10-15%. Additional the bcl-2 protein was detected in 15-20% of the tumor cells and the epidermal growth factor receptor in >20%. The patient was referred in the oncology department for further treatment. On follow up evaluation after one year no tumor recurrence was noted.

Conclusions: The exact prognosis of PXA-GG is difficult to estimate since this tumor is extremely rare. Nevertheless, the clinical behavior of PXA-GG has been reported usually benign after complete surgical excision. Close follow-up is mandatory, because PXA-GG may exhibit malignant degeneration especially in anaplastic types.

112. Combined Preoperative Embolization and Perioperative Administration of Tranexamic Acid to Decrease Blood Loss during Resection of a Choroid Plexus Papilloma

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Introduction: Choroid plexus papillomas (CPP) represent 3% of primary brain tumors in the pediatric population and treatment is surgical resection. The highly vascular nature of these tumors makes blood loss a major concern, particularly in infants. Preoperative embolization can reduce bleeding, but technical challenges may limit complete embolization, particularly in infants - the group most susceptible to blood loss. Tranexamic acid (TXA), an antifibrinolytic drug, has been effective in reducing blood loss and transfusion requirements in children undergoing scoliosis and cardiac surgery. Here we describe a novel strategy designed to limit blood loss in an infant with CPP; the combined use of preoperative embolization and intraoperative administration of TXA.

Methods: Case report

Results: A 12 week old child presented with a large CPP. One day prior to surgery, tumor embolization via the distal anterior choroidal artery was performed, using NBCA. We administered TXA at a dose of 50 mg/kg load and 5 mg/kg/hr infusion for the duration of the surgery. Blood loss during the case was 100 cc.

Conclusions: Here we present the first reported use of combined preoperative embolization and intraoperative TXA to minimize blood loss in an infant with a large, vascular tumor. Our success with this combined approach suggests that it may have utility in the treatment of a wide range of pathologies common to pediatric neurosurgical practice.

113. Endoscopic Assisted Removal of Periorbital Inclusion Cysts

Jared Knopman, MD; Mark M. Souweidane, MD (New York, NY)

Introduction: Surgical treatment for peri-orbital inclusion cysts typically involves a brow, pterional, or partial bicoronal scalp incision for sufficient exposure. We have recently employed an endoscopic-assisted technique as an alternative approach intended to minimize the length of the skin incision and avoid scarring in the brow.

Methods: Children having typical clinical findings of a dermoid cyst of the scalp were selected for endoscopic-assisted removal. For suspect intradiploic lesions, MRI was used to assess osseous involvement. Using general anesthetic, a 1-2 cm curvilinear incision was made posterior to the hairline. A 30-degree angled endoscope (4 mm) was then used in the subgaleal compartment for visualization. Subgaleal dissection was followed by a circumferential periosteal incision using an angled needle-tip unipolar cautery. For lesions within the diploe, a high-speed air drill was utilized to expose the lesion. Complete removal was accomplished with curettage off either the skull or dural surface.

Results: Four patients (ages 5-24 months) underwent outpatient endoscopic resection. Two cysts were located at the fronto-zygomatic suture, 3 were extracranial, and 1 extended through the inner table. All patients had a complete excision of the cyst. There was negligible blood loss, no dural violation, and no postoperative infection. There have been no recurrences to date.

Conclusions: Endoscopic resection of scalp inclusion cysts is a safe and effective surgical approach. This technique results in shorter incisions and less apparent cosmetic scars compared with previously described standard incisions.

POSTER ABSTRACTS

114. Transition Between Childhood and Adulthood in Tuberous Sclerosis

Sandrine de Ribaupierre, MD (Canada, London); Matthieu Vinchon, MD (France, Lille); Olivier Vernet, MD; Benedict Rilliet, MD (Switzerland, Lausanne)

Introduction: Three types of central nervous system lesions are seen in patients affected by tuberous sclerosis (TS): cortical tubers, subependymal giant cell astrocytoma (SEGA) and subependymal nodules. While cortical tubers might be responsible of refractory epilepsy, SEGA will affect the CSF pathway and might cause hydrocephalus. It has been shown that SEGA grow predominantly in childhood, however, they might still become symptomatic in adulthood. And while the majority of seizures will start in infancy or childhood, the patients might only be offered surgery later in life.

Methods: We reviewed the cases of TS patients seen in the Neurosurgical Clinics in Lausanne (Switzerland) and Lille (France). 29 patients have been followed between 1961 and 2007. At the time of their first clinic: 23 were children, while 6 were adults.

Results: The majority of pediatric patients (n=20) were operated, while only half of the adults needed an operation. When operated the mean age at surgery was 11y. 17 pediatric patients underwent a surgery for a SEGA, while 3 were operated for seizures. 2 adults required resection of a SEGA, while 1 patient had epilepsy surgery.

Conclusions: When focusing on the neurosurgical aspect of TS there is a need for follow-up into adulthood. Teenagers who were usually followed regularly as children are lost to follow-up. This could delay the diagnosis of growing lesions and lead to difficult situations. A solution could be the continuous follow-up by pediatric neurosurgeons into adulthood, or to hand over to a multidisciplinary team who will be taking over into adulthood.

115. Re-classifying Defects Involving the Secondary Neural Tube

Timothy M. George; Scott Crosby, BA (Austin, TX)

Introduction: Most attention in neural tube defect research has focused on defects of primary neurulation. Defects of the secondary neural tube have more clinical relevance and better functional outcomes than primary neural tube defects. However, the interrelation of primary and secondary neurulation defects has not been well characterized.

