



# Pediatric Thrombectomy

Translating adult standard of care to pediatric patients

---

DATE: September 16, 2016 PRESENTED BY: Ittai Bushlin MD, PhD and Adrienne McDougal, RN

# Objectives:

- Review acute management of pediatric stroke
- Describe the development of an acute pediatric stroke program
- Describe successful thrombectomy in a pediatric patient with acute stroke

No financial disclosures

# Pediatric Stroke

# Epidemiology

- Rate of arterial ischemic stroke in children (1 month – 18 yo): 0.6 – 7.9/100,000
- Rates of arterial ischemic stroke in adults older than 45 years: 3.4 – 22.8/100,000
- Common risk factors: congenital heart disease, sickle cell disease, vasculopathy, infection, hematologic
- Presentation: focal deficit, headache, AMS, seizure
- 60% left with permanent neurologic deficits

# Acute therapy in pediatric stroke

- Acute therapies have been used in children 2 years and older
- ~2% of children receive IV tPA
- Mechanical thrombectomy described in case reports, with no trial data demonstrating efficacy/safety
- Current guidelines:
  - IV tPA generally not recommended outside of clinical trial
  - No consensus about the use of tPA in older adolescents
  - Mechanical thrombectomy through interventional neuroradiology (INR) may be reasonable for some children
- Pediatric hospitals with rapid stroke response may be tailored to administer tPA, but not endovascular therapy

# Acute Pediatric Stroke: OHSU

# Doernbecher Children's Hospital/OHSU

- Pediatric ER
- PICU
- Level 1 trauma center
- Joint Commission Certified Comprehensive Stroke Center (neurology, neurosurgery, neuroradiology, neurointerventional)
- 8 pediatric neurologists



