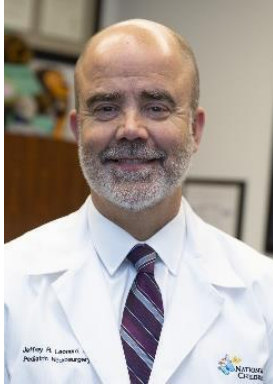


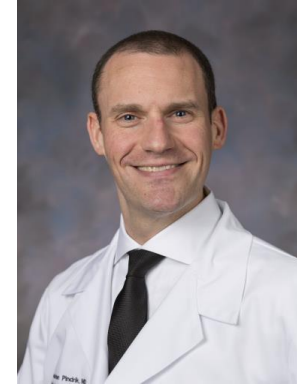
Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program



Jeffrey Leonard, MD
Neurosurgery Chief



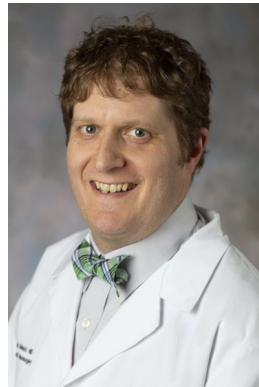
Albert Isaacs, MD, PhD



Jonathan Pindrik, MD



Ammar Shaikhouni, MD, PhD



Eric Sribnick, MD, PhD



Michelle Wedemeyer, MD, PhD

Nationwide Children's Hospital/OSU Multidisciplinary Programs

- Neuro-Oncology
- Epilepsy Surgery
- Craniofacial
- Surgical Spasticity Management
- Neurotrauma
- Hydrocephalus/Spine/Peripheral Nerve
- Research

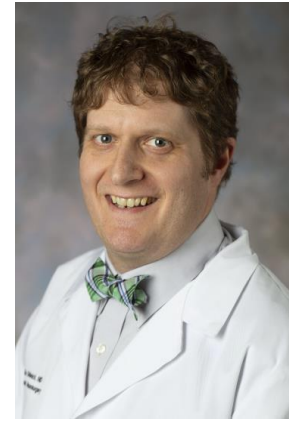
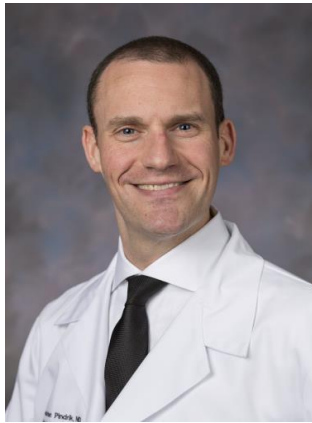


- Honor Roll for the past nine years
- Top 10 in Neurology and Neurosurgery for past six years

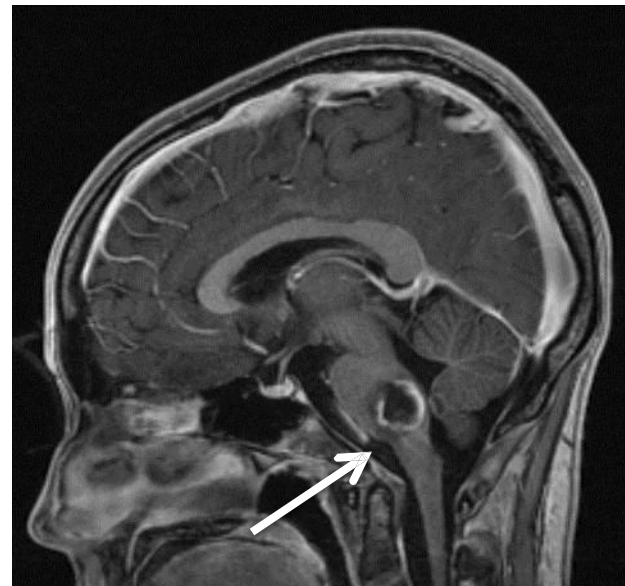
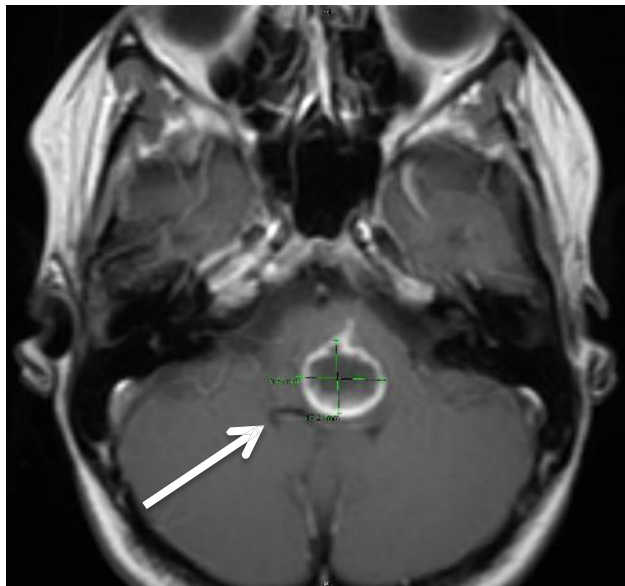
Nationwide Children's Hospital/OSU Multidisciplinary Programs



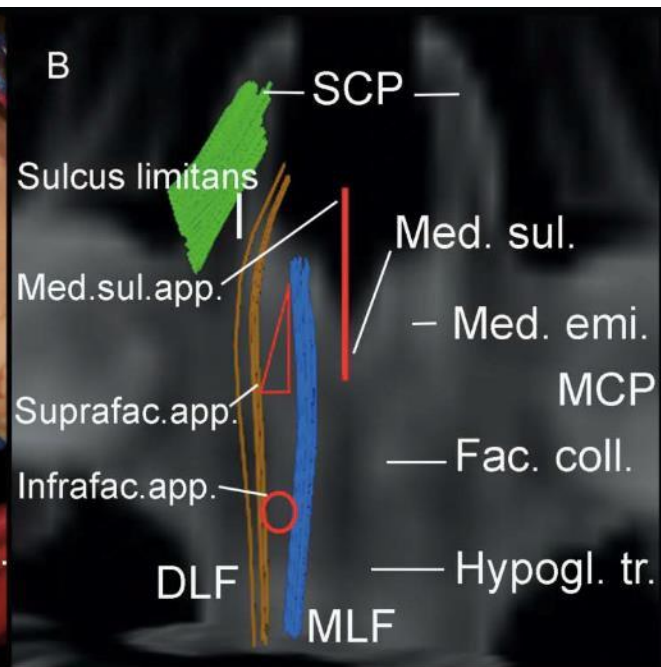
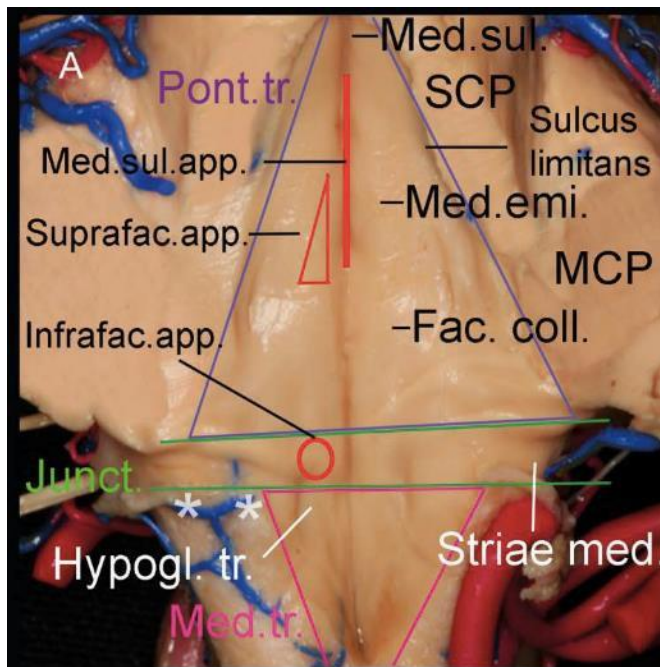
- Surgical Neuro-Oncology Team:
All of us (to varying degrees)...



Complex Intrinsic Brainstem Tumors



Monitoring of
Brainstem Nuclei

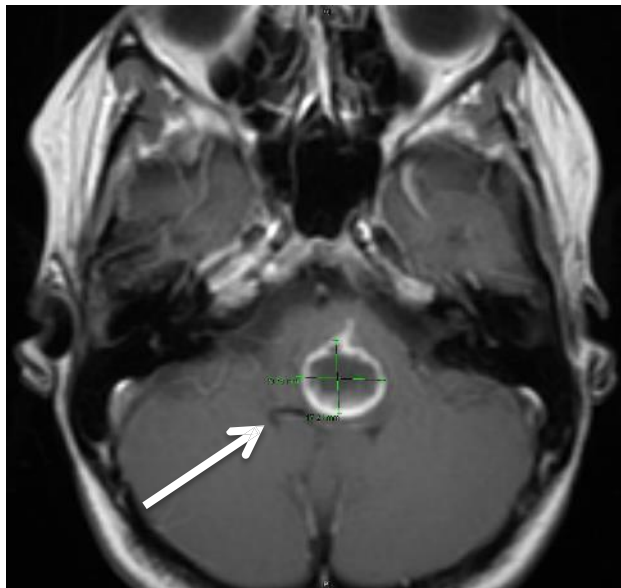


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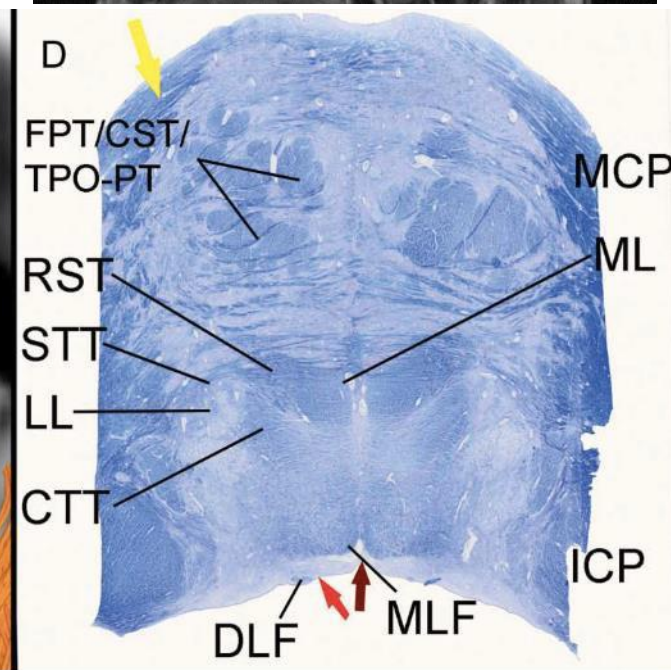
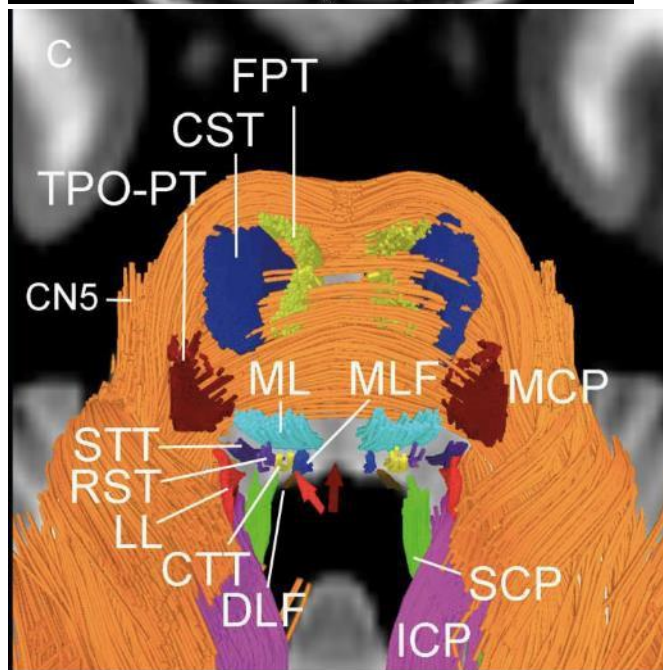


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Complex Intrinsic Brainstem Tumors



Monitoring of
Brainstem Nuclei

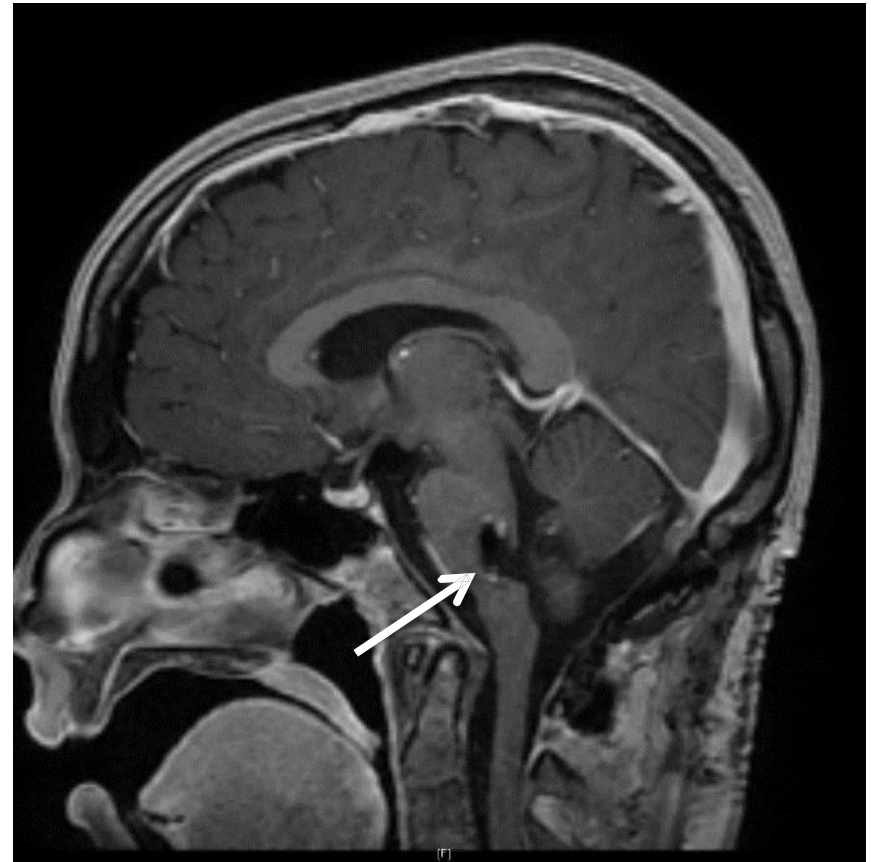
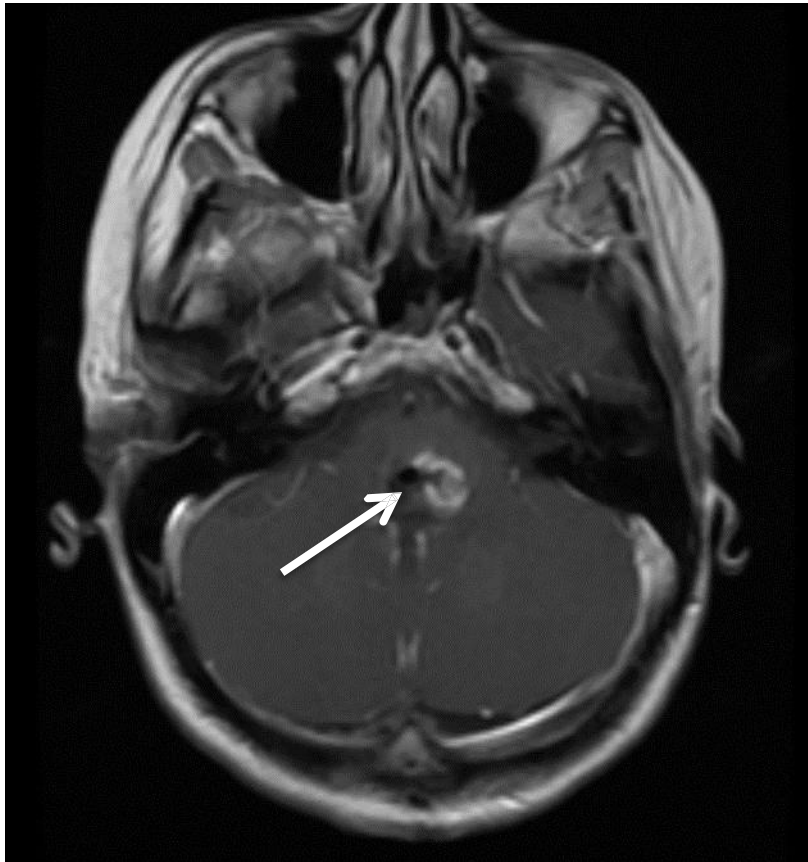