Methods: The NTD database was reviewed for the association of defects of the primary neural tube to defects of the secondary neural tube.

Results: All defects that affected the caudal primary neural tube had associated secondary neural tube anomalies. Defects of the secondary neural could occur in isolation when only the conus medullaris and/or filum terminale were affected.

Conclusions: Since, the embryology of secondary neurulation is poorly and incompletely understood; a relevant mechanistic theory is needed. We will discuss the genetic implications and embryological theories of secondary neural tube development in order to give a rationale to a classifying caudal spinal cord defects.

116. Failure of Bone Regrowth after Craniectomy for Sagittal Synostosis.

Timothy M. George, MD, FACS; Patrick Kelley, MD; Mary Breen, RN; Nicole Higginbotham, NP, MS (Austin, TX)

Introduction: It is current dogma that the calvarium will regrow when bone is removed during surgery in infants for sagittal synostosis. Indeed, most of the impetus for the development of a variety of surgical techniques had been to prevent poor outcome from recurrent bone growth.

Methods: We reviewed 8 patients that presented with large midline defects after craniectomy for sagittal synostosis that presented to our Craniofacial Center. Two patients had previous failed cranioplasties. All children had normal neurological examinations. All had limited activity level secondary to the cranial defect. All underwent reoperation consisting of cranial expansion and cranioplasty with autologous bone graft.

Results: All children have good results after the repair. There was no morbidity or mortality. Postoperative imaging confirmed adequate intracraial volume.

Conclusions: Failure of bone regrowth is uncommon in sagittal synostosis repair. We believe that the main reason for the lack of bone was inadequate cranial volume. However, other factors may play a role.

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Name _____

ID NUMBER _____

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 are appreciated.

Scientific Sessions – Wednesday, December 3, 2008

Session Details: Scientific Sessions I - IV	Rating Scale				
	Excellent	Average	Average	Poor	Poor
1. The quality of the Oral Abstract Presentations were:	A	B	C	D	E
2. Topics were addressed completely.	A	B	C	D	E
3. Content was relevant to my practice.	A	B	C	D	E
4. There was sufficient opportunity for questions/discussion.	A	B	C	D	E
5. What did you learn in these sessions that you will apply to your practice?					

6. Overall, how could these sessions be improved?

7. Did you perceive any commercial bias during these sessions? Yes No

If yes, please explain

8. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

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2008 AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ANNUAL MEETING

Name _____

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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 are appreciated.

Scientific Sessions – Thursday, December 4, 2008

Session Details: Scientific Session V	Rating Scale				
	Excellent	Average	Average	Poor	
1. The quality of the Oral Abstract Presentations were:	A	B	C	D	E
2. Topics were addressed completely.	A	B	C	D	E
3. Content was relevant to my practice.	A	B	C	D	E
4. There was sufficient opportunity for questions/discussion.	A	B	C	D	E
5. What did you learn in these sessions that you will apply to your practice?					

6. Overall, how could these sessions be improved?					

7. Did you perceive any commercial bias during these sessions? Yes No					
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Scientific Sessions – Thursday, December 4, 2008

Session Details: Raimondi Lecture	Rating Scale				
	Excellent	Average		Poor	
1. The quality of the Presentation was:	A	B	C	D	E
2. Topic was addressed completely.	A	B	C	D	E
3. Content was relevant to my practice.	A	B	C	D	E
4. There was sufficient opportunity for questions/discussion.	A	B	C	D	E
5. What did you learn in these sessions that you will apply to your practice?					

6. Overall, how could these sessions be improved?

7. Did you perceive any commercial bias during these sessions? Yes No

If yes, please explain

8. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

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2008 AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ANNUAL MEETING

Name _____

ID NUMBER _____

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 are appreciated.

Scientific Sessions – Thursday, December 4, 2008

Session Details: Scientific Sessions VI - VII	Rating Scale				
	Excellent	Average	Average	Poor	Poor
1. The quality of the Oral Abstract Presentations were:	A	B	C	D	E
2. Topics were addressed completely.	A	B	C	D	E
3. Content was relevant to my practice.	A	B	C	D	E
4. There was sufficient opportunity for questions/discussion.	A	B	C	D	E
5. What did you learn in these sessions that you will apply to your practice?					

6. Overall, how could these sessions be improved?

7. Did you perceive any commercial bias during these sessions? Yes No

If yes, please explain

8. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

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2008 AANS/CNS SECTION ON PEDIATRIC NEUROLOGICAL SURGERY ANNUAL MEETING

Name _____

ID NUMBER _____

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 are appreciated.

Scientific Sessions – Friday, December 5, 2008

Session Details: Scientific Sessions VIII - IX	Rating Scale				
	Excellent	Average	Average	Poor	Poor
1. The quality of the Oral Abstract Presentations were:	A	B	C	D	E
2. Topics were addressed completely.	A	B	C	D	E
3. Content was relevant to my practice.	A	B	C	D	E
4. There was sufficient opportunity for questions/discussion.	A	B	C	D	E
5. What did you learn in these sessions that you will apply to your practice?					

6. Overall, how could these sessions be improved?

7. Did you perceive any commercial bias during these sessions? Yes No

If yes, please explain

8. What other topics and/or speakers would you like to see at future Annual Meetings or courses?

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December 1-4, 2009
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