DOERNBECHER  
CHILDREN'S  
*Hospital*



The Joint  
Commission



American Heart  
Association  
American Stroke  
Association

CERTIFICATION

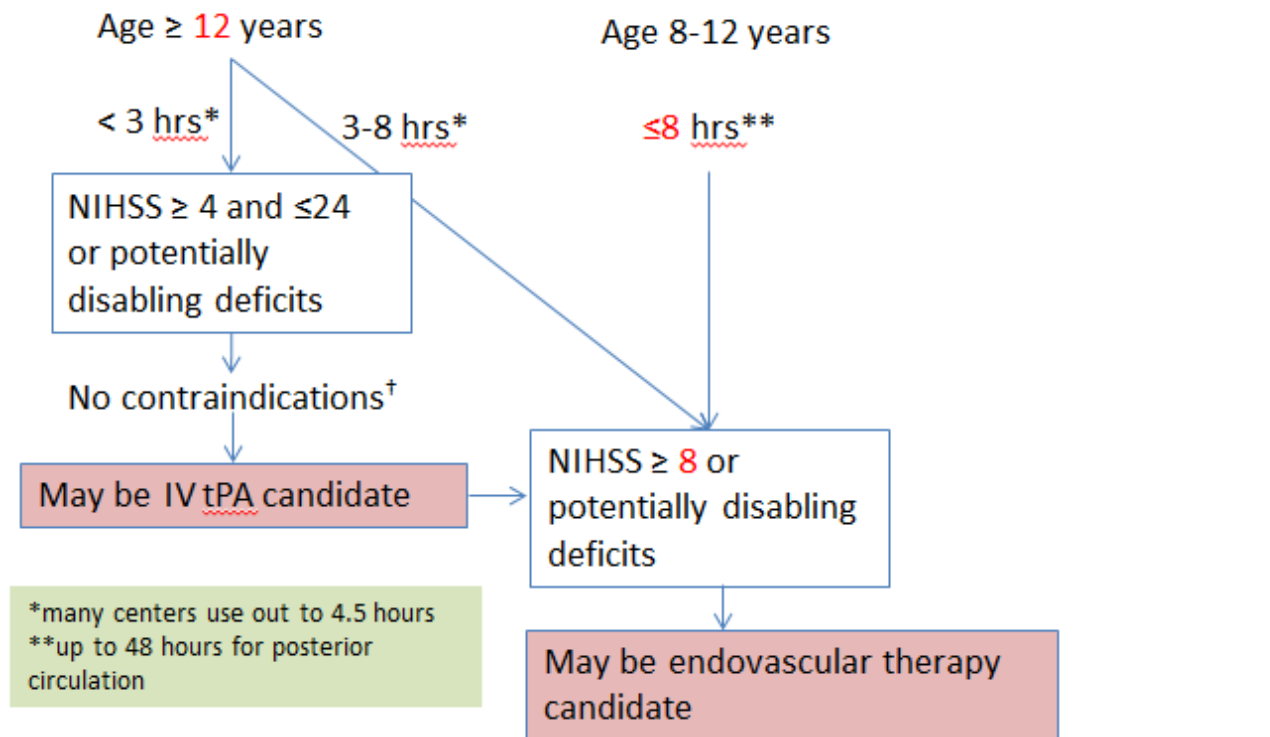
Meets standards for

Comprehensive Stroke Center



# Acute stroke management

- Neuroprotection
- Consider acute therapies



# Program development

# Translating adult standard of care to children

- Identified a need- using the process we have in place for adults was not sufficient
- Collaborated with interprofessional teams of adult and pediatric stakeholders
- Involved direct care staff from early stages of the process
- Identified educational opportunities (for RNs and MDs) and developed curriculum

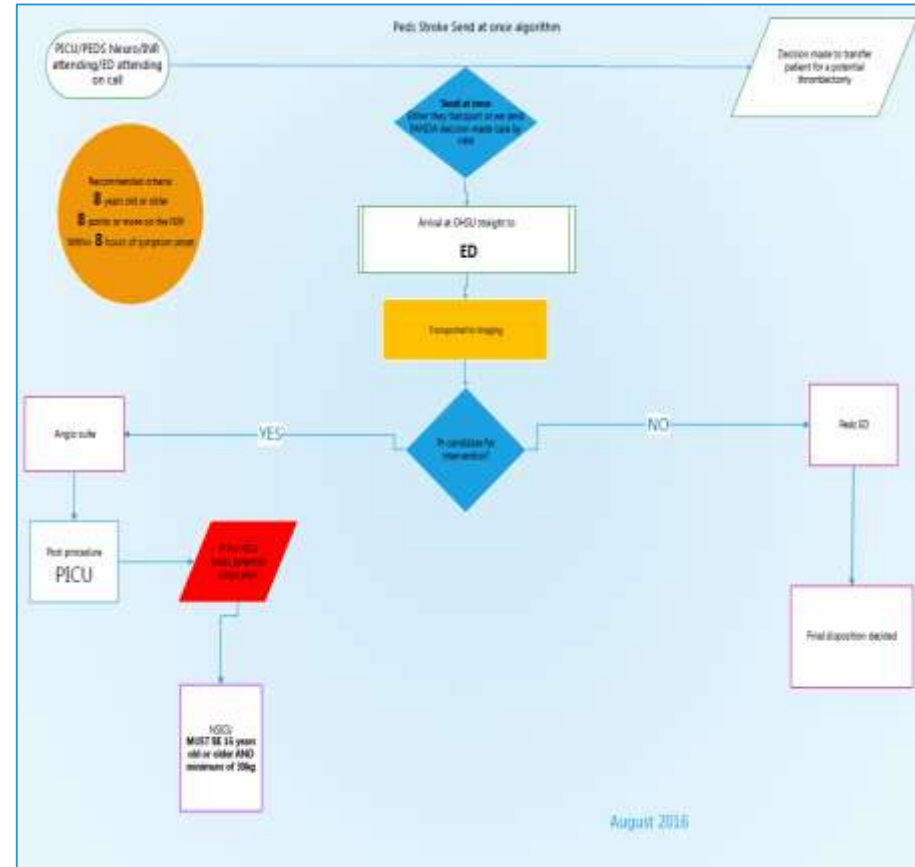


# Acute stroke therapy team

- Pediatric/Adult Stroke Neurology
- Pediatric ICU/Adult Neuro ICU
- Angiography/Neuro interventional team
- Pediatric anesthesia
- Emergency Department
- Stroke coordinator
- Nursing leadership
- Pediatric Rapid Response team
- Neuroradiology
- Emergency Communication center
- Lab