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Post-operative Images & Follow-up 6 months



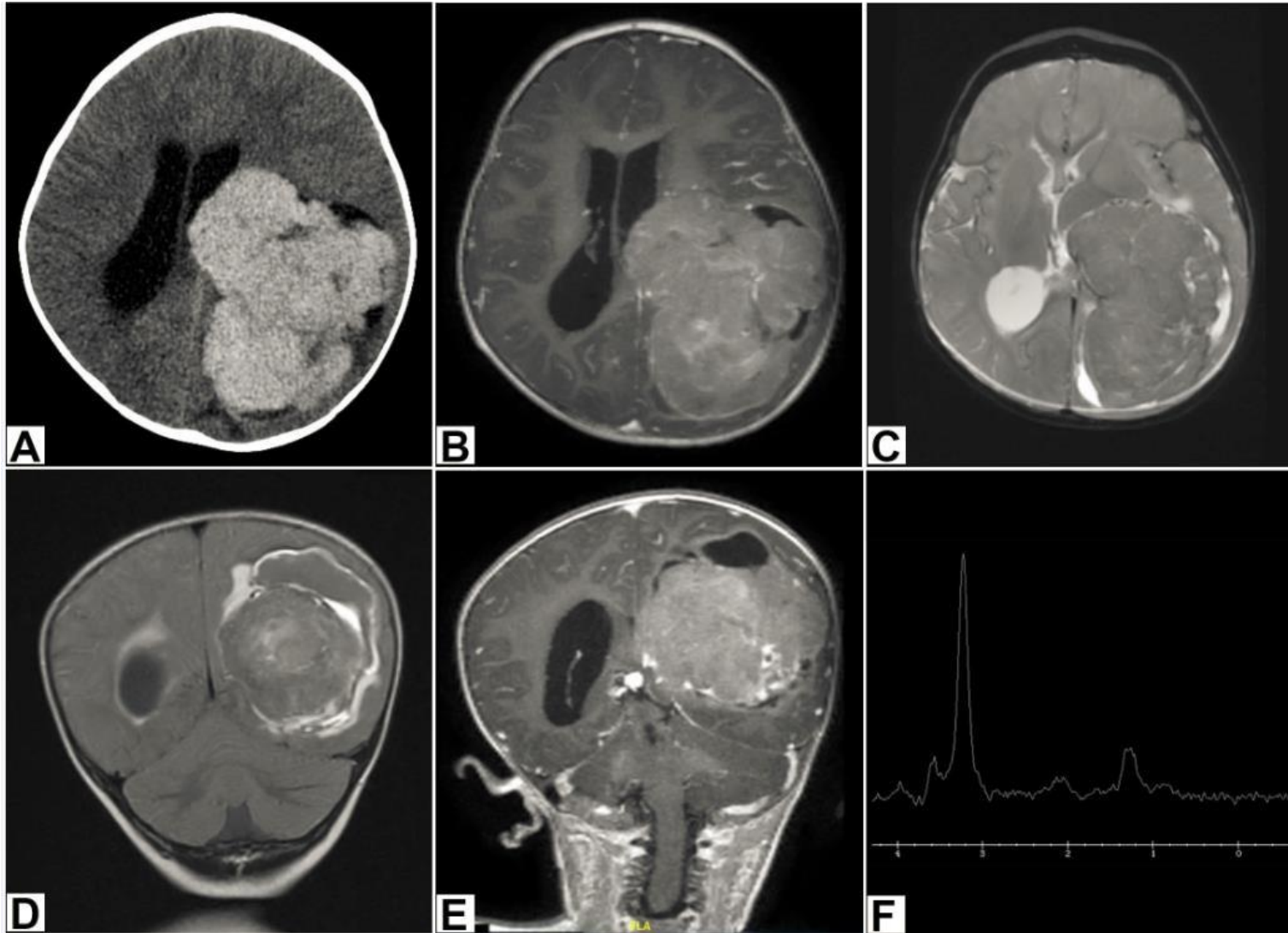
A small amount of enhancement was left due to activity of the 7th cranial nerve on the left and the diagnosis of pilocytic astrocytoma

Far From Home and Battling Brain Cancer: Agustin's Story

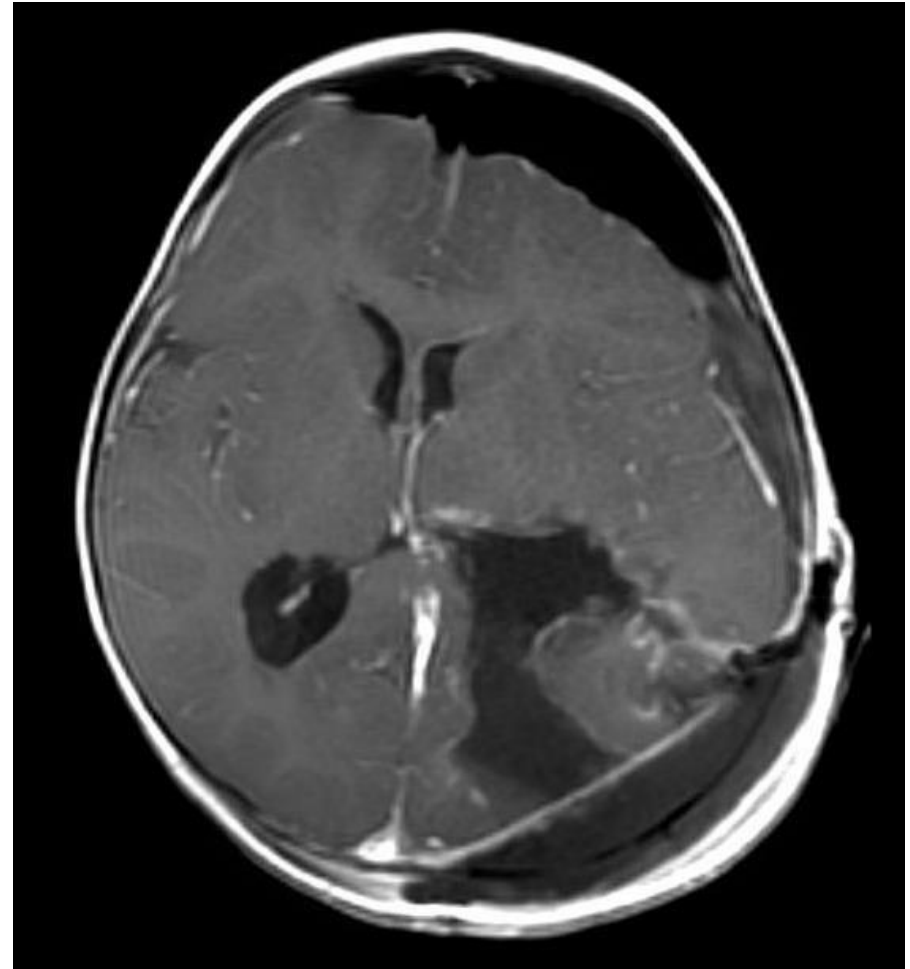
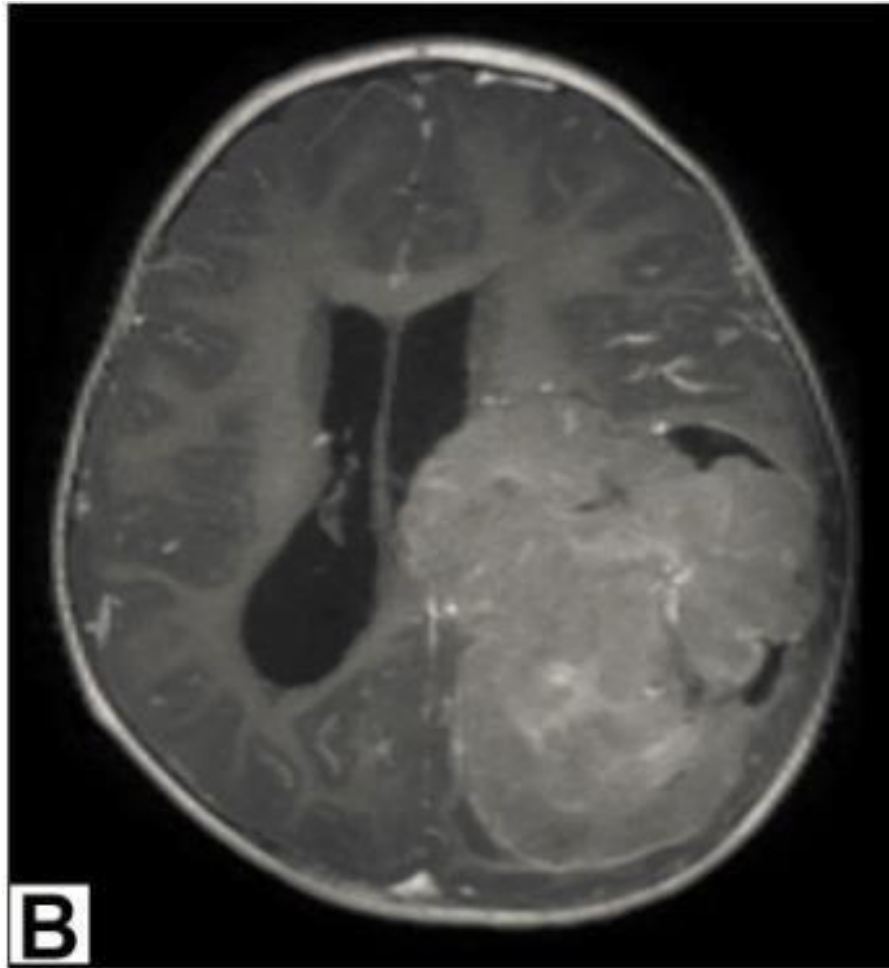


[Click for Video](#)

Large Intra-Axial Tumors



Pre- & Post-Operative Imaging



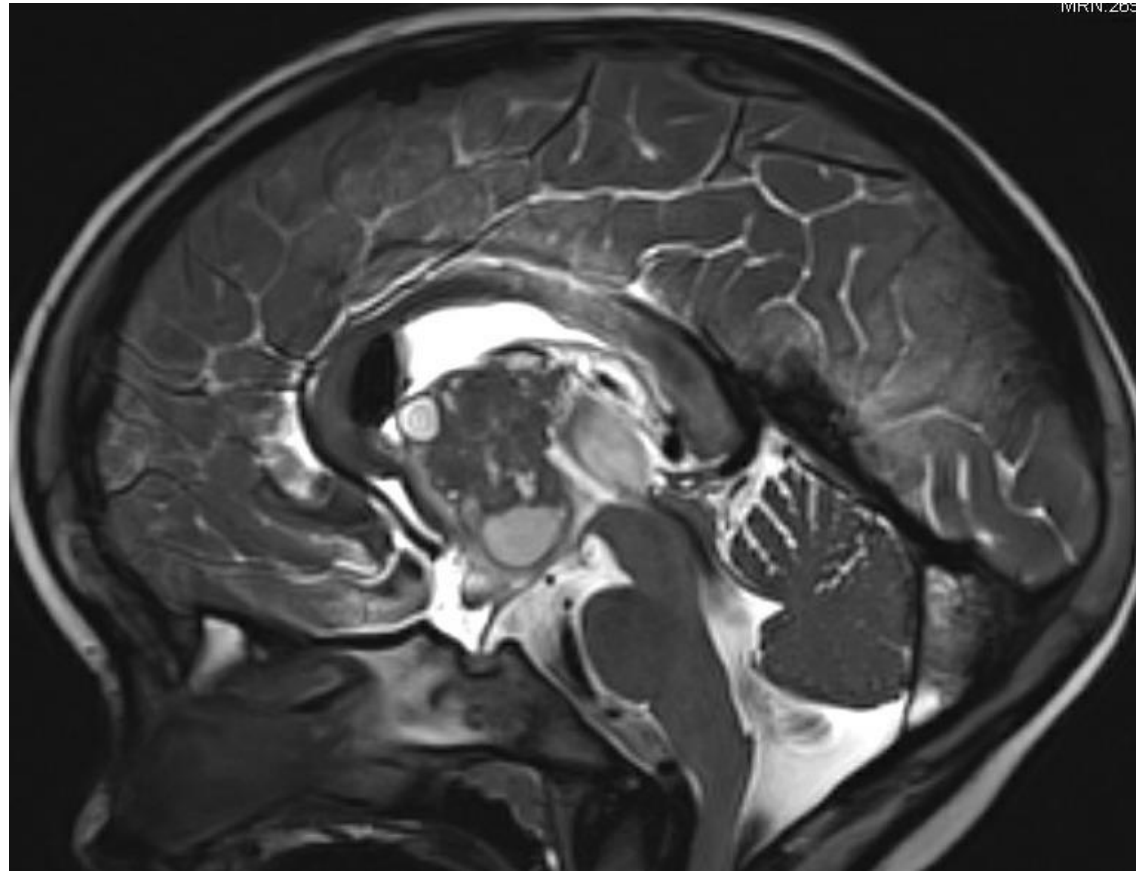
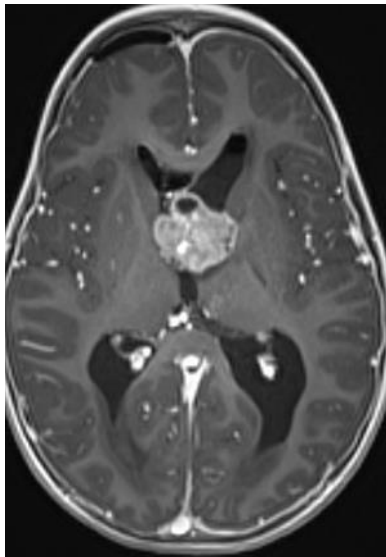
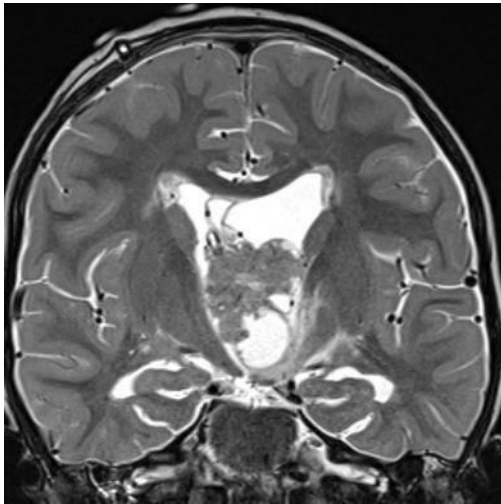
Staging of Procedures: Blood loss

- * Special consideration of blood volume/losses in pediatric cases

Estimated blood volume		Weight	Volume
Preterm Neonate	100 mL/kg	1.5 kg	150 mL
Full term Neonate	90 mL/kg	3.5 kg	315 mL
< 1 year old	80 mL/kg	10.5 kg	840 mL
1-12 year old	75 mL/kg		
Adolescent and adults	70 mL/kg		