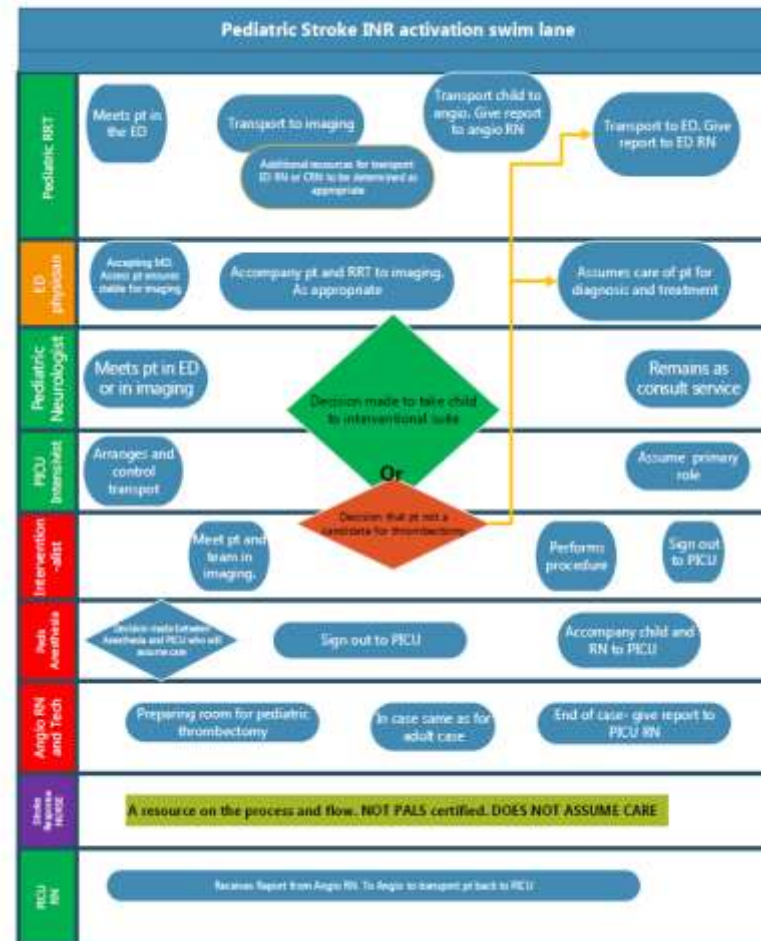
# Process Maps: transport

- Developed algorithm for transport of children who may be candidates for endovascular therapy



# Process Maps: care at OHSU

- Developed algorithm for patient flow and provider responsibilities at OHSU



# Paging System

- Creation of pager groups for acute pediatric stroke and peds INR alert

Role	Response expectation
PICU RRT	Meet the patient on ED , go with patient to imaging, angio, back to PICU
PICU Charge	Prepare for patient admission and 1:1 assignment
Adult Stroke Response Nurse	Check in with PICU RRT – meet team when pt arrives
Peds Anesthesia	Be available within one hour of page, check in with PICU intensivist and meet patient at angio or imaging
PICU physician group	Arrange and control transport. Help triage patients, assume care after acute therapies, or in stroke patients who are not candidates for acute therapies, back up for anesthesia
Adult Stroke 12600 (not on paging group – paged separately)	Resource for managing patients with acute stroke
CT/MRI	Prepare for patient arrival
Angio Tech	Off hours: Check in with comm center arrival on site within 30
Angio RN	Off hours:Check in with comm center arrival on site within 30
Neuro Interventionist	Check in with comm center arrival on site within 30
ED	Assume initial care of patients transferred from OSH, facilitate consultant evaluation and transport to imaging or angio
Lab	Expedites labs drawn for potential tPA candidates
Pharmacy	Prepares IV tPA if indicated, programs pump to administer