Intra-Ventricular Tumors with Obstructive HCP



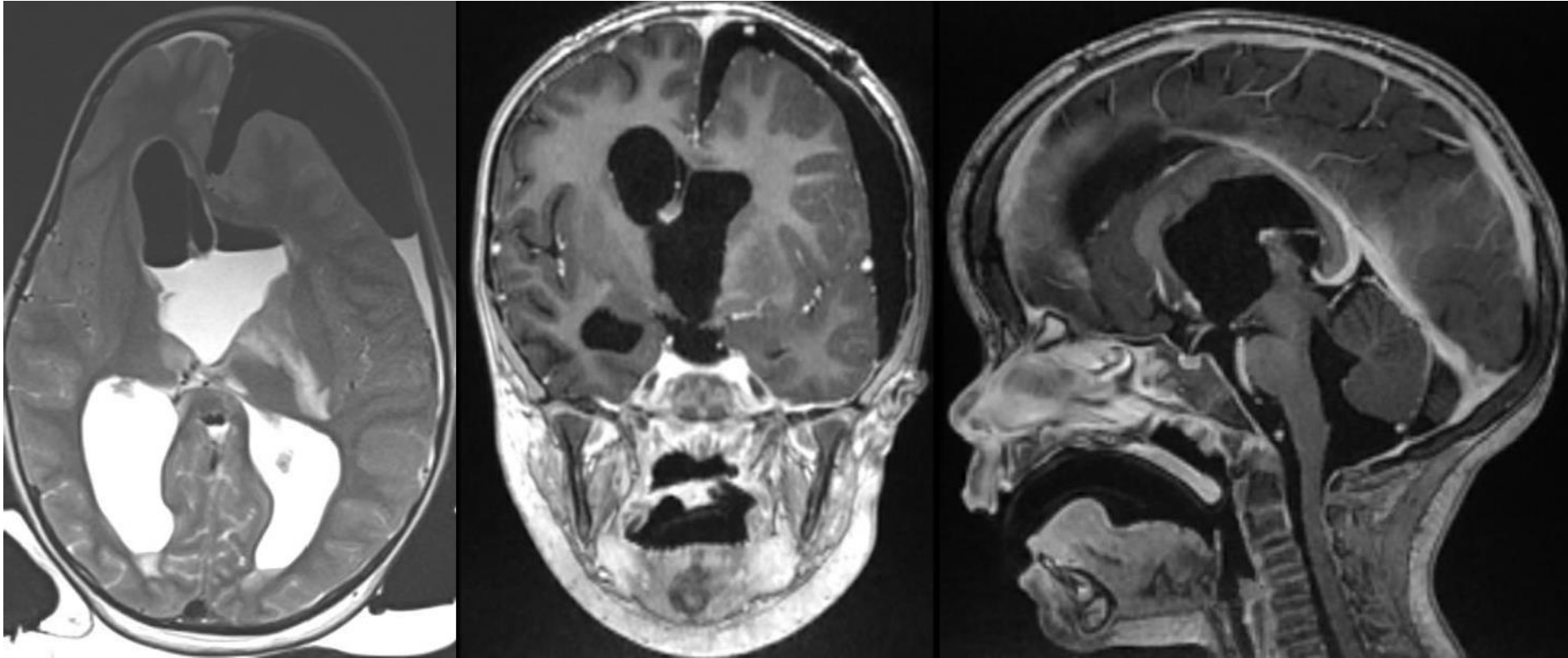
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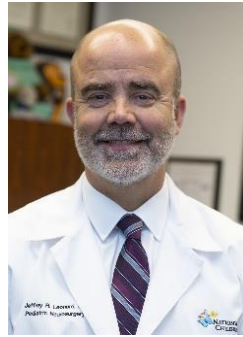
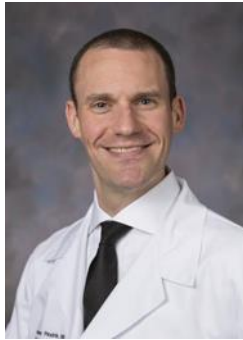
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Intra-Ventricular Tumors with Obstructive HCP

- Intra-Operative MRI & Post-Operative MRIs with GTR

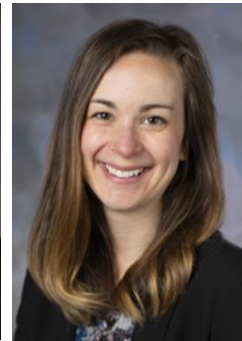


Nationwide Children's Epilepsy Surgery Program



Pediatric Neurosurgeons:

- Ammar Shaikhouni, MD, PhD (Surgical Dir)
- Jonathan Pindrik, MD
- Jeffrey Leonard, MD (Neurosurgery Chief)



Pediatric Neurologists/Epileptologists:

- Adam Ostendorf, MD (Medical Dir)
- Monica P. Islam, MD (Center Dir)
- Stephanie Ahrens, DO
- Christopher Beatty, MD

Nationwide Children's Epilepsy Surgery Program

- **Multi-Disciplinary Team**

- Neurosurgeons, Neurologists/Epileptologists, Neuroradiologists
- Neuropathologists, Neuropsychologists, Rehabilitation Specialists
- EEG technicians, Social Work, Nurses/NPs, Coordinators
- Weekly Epilepsy Management Conference

- **NAEC Level IV Epilepsy Center**—Highest distinction

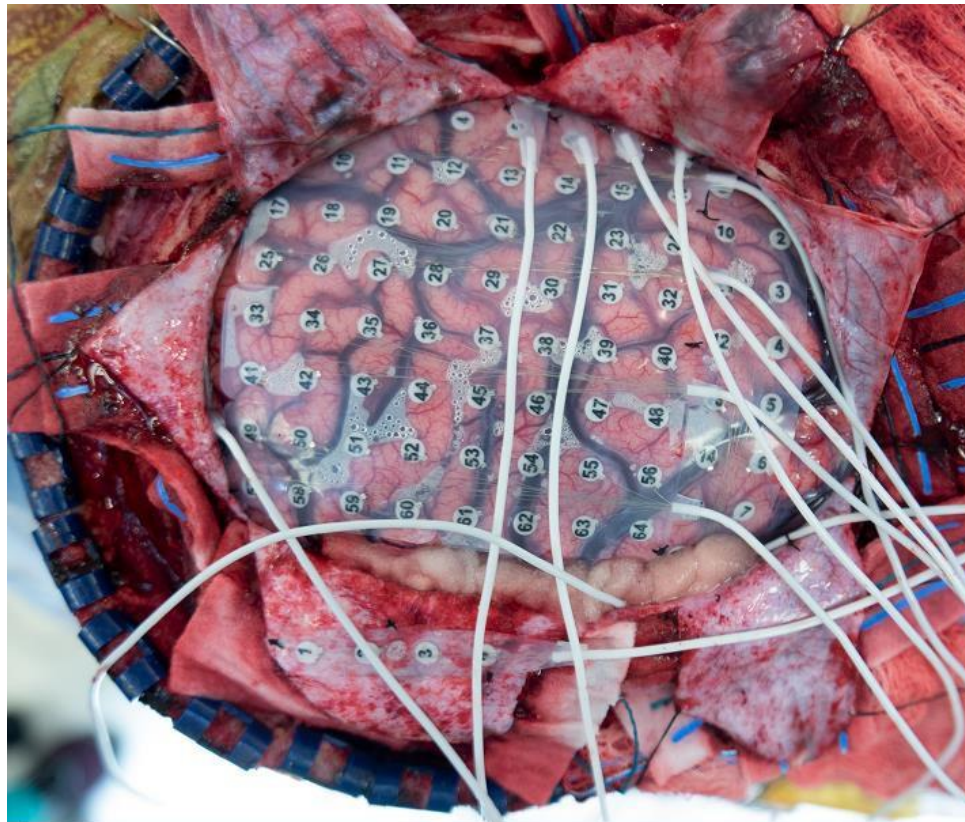
- >3650 epilepsy patients
- \geq 1400 new evaluations/year
- 53 Epilepsy Surgery patients (excluding VNS) in 2022

- **Fully equipped Epilepsy Monitoring Unit (EMU)**

- Phase I studies: 80-90/year, and growing...
- Phase II studies: >20/year, and growing...

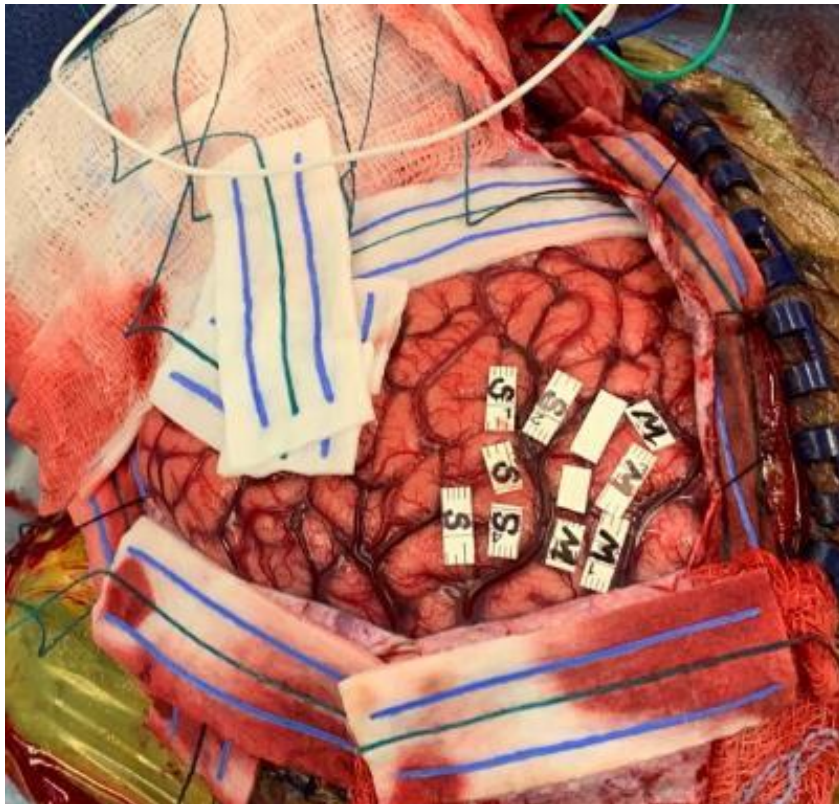
Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Stage I Surgery
 - Standard Craniotomy with Subdural (SD) Grid/Strip Electrodes



Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage or Stage II Surgery
 - Curative: Standard Craniotomy for Anatomic Resection
 - Motor Mapping, SSEPs, Phase Reversal, Intra-Op ECoG



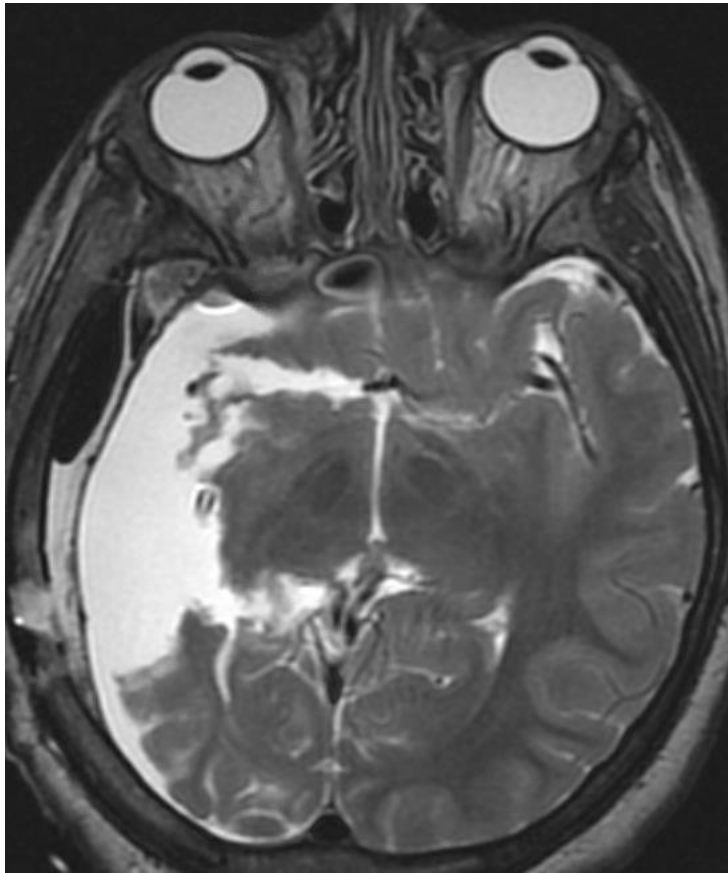
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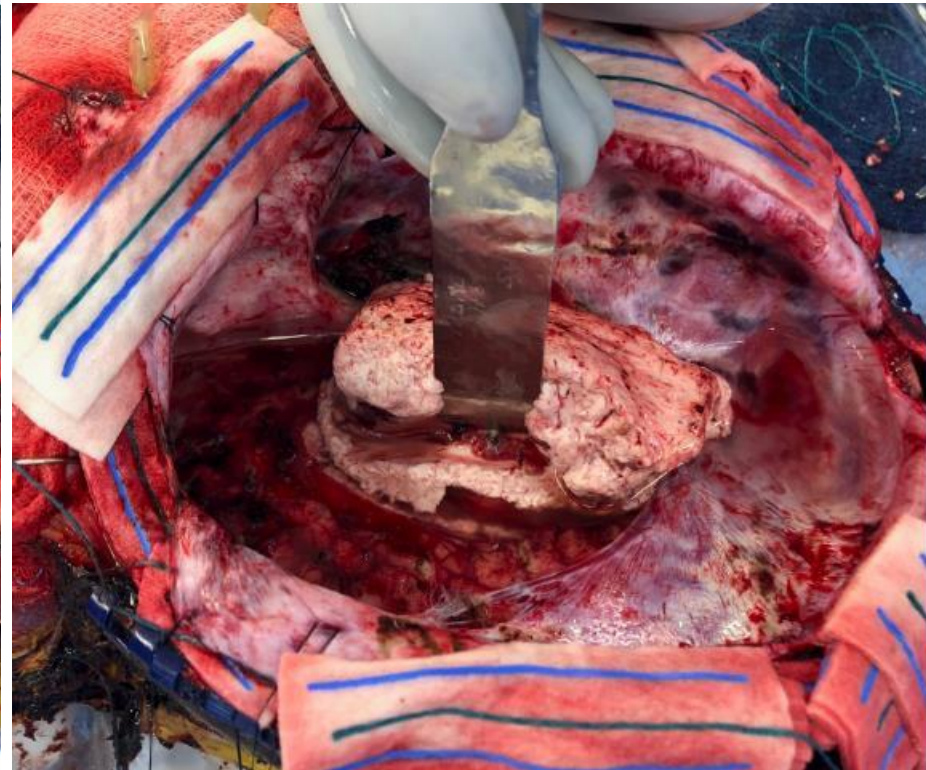
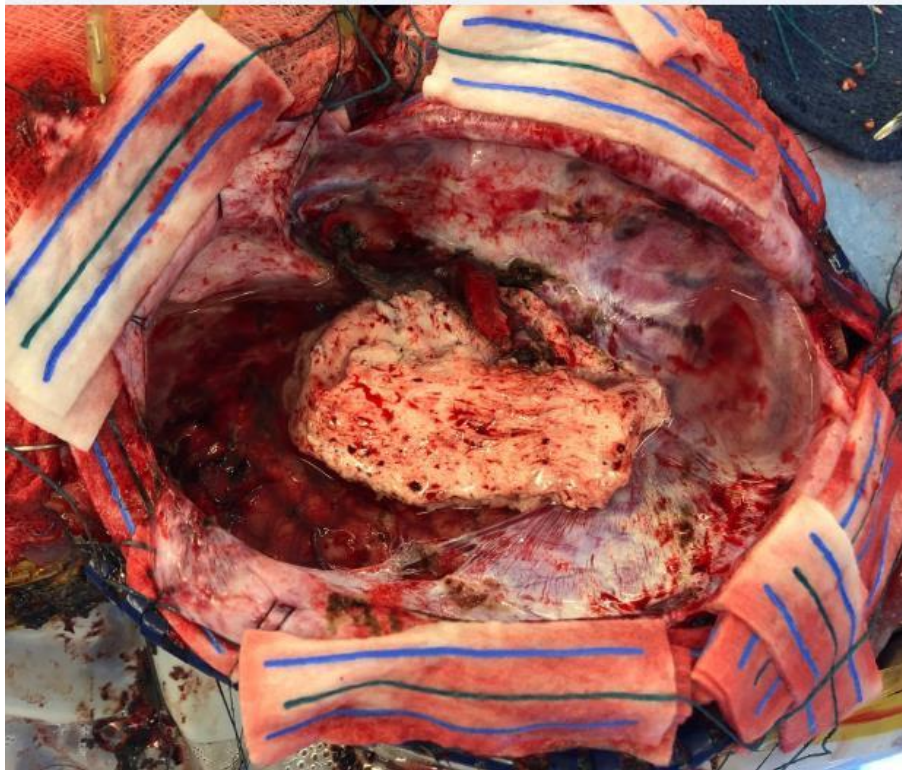
Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage Surgery
 - Curative: Functional Hemispherotomy



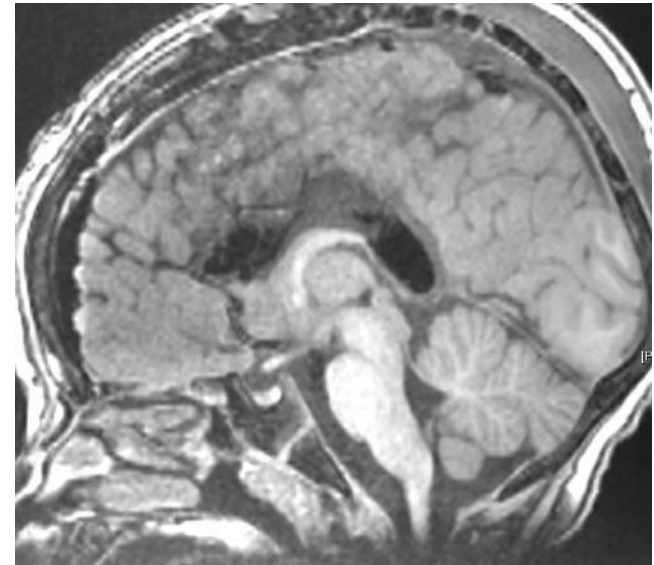
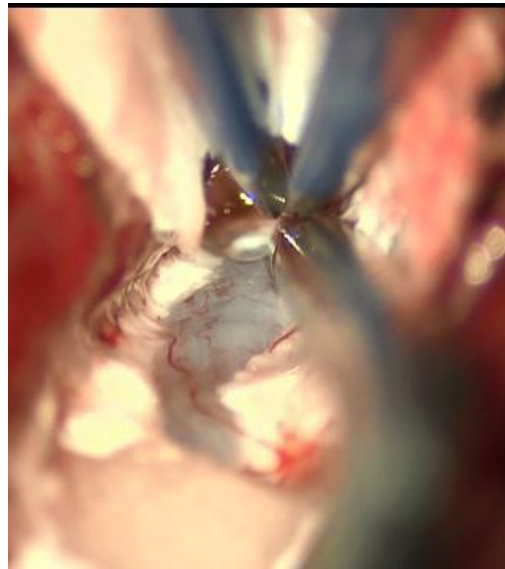
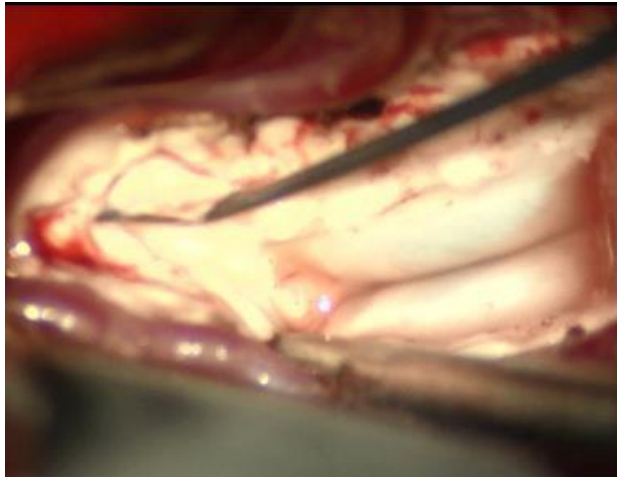
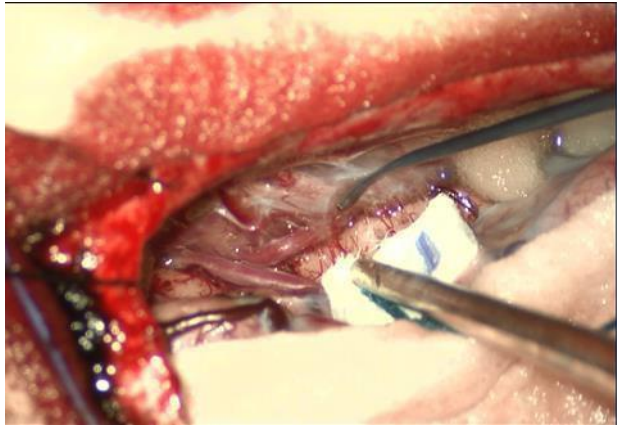
Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage Surgery
 - Curative: Anatomic Hemispherectomy



Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage Surgery
 - Palliative: Corpus Callosotomy, VNS



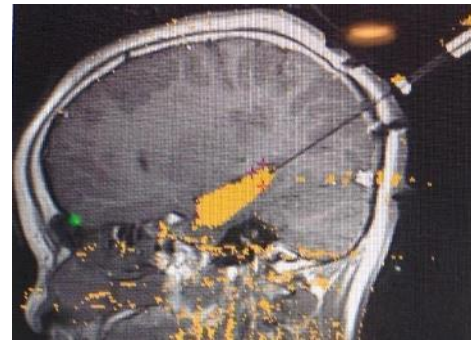
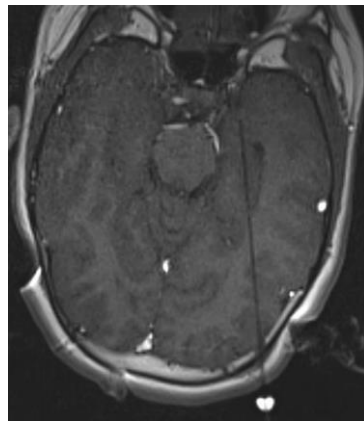
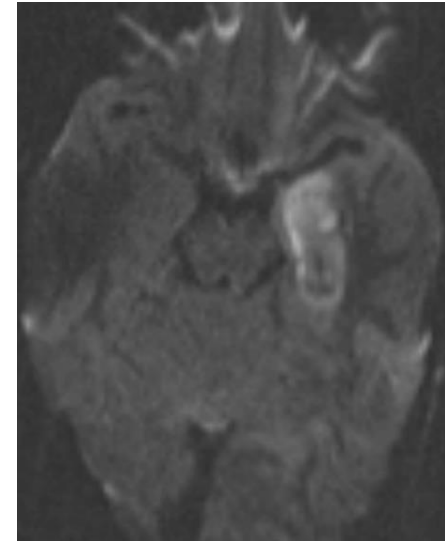
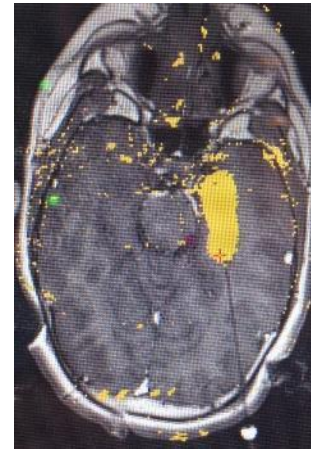
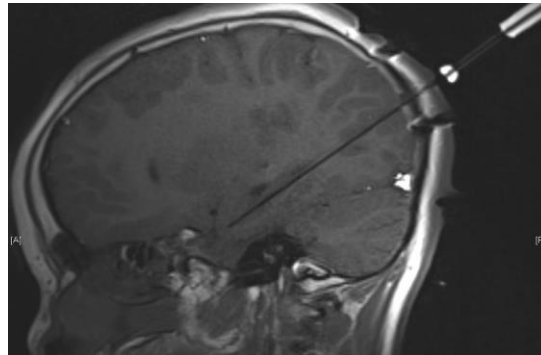
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Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage or Stage II Surgery
 - Minimally Invasive: MRI-guided Laser Interstitial Therapy (MRIgLITT) or Stereotactic Laser Ablation (SLA)



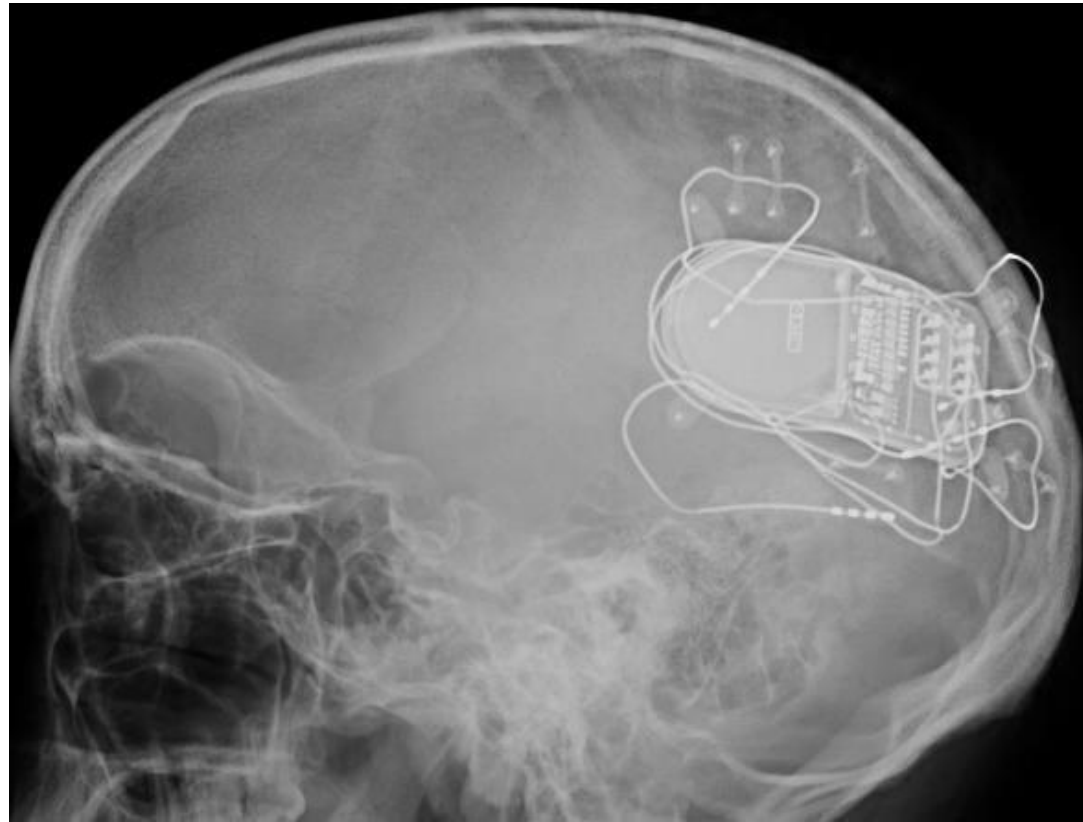
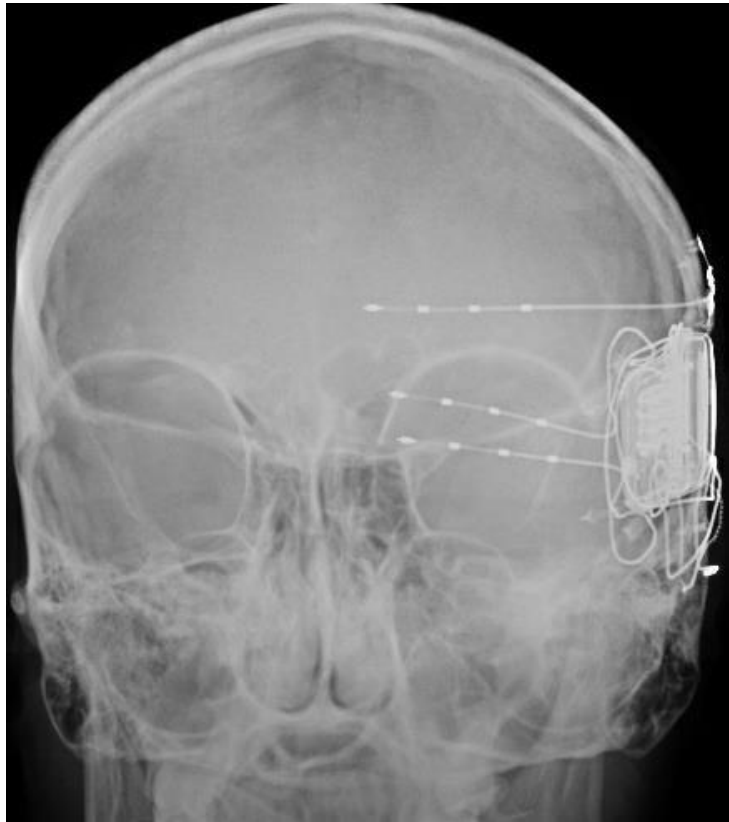
Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Stage II Surgery
 - Neurostimulation: Responsive Neurostimulator (RNS), 1st hospital in Ohio to implant a RNS in a pediatric patient



Nationwide Children's Epilepsy Surgery Program

- Surgical Modalities: Single Stage or Stage II Surgery
 - Neurostimulation: Responsive Neurostimulator (RNS)



Nationwide Children's Epilepsy Surgery Program

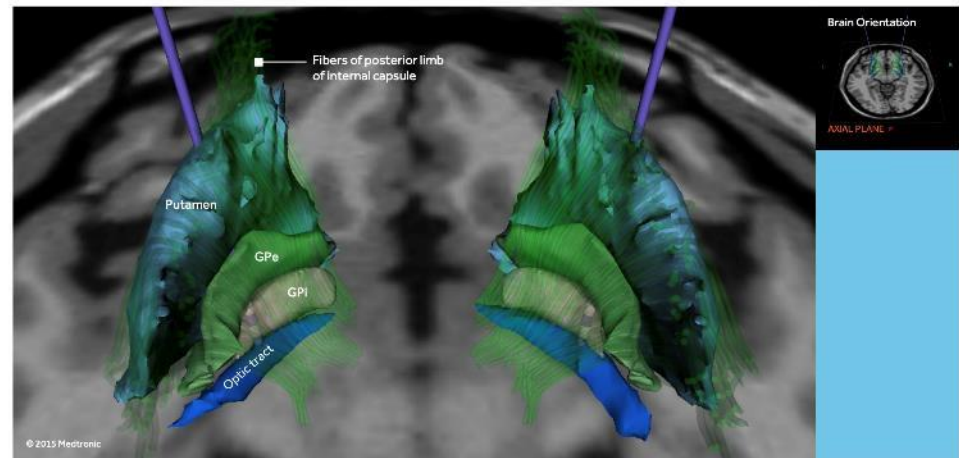
- Deep Brain Stimulation (DBS)
- First pediatric hospital in Ohio to implant a deep brain stimulator for intractable epilepsy
- Target: anterior thalamic nucleus (ATN)
- Other targets under review include centromedian nucleus of the thalamus.



Ammar Shaikhouni, MD, PhD



GPI: EFFECTIVELY-PLACED BILATERAL LEADS



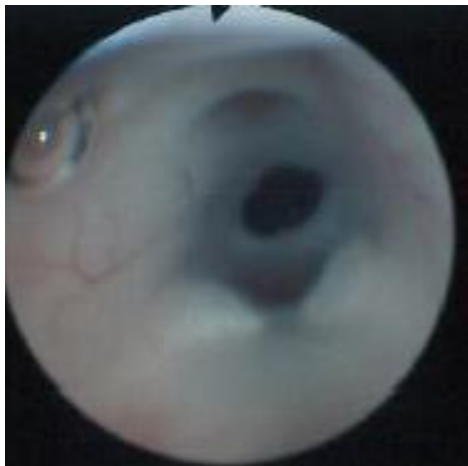
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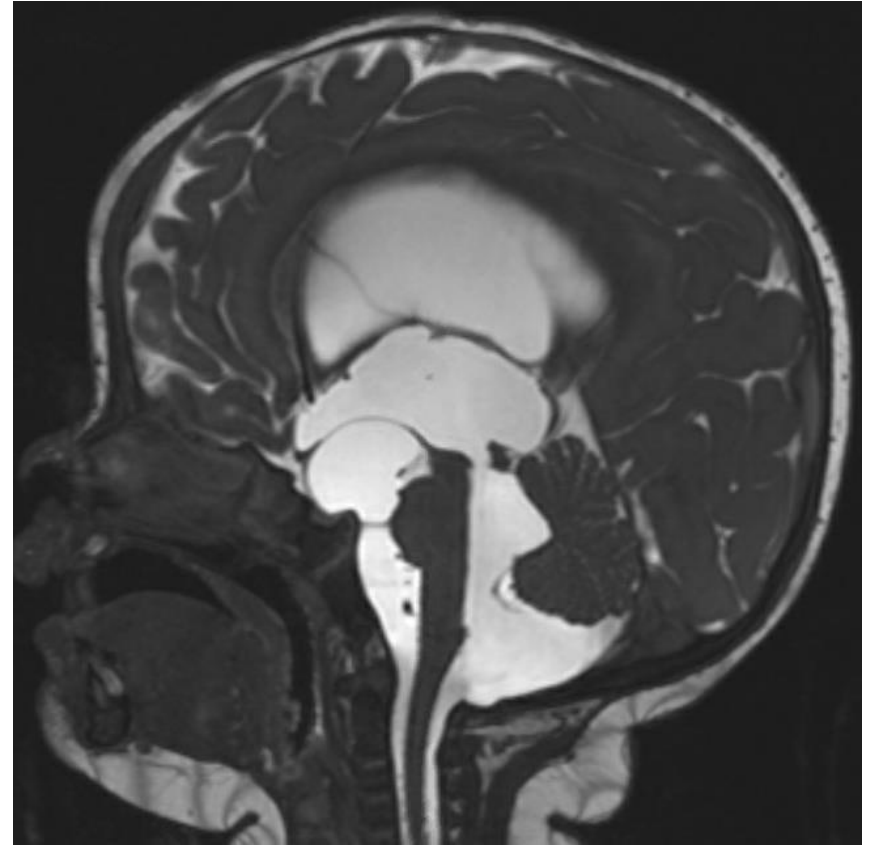
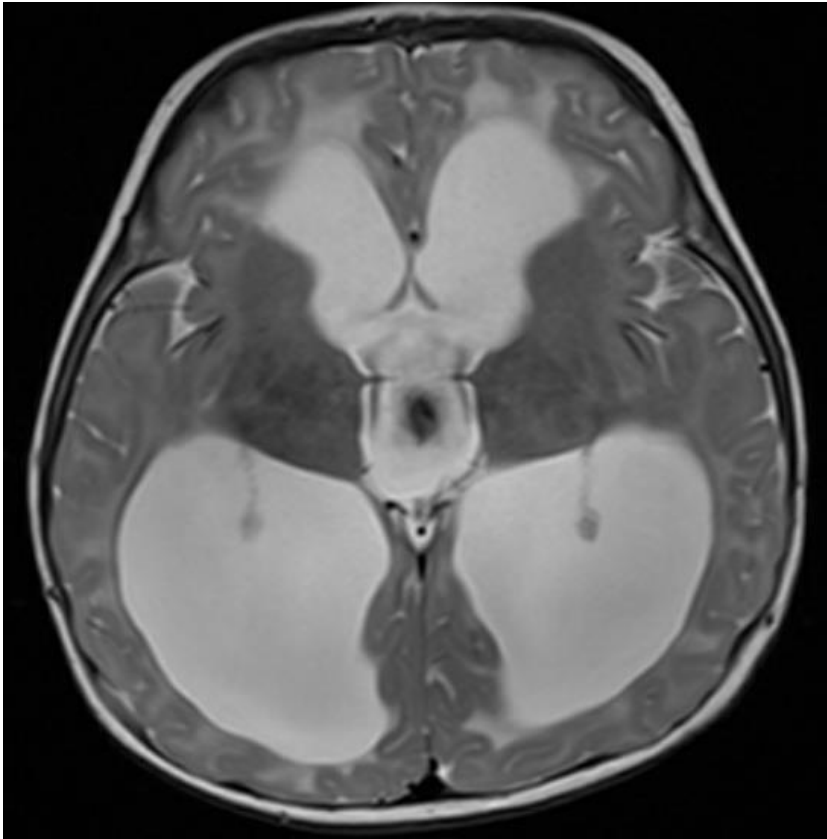
Nationwide Children's Hydrocephalus Program