# Education

- PICU mock code of acute stroke
- Development of education modules for nursing and physicians
- Multidisciplinary review of acute peds stroke cases for QI



# Case

# Clinical presentation

- 8 y/o F
- 9 days fever, vomiting, 1 day of chest pain
- 1 hour after acute onset expressive aphasia, lethargy
  
- Studies
  - CSF: WBC 0 , RBC 0, Glucose 60, Protein 16
  - Troponin 12.2, WBC 15.8
  - EKG: deep asymmetric T wave inversions diffusely
  - Bedside TTE: moderate septal motion abnormalities, PFO

# Workup

- Developed right sided hemiparesis in ED
- Neuroimaging



CT Head wo contrast

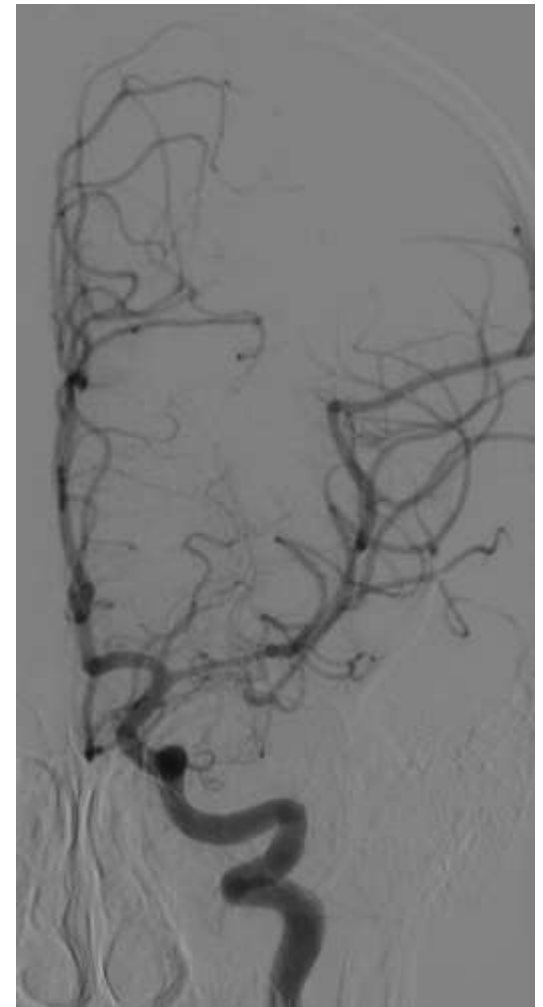
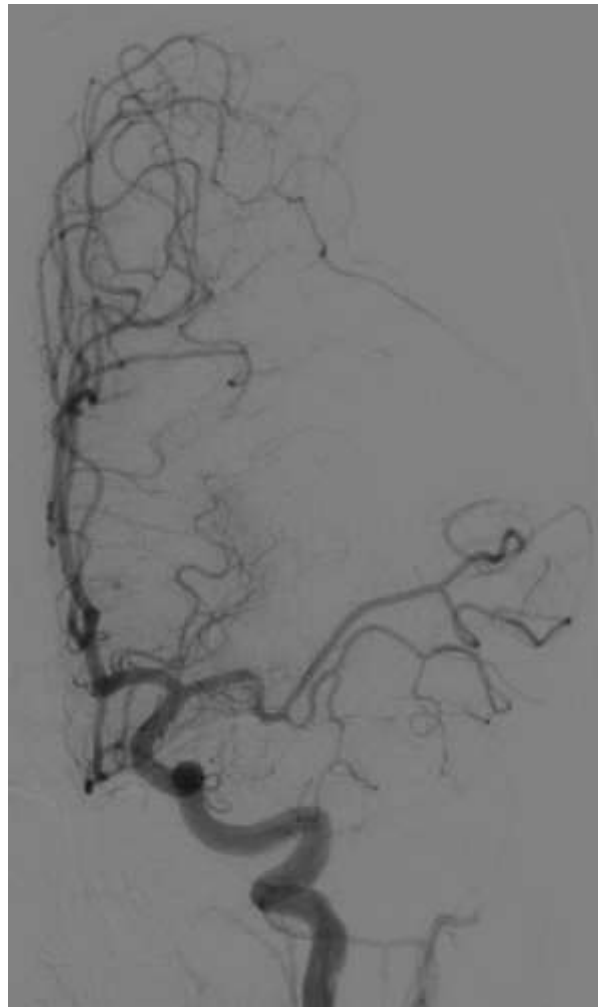
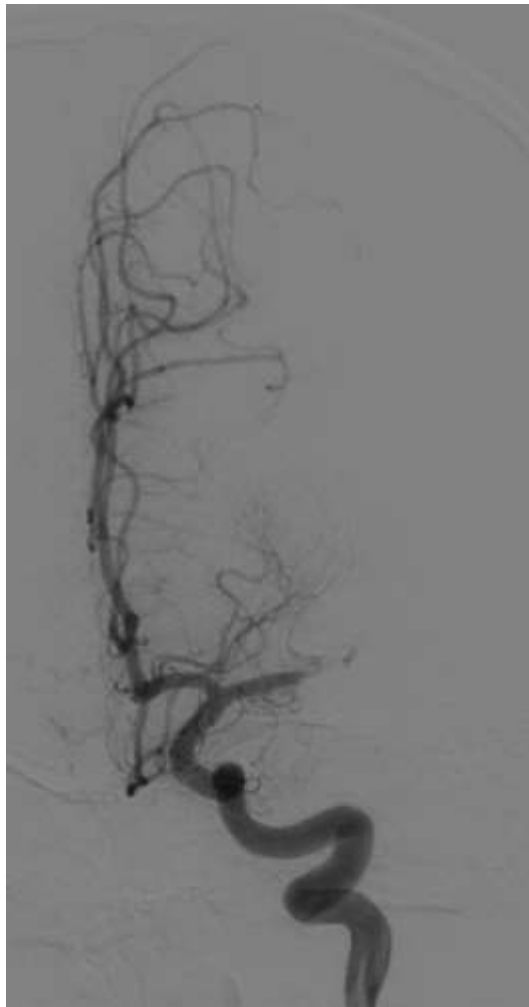