- Clinical/Operative Volume
 - Large pediatric hydrocephalus population: ~1500 patients
 - High surgical volume
 - 200-230 cases/year for hydrocephalus
 - Average 16-19 cases/month for hydrocephalus
- All Surgical Modalities: Shunt, ETV, ETV/CPC, Endoscopic Fenestrations, VAD/VSGS



Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



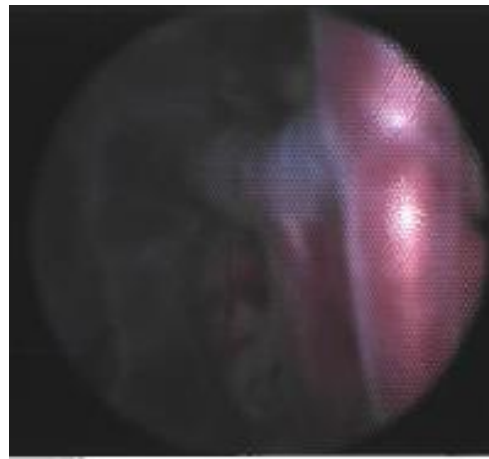
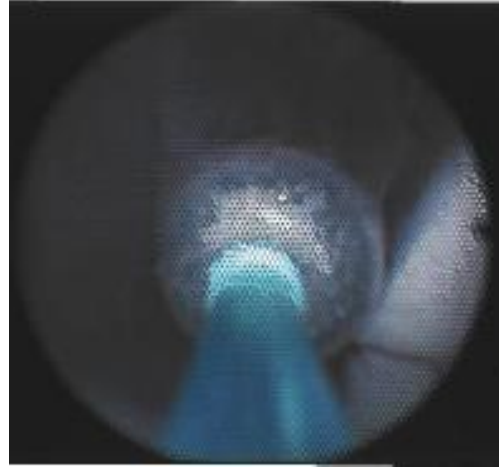
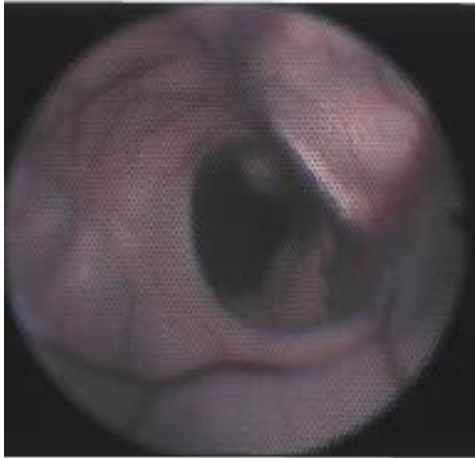
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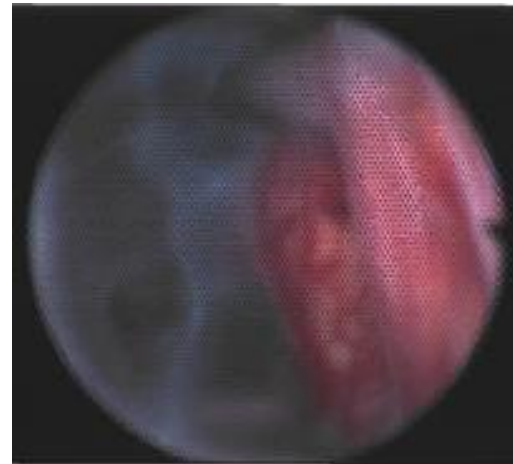
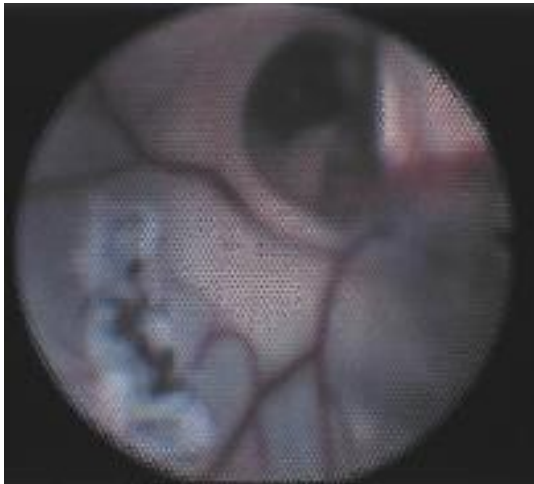
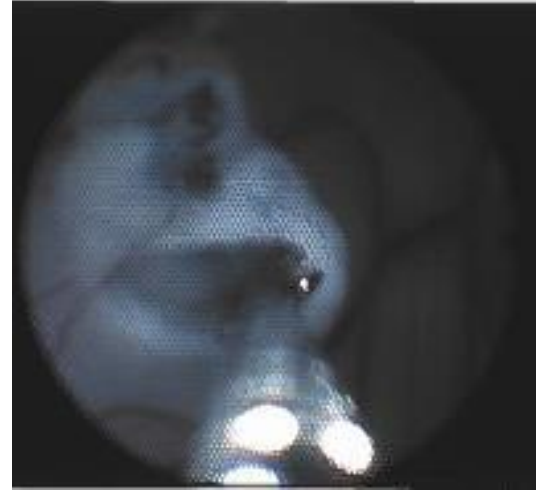
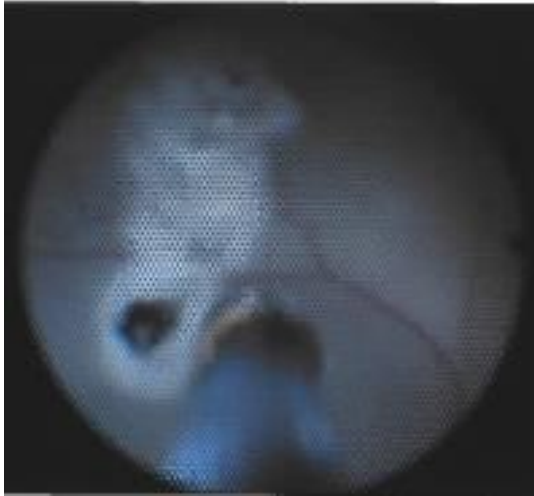
Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



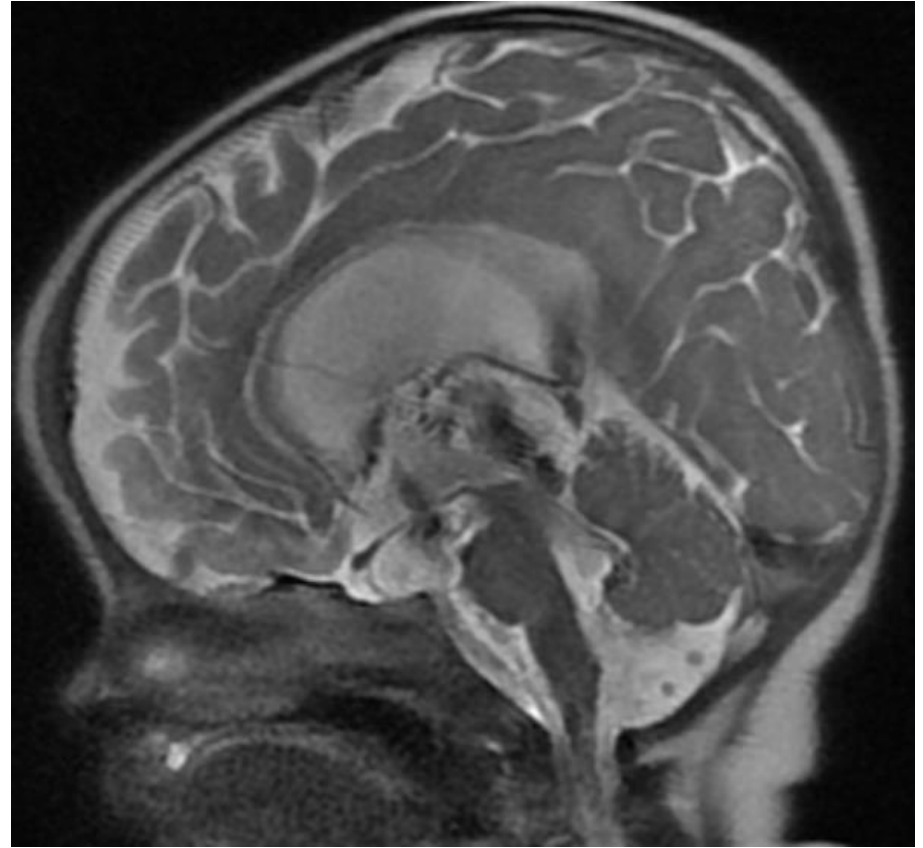
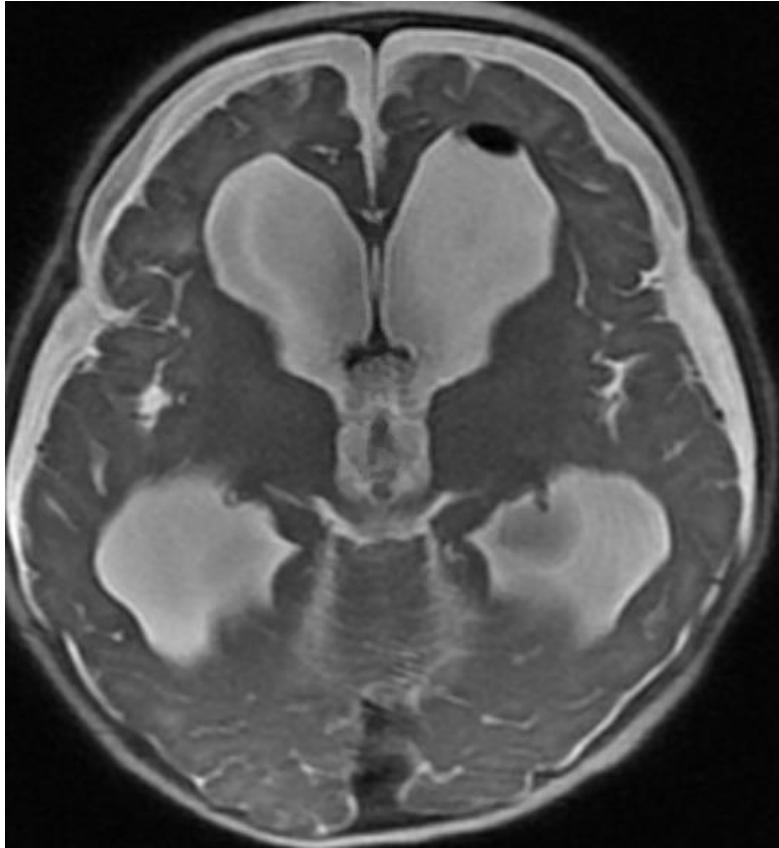
Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



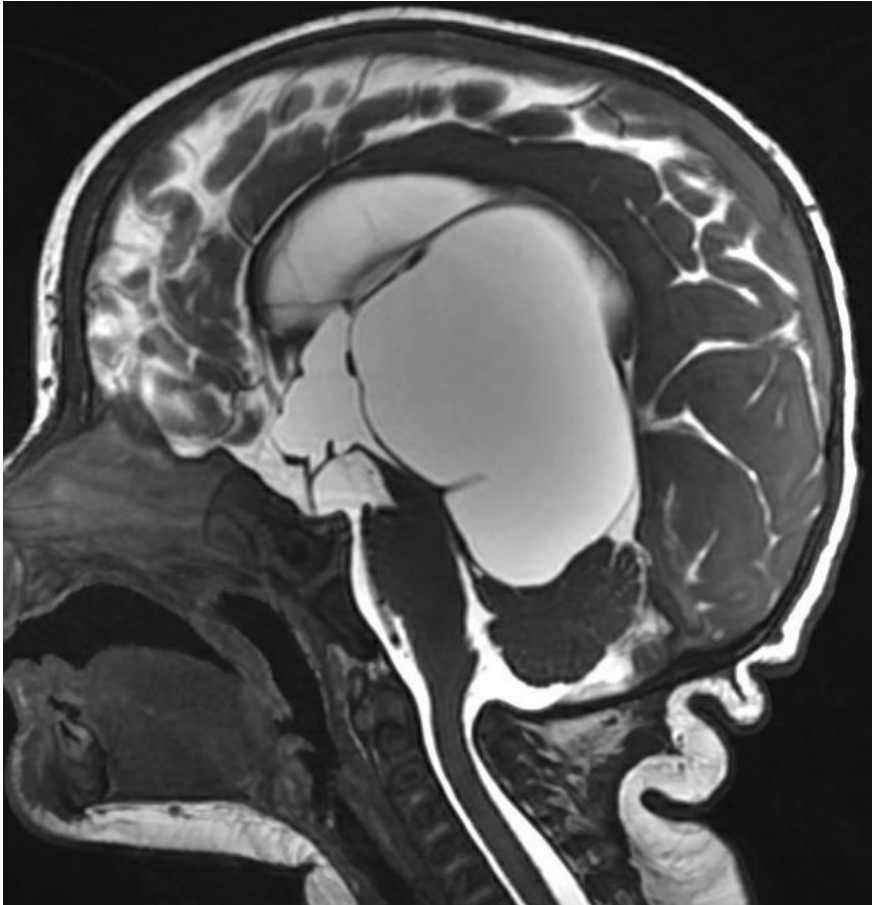
Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



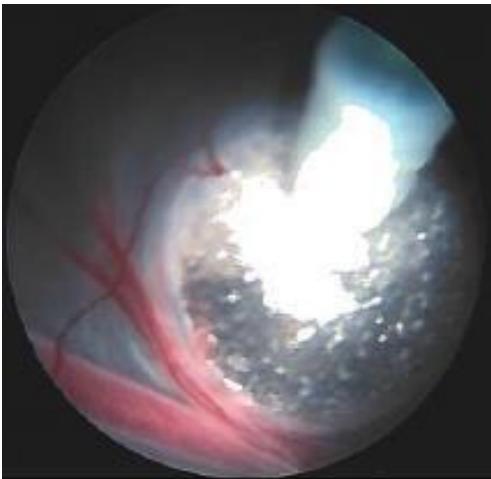
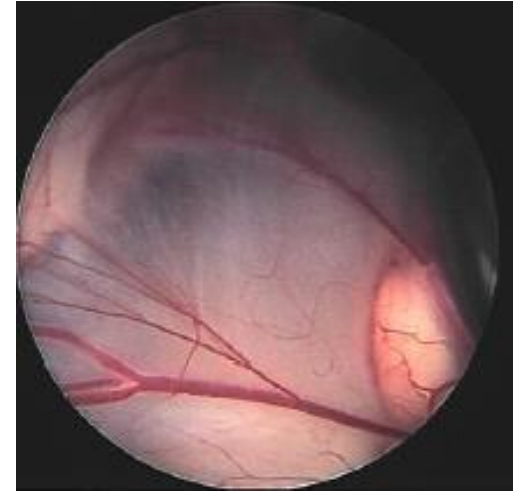
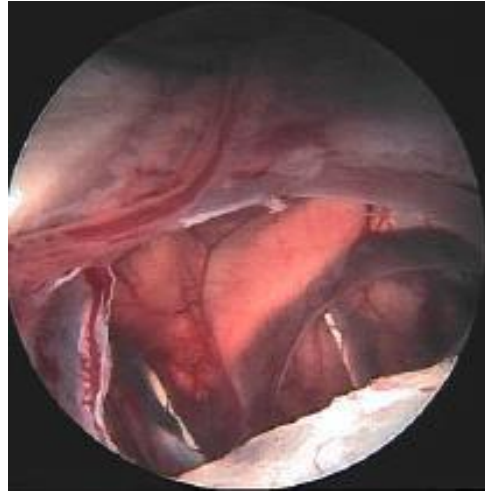
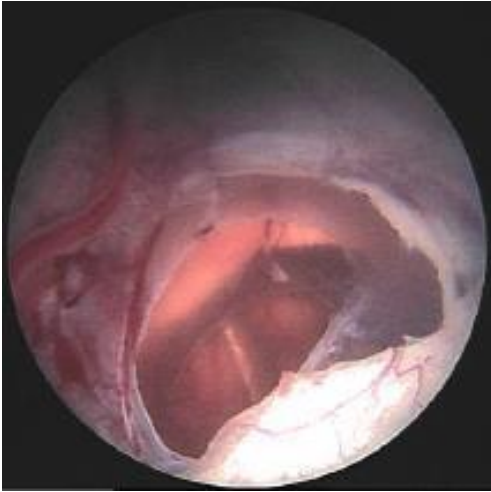
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Nationwide Children's Hydrocephalus Program

- Complex **Neuro-Endoscopic Surgery** for Hydrocephalus



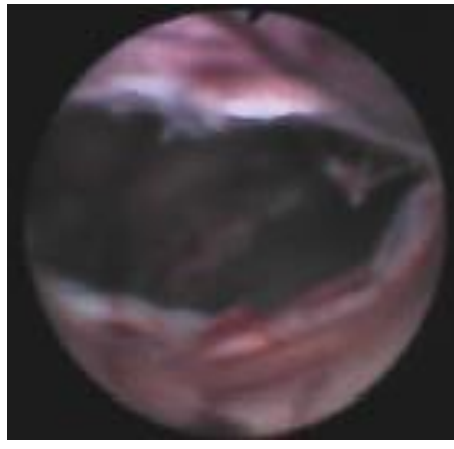
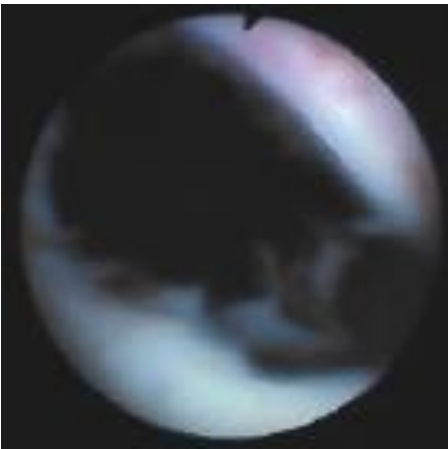
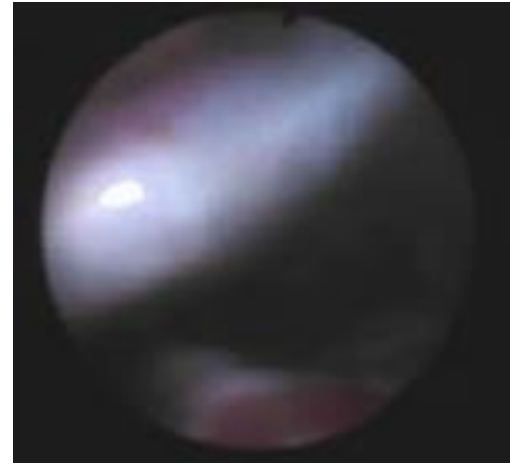
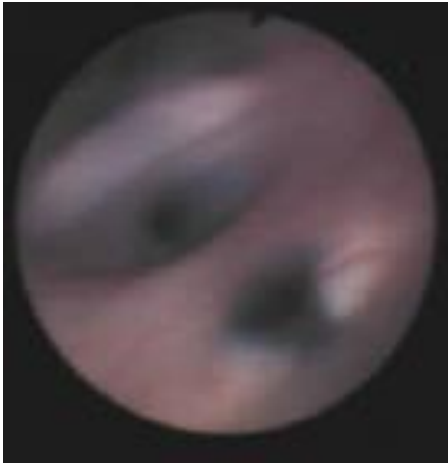
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Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus

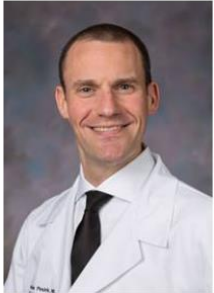


Nationwide Children's Hydrocephalus Program

- Complex Neuro-Endoscopic Surgery for Hydrocephalus



Craniofacial Physician Team



Jonathan A. Pindrik, MD
Pediatric Neurosurgery



Gregory D. Pearson,
MD, FAAP, FACS
Pediatric Plastic &
Reconstructive Surgery



Ibrahim Khansa, MD
FAAP, FACS
Pediatric Plastic &
Reconstructive Surgery



- Ophthalmology, ENT, OMFS, Orthodontics and many others
- 40-45 cases per year

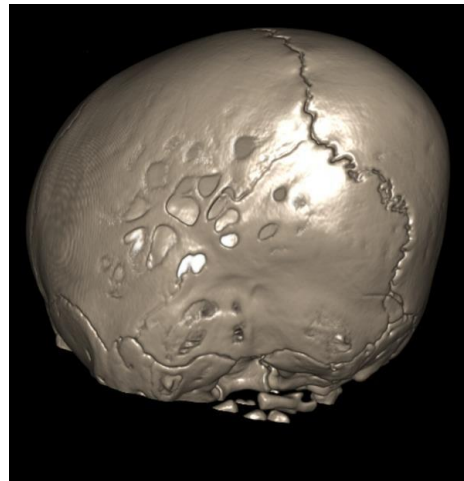
Craniofacial Surgery: Types of Synostosis



Sagittal Craniosynostosis



Unilateral Coronal Synostosis



Lambdoid Synostosis



Metopic Synostosis



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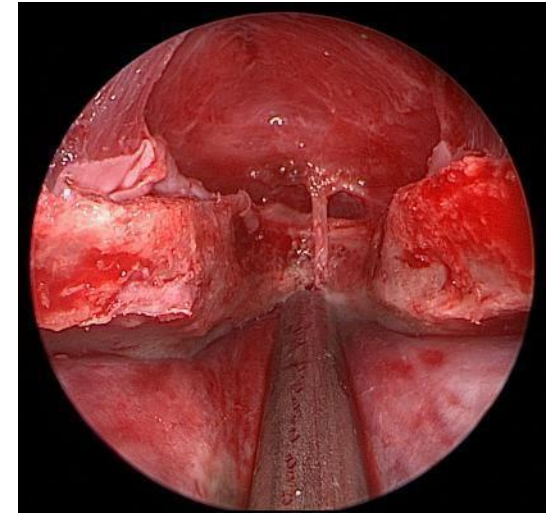
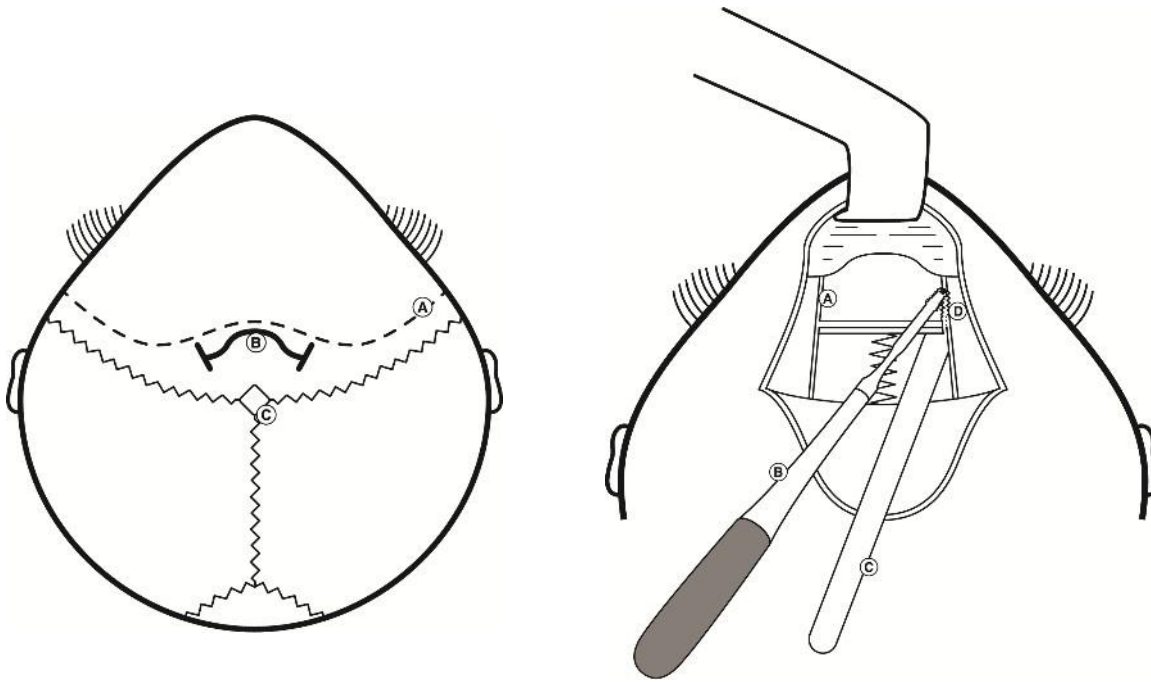


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Craniofacial Surgery: Types of Treatment

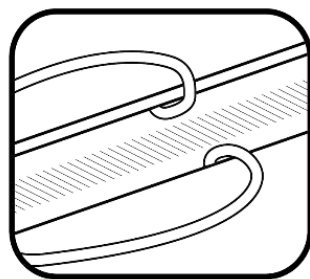
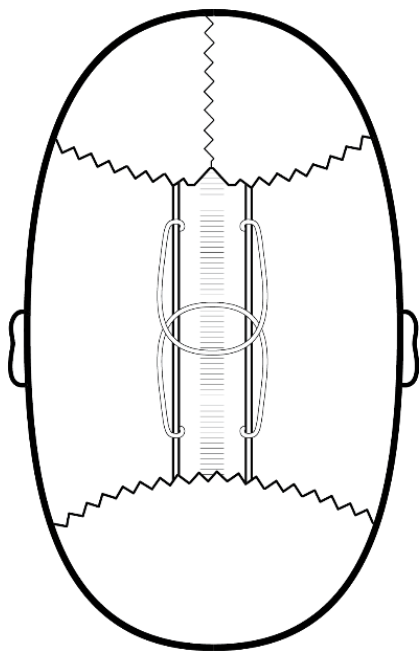
- Minimally Invasive
 - Strip Craniectomy
 - With/without Spring placement
 - Post-operative Helmeting
 - Posterior Cranial Vault Distractors
- Standard Open Surgery
 - Anterior Cranial Vault Reconstruction (CVR)
 - Fronto-Orbital Advancement (FOA)
 - Posterior Cranial Vault Reconstruction (CVR)

Minimal Invasive Strip Craniectomy



Illustrations by Olivier Robidoux © (figures for manuscript in submission for publication)

Minimally Invasive Strip Craniectomy & Springs

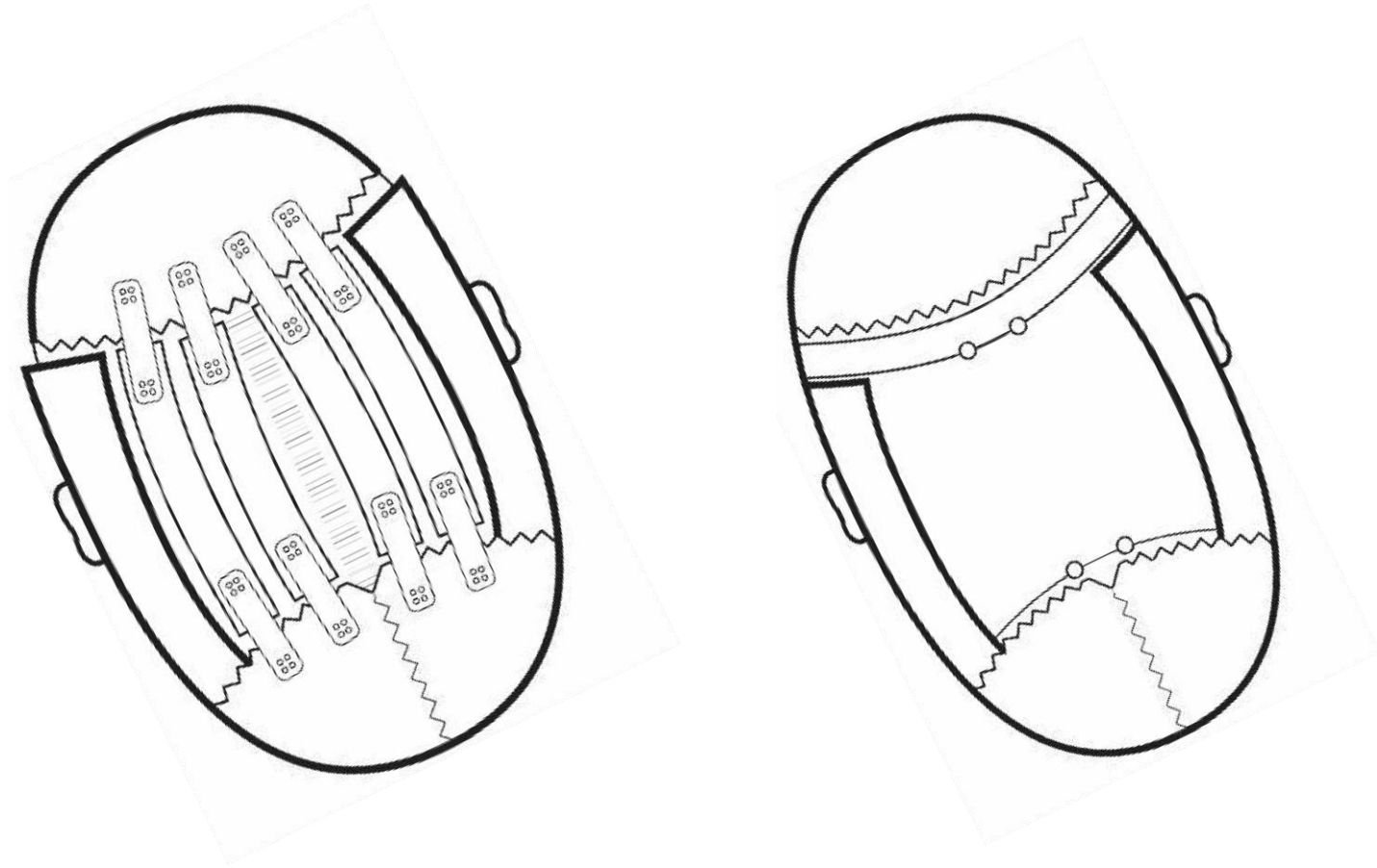


Spring-Assisted Cranioplasty for Sagittal Synostosis

Note the placement of two omega-shaped tension springs across the sagittal synostectomy defect.