CTA head and neck

ASPECTS = 10

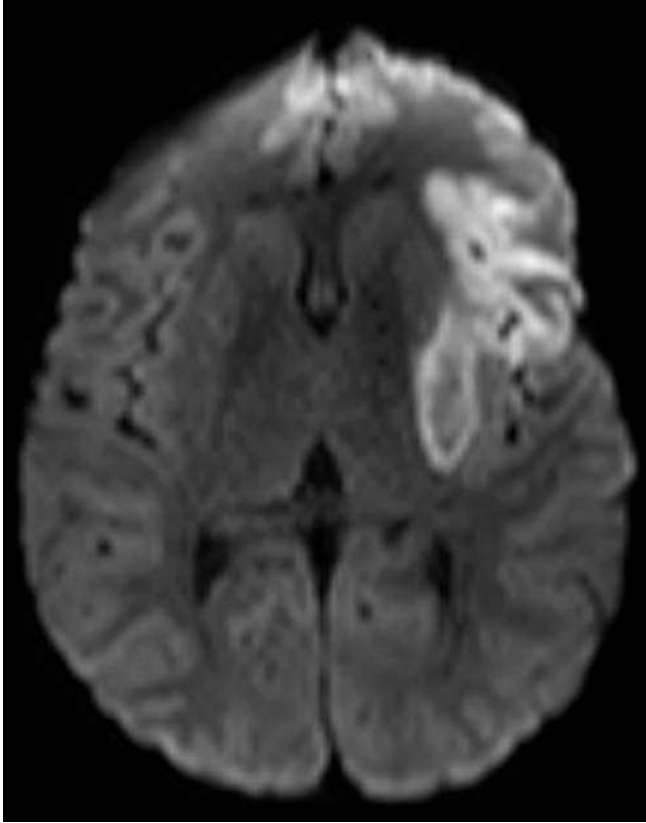
# Transferred to DCH PICU

- Arrival 4 hours after onset of symptoms
- Ped NIHSS = 14 on admission (expressive aphasia, dysarthria, right facial droop, right hemiparesis, and right hemisensory loss)
- TTE: Minimal motion of ventricular septum, PFO, no clot
- To INR suite 6 hours after symptom onset