Illustrations by Olivier Robidoux ©

Open Posterior CVR (Multiple Options)



Illustrations by Olivier Robidoux ©



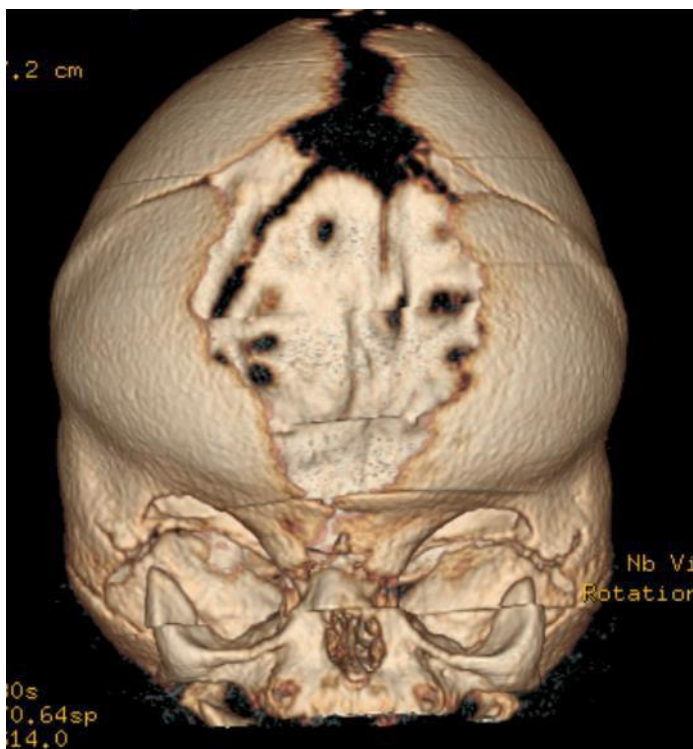
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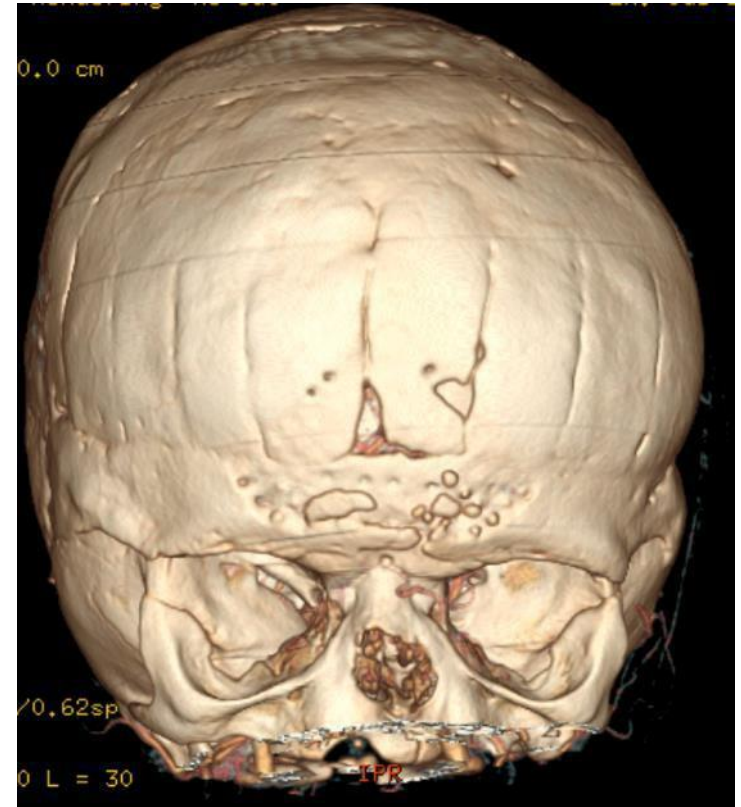
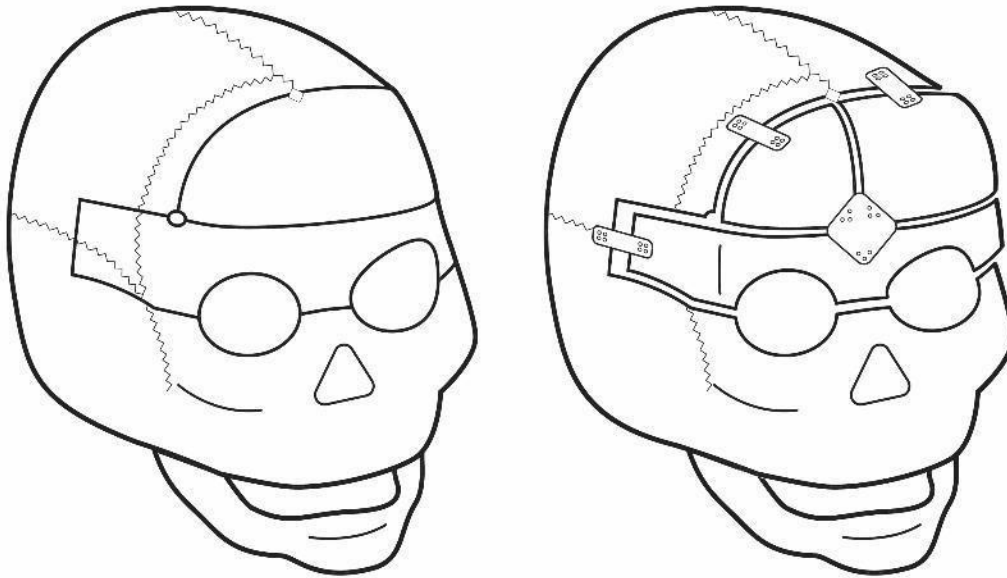
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COLLEGE OF MEDICINE

Apert Syndrome

Bilateral Coronal Craniosynostosis



Anterior CVR & Fronto-orbital Advancement

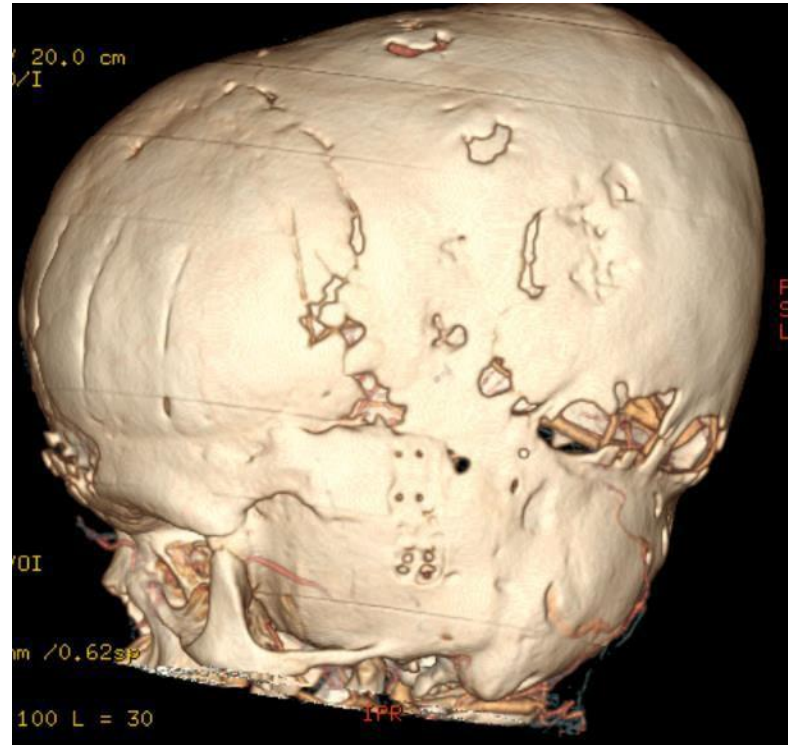


Illustrations by Olivier Robidoux ©

Apert Syndrome

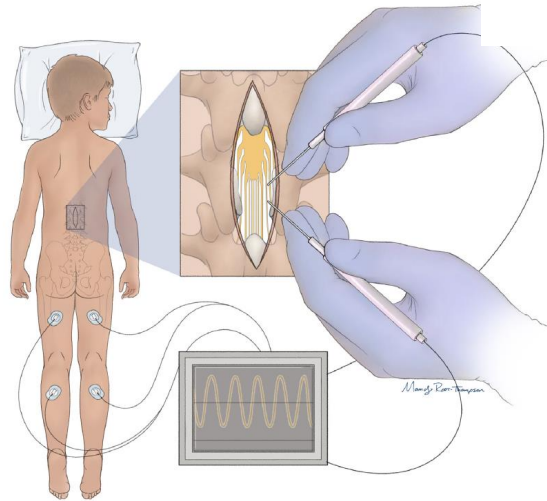


Pre-op



Final post-op

Cerebral Palsy (CP) and Spasticity Program: **Selective Dorsal Rhizotomy (SDR)**



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Cerebral Palsy

Non-progressive disturbances
in the developing fetal or
infant brain

Hypertonia accompanied by
loss of selective motor
control, muscle weakness

Secondary musculoskeletal
problems



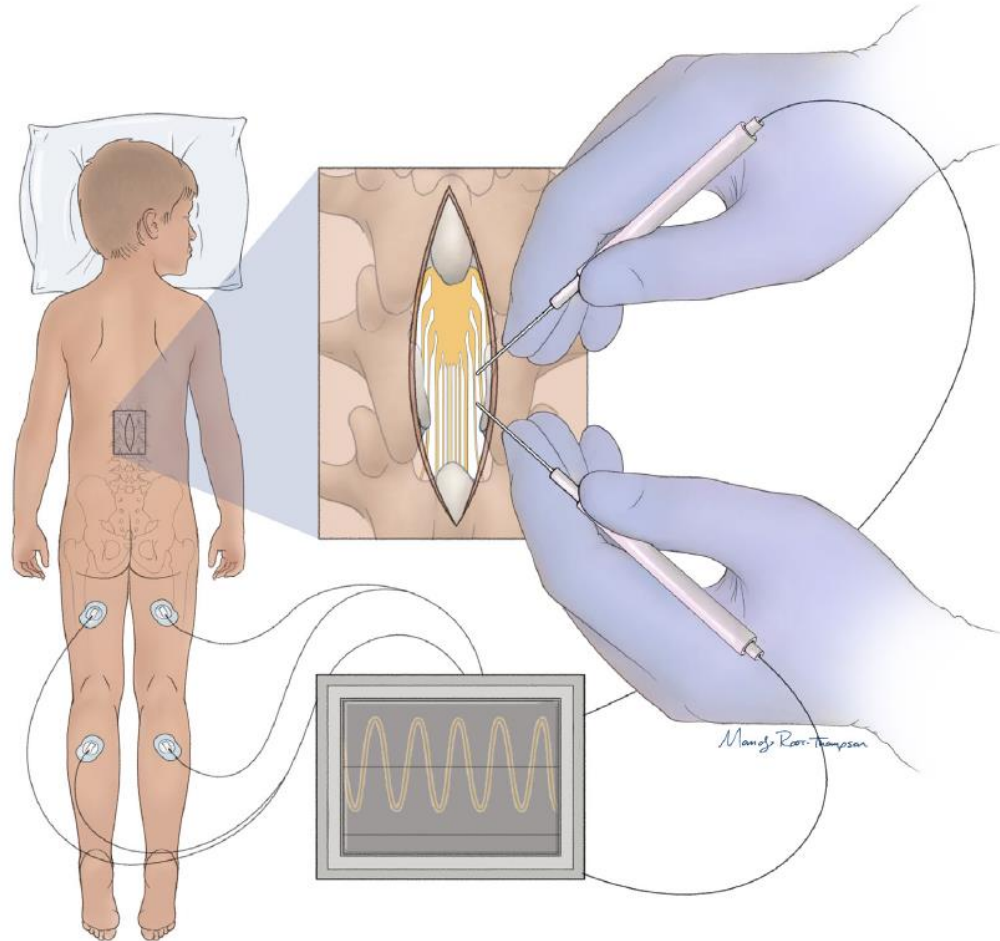
SDR (Conus Rhizotomy)

- Operative Procedure
 - Partial (60-75%) deafferentation of L1-S2
 - EMG testing of nerve roots
- Park Modifications
 - Single (L1) or Two-Level Laminectomy (minimally invasive)
 - Ultrasound localization of conus
 - Rootlets are sectioned that have response beyond their myotomes

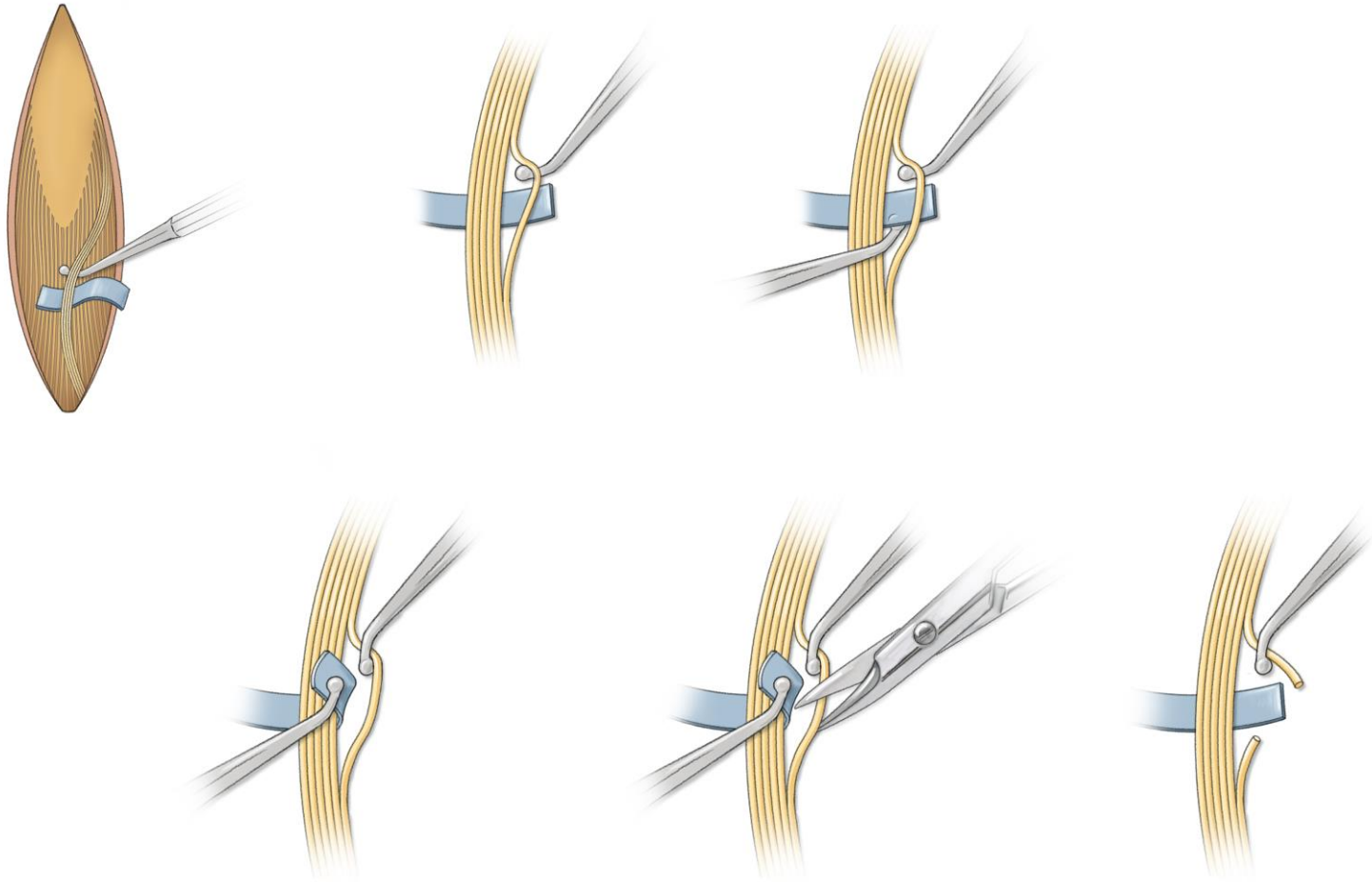
Selective Dorsal Rhizotomy (SDR)

SDR is done in a single operation at Nationwide Children's.

The procedure takes about 4 hours.



Selective Dorsal Rhizotomy (SDR)

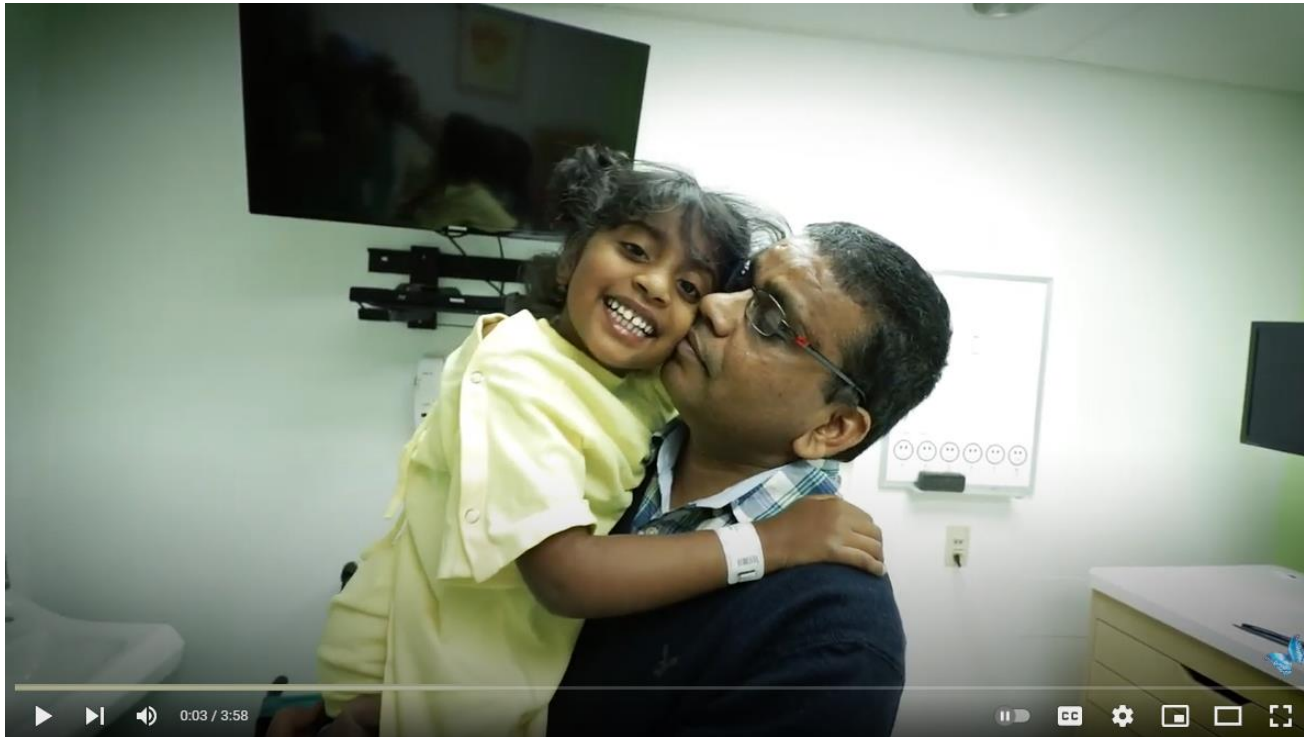


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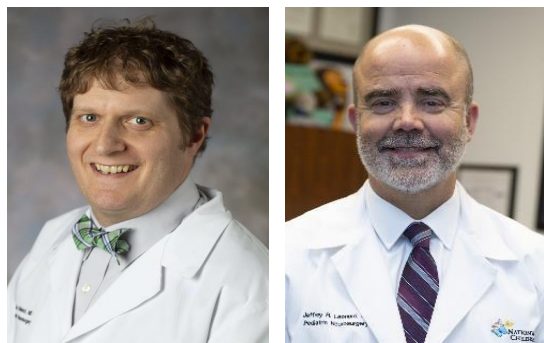
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Selective Dorsal Rhizotomy (SDR): Bhoomi's Story



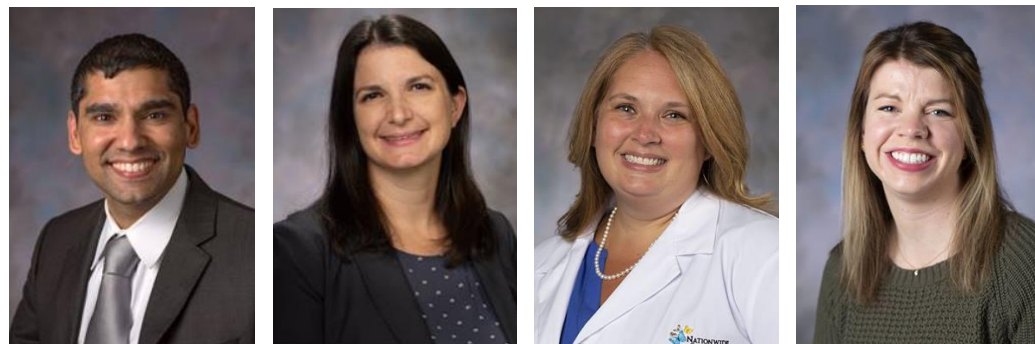
[Click for Video](#)

Nationwide Children's Neurotrauma Program



Pediatric Neurosurgeons:

- Eric Sribnick, MD
- Jeffrey Leonard, MD
(Neurosurgery Chief)



Pediatric Trauma Team:

- Rajan Thakkar, MD (Medical Director for Trauma)
- Dana Schwartz, MD (Associate Medical Director for Trauma)
- Jennifer MacDonald, MD, PhD (PICU Trauma Liaison)
- Morgan Wurtz, DO (Emergency Department Trauma Liaison)

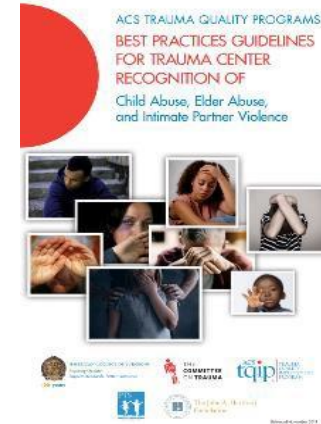
Neurotrauma Program



One of first pediatric centers to apply neurotrauma activation



One of the largest Freestanding Level 1 trauma centers



Involvement in local and national neurotrauma guidelines

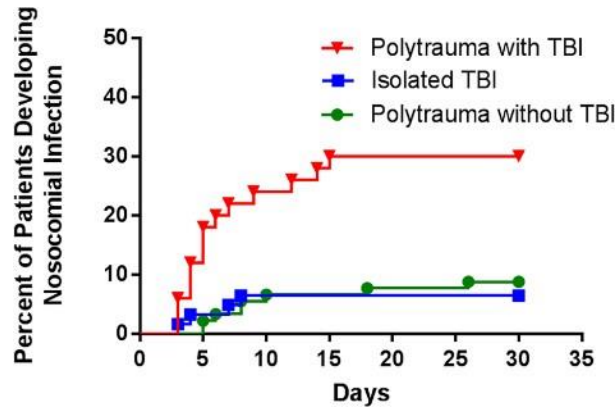


One of the largest pediatric neurocritical care groups



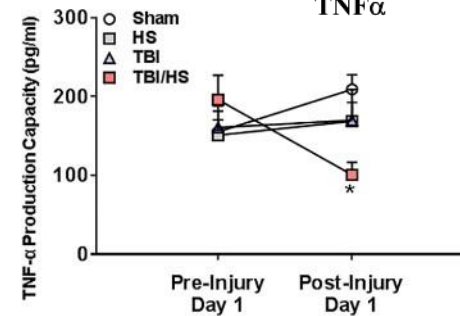
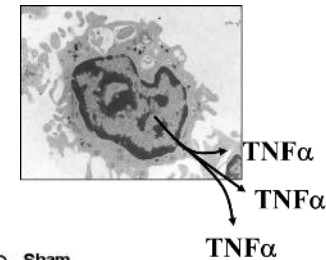
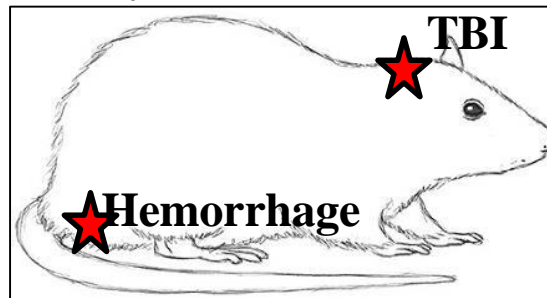
Multi-disciplinary neurotrauma research regarding coagulopathy, critical care, immunology, abuse, and seizure

Neuroimmunology and Trauma Research

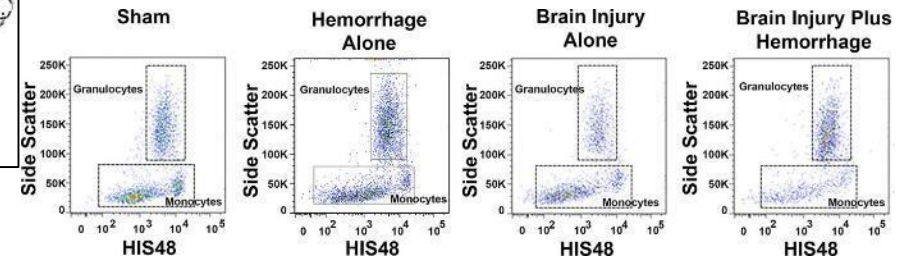


Sribnick *et al.* *Pediatr Crit Care Med.* 2020;21(5):443-450.

Polytrauma Rat Model



Sribnick *et al.* *J Neuroimmunol.* 2019; 337:577073



Nationwide Children's **Institute for Genomic Medicine** Research



Michelle Wedemeyer, MD, PhD

- Progenitor Populations of the Developing Human Hindbrain
 - Using Single Cell Omics to Identify New Targets for Brain Tumors
- Methylation Array Based Classification of Brain Tumors
 - Modern methods of DNA methylation-array based classification of brain tumors has been shown to both outperform traditional immunohistochemical classification and to identify previously unrecognized subclasses of tumor

Nationwide Children's Hydrocephalus Research

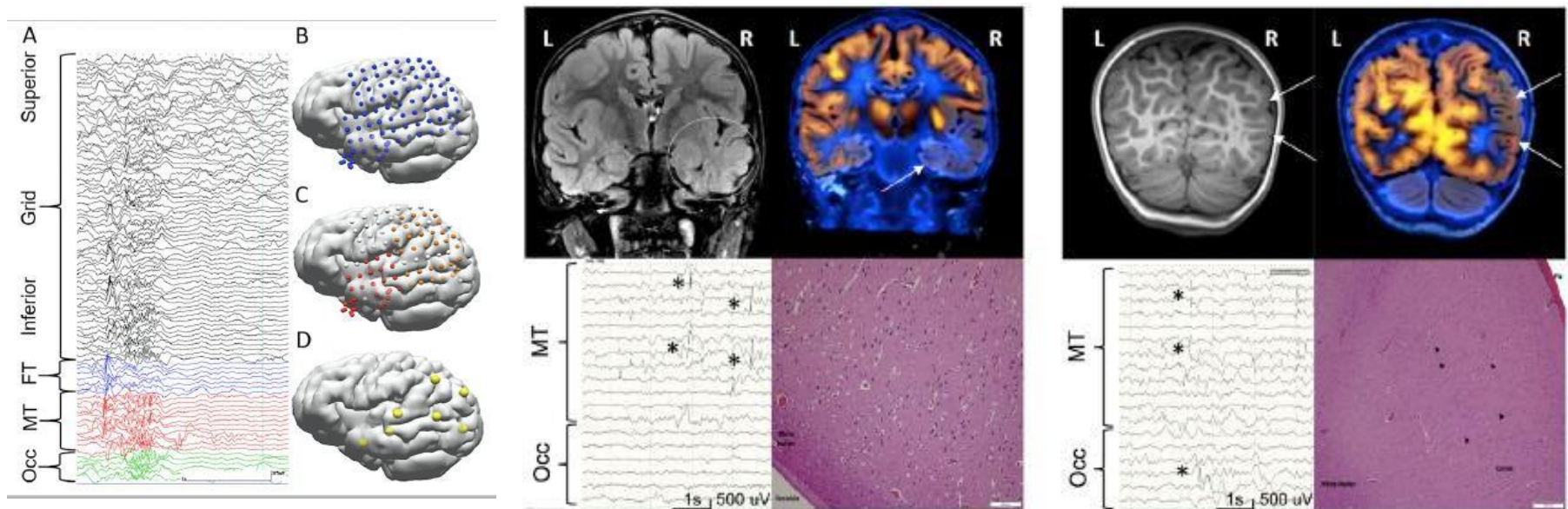
- Member, Hydrocephalus Clinical Research Network (HCRN)
 - 14 North American Academic Children's Hospitals
 - Nationwide Children's Site PI: Jonathan Pindrik, MD
- Multi-Institutional Clinical Trials (NIH/PCORI Funded)
 - CSF Shunt Entry Site Trial
 - Endoscopic vs. Shunt Treatment of Hydrocephalus in Infants (ESTHI) Trial
- Primary Site for Recent HCRN Registry Study & Manuscript

Surgical Resource Utilization after Initial Treatment of Infant Hydrocephalus: Comparing Endoscopic Third Ventriculostomy (ETV), Early Experience of ETV with Choroid Plexus Cauterization, and Shunt Insertion in the Hydrocephalus Clinical Research Network

Jonathan Pindrik, MD,¹ Jay Riva-Cambrin, MD, MSc,² Abhaya V. Kulkarni, MD, PhD,³ Jessica S. Alvey, MSc,⁴ Ron W. Reeder, PhD,⁴ Ian F. Pollack, MD,⁵ John C. Wellons, III, MD, MSPH,⁶ Eric M. Jackson, MD,⁷ Curtis J. Rozzelle, MD,⁸ William E. Whitehead, MD, MPH,⁹ David D. Limbrick, MD, PhD,¹⁰ Robert P. Naftel, MD,⁶ Chevis Shannon, MBA, MPH, DrPH,⁶ Patrick J. McDonald, MD, MHSc,¹¹ Mandeep Tamber, MD, PhD,¹¹ Todd C. Hankinson, MD,¹² Jason S. Hauptman, MD, PhD,¹³ Tamara D. Simon, MD, MSPH,¹³ Mark D. Krieger, MD,¹⁴ Richard Holubkov, PhD,¹⁵ and John R.W. Kestle, MD, MSc,⁴ for the Hydrocephalus Clinical Research Network

Nationwide Children's Epilepsy Surgery Research

- Multidisciplinary Research
 - Somatic Mutations in Epilepsy with Institute for Genomic Medicine (IGM)
 - Somatic *SLC35A2* mosaicism correlates with clinical findings in epilepsy brain tissue. *Neurology: Genetics*



Nationwide Children's **Epilepsy Surgery** Research

- Multidisciplinary Research
 - Quality Improvement (QI) initiative to augment pre-op evaluation and increase number of epilepsy surgeries per year
 - Nationwide Children's *Epilepsy Surgery Cure Me Initiative*
 - Evaluation & Surgical Management of Infants & Toddlers with Drug Resistant Epilepsy (DRE)

NEUROSURGICAL
FOCUS

Neurosurg Focus 45 (3):E3, 2018

Preoperative evaluation and surgical management of infants and toddlers with drug-resistant epilepsy

*Jonathan Pindrik, MD,^{1,2} Nguyen Hoang, MD,² Luke Smith, MD,² Mark Halverson, MD,³ Mary Wojnaroski, PhD,⁴ Kelly McNally, PhD, ABPP,⁴ Satyanarayana Gedela, MD, MRCP,⁵ and Adam P. Ostendorf, MD⁵

Nationwide Children's **Epilepsy Surgery** Research

- **Multi-Institutional Research Projects**

- MRI-guided Laser Interstitial Thermal Therapy (MRIgLITT) Registry
 - Primary Site: Hospital for Sick Children (Toronto, CA)
 - Nationwide Children's Site PI: Jonathan Pindrik, MD
- Descriptive Analysis of Diagnostic and Surgical Resources available at Major Epilepsy Centers through NAEC
- Clinical Outcomes Research among Major Epilepsy Centers through Pediatric Epilepsy Research Consortium (PERC)

Nationwide Children's **Epilepsy Surgery** Research

- **Multidisciplinary Research**

- Cognitive Impact of Intracranial Epilepsy Surgery
- Radiographic Predictors of Seizure/Functional Outcomes following Corpus Callosotomy
- Impact of Etiology in Children with Cerebral Palsy (CP) and DRE undergoing Hemispherotomy/Hemispherectomy

AACPDM
74TH
ANNUAL
MEETING

2020

SEPTEMBER 23-26
NEW ORLEANS
MARRIOTT



Abstract Title: Impact of Etiology in Children with Cerebral Palsy (CP) and Medically Intractable Epilepsy (MIE) Undergoing Hemispherotomy/Hemispherectomy

Nationwide Children's **Neuro-Oncology & Chiari** Research

- Multidisciplinary Research & Laboratory Benchwork
 - Collaboration with Institute for Genomic Medicine (IGM)
 - Multicenter Collaboration for Craniopharyngioma
 - Immune Cell Infiltrates after Viral Tx for Medulloblastoma
- Chiari I Malformation and Genetics Study



The Institute for
Genomic Medicine
currently has more than

180

faculty and staff



Institute for Genomic
Medicine Clinical
Laboratory reported

13,000+

clinical assays



100+

Intensive Care Unit (ICU) patients
received rapid-turnaround
whole genome sequencing (rGS)
due to critical illness caused by
suspected genetic conditions



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Nationwide Children's **Quality Improvement (QI)** Projects

- pRBC Availability during Craniostomy Surgery
- Cerebral Palsy Health Equity
- Fulminant Intracranial Hypertension (FIH) Pathway
- Augmenting Pre-Operative Evaluation for Pediatric Epilepsy Surgery Patients (NCH *Epilepsy Surgery Cure Me Initiative*)

Nationwide Children's Hospital/OSU

Pediatric Neurosurgery Program

- Multidisciplinary Programs
- Multiple Unique Operative Experiences
- Robust Research Programs
- Consistently ranked as a top 10 program by USNWR!



- Honor Roll for the past nine years
- Top 10 in Neurology and Neurosurgery for past six years

Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Collaborative colleagues with diverse backgrounds and interests... And all friends 😊...



Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Attendings, Fellows, Residents and more!



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Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Friendly and Fun!



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Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Building relationships both in and outside of NCH!



Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Playing Cards and Sitting Skybox at Columbus Blue Jackets Games..



Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

- Maintaining Lifelong Friendships with Our Fellows!



Nationwide Children's Hospital/OSU Pediatric Neurosurgery Program

Join us...



Visit:

[Pediatric Neurosurgery Fellowship](#)

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