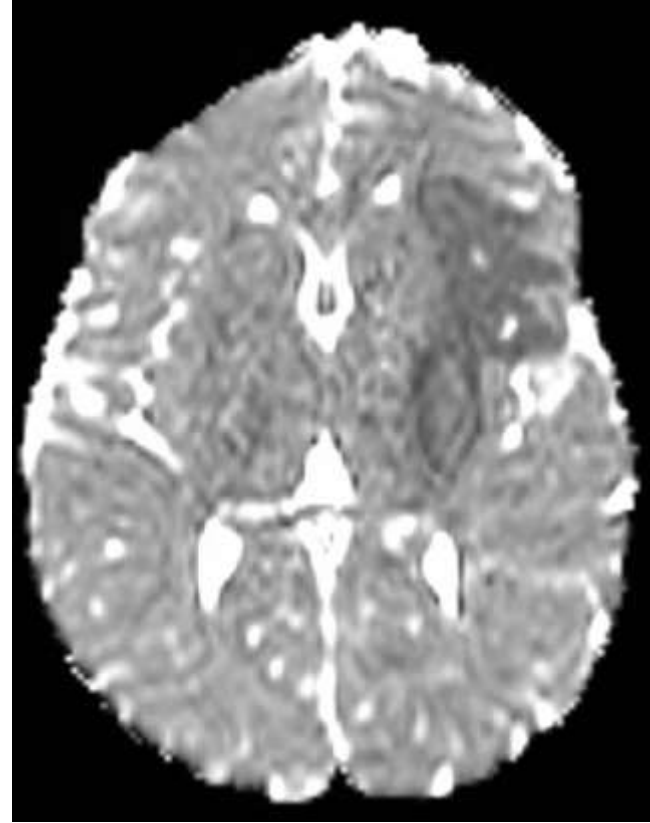


TICI 2a

TICI 2b



DWI



ADC

# Clinical course

- Workup:
  - Cardiac MRI: septal akinesis
  - UE and LE Dopplers: negative for clot
  - Extensive infectious, hypercoagulable, autoimmune workup: negative
- Treatment
  - Received IVIG for presumed viral myocarditis
  - Anticoagulation with subcutaneous enoxaparin was started approximately 24 hours after thrombectomy
- Clinical progress
  - Discharged after 7 days to inpatient rehab
  - Aphasia improved, right sided hemiparesis improved; ambulating with assistance



# Summary

- Acute therapy for stroke in children: low volume, high risk cases
- No trial data supporting endovascular therapy in children
- Endovascular therapy can be considered in pediatric patients, and consensus guidelines and processes for implementation are needed
- Successful implementation of endovascular therapy requires the coordination of timely responses by an inter-professional team
- Studies are needed to understand if endovascular therapy is safe and effective in children

# Future directions

- Regularly update curriculum with nurses and physicians
- Enter children undergoing endovascular therapy in stroke registry
- Hold simulations/mock stroke codes
- Coordinate multidisciplinary stroke case conference
- Establish telemedicine

# Acknowledgements

## Pediatric Neurology

Jenny Wilson, MD

Juan Piantino, MD

Daniel Crowder, MD

## Stroke Neurology/Neurointerventional

Hormozd Bozorgchami, MD

## PICU

Cydni Williams, MD

Carly Byrne, RN

PICU rapid response team

## Pediatric ED

Beech Burns, MD

## Neuro ICU

Stroke Response Nurses



# Questions?

Ittai Bushli, MD PhD [bushlin@ohsu.edu](mailto:bushlin@ohsu.edu)  
( Pediatric neurology)

Jenny Wilson, MD [wilsjen@ohsu.edu](mailto:wilsjen@ohsu.edu)  
(Pediatric neurology)

Adrienne McDougal, RN [padillad@ohsu.edu](mailto:padillad@ohsu.edu)  
( Stroke Program Coordinator)





Thank You