Strokes in newborns: Early recognition improves outcomes

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Speaker Introduction

• Mona Jacobson has practiced as a pediatric nurse practitioner since graduating from the University of Pennsylvania in 1988. She spent 22 years in pediatric primary care working in a variety of outpatient clinics and transitioned to pediatric neurology in 2010. Currently, she is a CPNP in the department of neurology at Children’s Hospital Colorado. She practices in the general outpatient neurology clinic seeing a variety of patients with neurologic diagnosis. Along with being a provider in general neurology, Ms. Jacobson attends in a multidisciplinary stroke clinic, NF vascular clinic and new onset seizure clinic. She has lectured at national conferences on perinatal stroke, seizures, seizure medications and dizziness in neurologic patients. Along with her clinical duties, Ms. Jacobson is the lead education advance practice provider for neurology. Her work promoting advanced practice education led Ms. Jacobson to receive the Children’s Hospital medical staff outstanding service award in the adjunct category.

Disclosures

I have no financial disclosures or conflicts of interest

Learning Objectives

Define

- Define perinatal and presumed perinatal stroke

Identify

- Identify risk factors for perinatal stroke

Recognize

- Recognize signs of perinatal stroke

Discuss

- Discuss interventions and resources for perinatal stroke

Differential diagnosis of neonatal seizures

Case #1

A newborn was noted 13 hours after delivery to have jerking movements of his right arm concerning for a seizure

Birth History:
- Born at 41 2/7 weeks by induced vaginal delivery
- Apgar 7/9
- BW 3000 grams.
- Pregnancy history benign

What is the differential diagnosis?

What is the next step in evaluation?

Medical conditions:
- Hypoxic-ischemic encephalopathy
- Cerebral infarction
- Intracranial hemorrhage
- Central nervous system infection
- Metabolic
- Chromosomal anomalies
- Congenital abnormalities of the brain
- Neurodegenerative disorders
- Inborn errors of metabolism
- Birth neural milestones
- Drug withdrawal or intoxication
Perinatal Arterial Ischemic Stroke (PAIS)

**Definition:** A vascular event that causes the focal interruption of cerebral blood supply. It occurs between 20 weeks of fetal life to 28 days postnatal.

**Incidence:** 1 per 2000 live births (figures range 1/1600 to 1/2300).

PAIS is usually unilateral (87%) and typically affects the Left Middle Cerebral Artery (80%).

There is a slight male predominance.

PAIS is a common cause of cerebral palsy and 2nd most common underlying etiology of neonatal seizures.

PAIS is easy to miss since many newborns do not show focal deficits.

Children with a history of perinatal stroke have higher neurologic morbidity than children with strokes occurring later in infancy or childhood.

Children with a history of perinatal stroke are felt to "grow into" their deficits so in infancy we are unable to provide accurate assessment of future ability.

**PAIS clinical presentation:**

- **Seizures**
  - Noted around 70-90% of the time.
  - Seizures present after 12 hours of life and usually within first 3 days.
  - Seizures are typically focal clonic seizure.
  - Repetitive focal movements, including sucking, chewing, or eye movements.
  - Unusual bicycling or paddling movements.
  - Staring.
  - Apnea, or pauses in breathing associated with slowing of the heart.
  - Rhythmic jerking movements involving the muscles of the face, tongue, arms, legs, or other regions.
  - Stiffening or tightening of muscle groups.
  - Quick, single jerks involving one arm or leg or the whole body.
Etiology of PAIS

Current thought is a thrombo-embolus originating in the placenta

Other mechanisms leading to perinatal stroke are:

- Embolism
- Cardiac etiology
- Thrombosis-blood stasis
- Genetic/acquired thrombophilia
- Systemic etiology
- Occlusion of the cervical or cerebral vessels
- Arteritis due to infection
- Malformation

Diagnosis of PAIS

- MRI brain- best sensitivity and anatomic resolution
- Echocardiogram-if there is any concern of cardiac defect or multifocal infarcts on brain MRI
- Laboratory Testing-not recommended unless significant concern

Risk Factors for PAIS

- Family/ maternal factors
- Family history of diabetes
- Family history of neurologic diseases
- Maternal smoking

- Fetal factors
- Morbidity
- Congenital heart defects

Perinatal Left MCA stroke

1 day of life
2 years later

Prognosis

- Reoccurrence rate is low, around 1% if no etiology identified
- Follow up brain imaging is not recommended on a routine basis
- Over 75% of newborns with PAIS are at high risk for poor neurologic outcomes

PAIS outcomes

- Motor deficits-48-59%
- Speech delay- 21%
- Neuropsychological morbidity in 60% of children
  - This includes language, cognition, behavior
  - Attention problems and hyperactivity are also common
- Epilepsy-38-46%
- Parental and family concerns
Case #2

A healthy 6-month-old presents for routine care. Mother raises concerns regarding decreased use of the right arm with some fisting of the hand.

Birth History:
- Born at 40 weeks gestation, induced vaginal delivery with forceps
- BW 3500
- Pregnancy history benign

Exam is normal except for decreased use of right arm will not grab for objects with right hand. Hand is fisted on right. Left side and right leg are normal.

What is your differential diagnosis?

Differential diagnosis of unilateral weakness:
- Cerebral injury
- Spinal cord
- Anterior horn cell
- Peripheral nerve – brachial plexus injury/Erb’s palsy
- Neuromuscular junction
- Muscle

Therapies:
- Speech
- Physical
- Occupational
- Manual therapy
- Constraint induced movement therapy
- Bimanual therapy

Direct treatments for spasticity:
- Botox, phenol blocks
- Casting
- Surgery
Presumed Perinatal Ischemic Stroke (PPIS)

Definition: a term-born child with normal neonatal neurological history presenting at 29 days of age or older with neurological deficit or seizure referable to focal, chronic infarction on neuroimaging.

Incidence is around 1:3600 live births. Studies have shown median age of parental concern 5 months of age, provider concern 7 months of age and median age of diagnosis 12 months of age.

PPIS outcomes

70-80% of children with PPIS have hemiparesis
50% with cognitive or behavioral difficulty
38% with epilepsy

A recent study of 99 participants with stroke show that children with PPIS have higher morbidity and rehab needs than children with PAIS.

Risk Factors and Clinical presentation

Many PPIS patients have maternal histories of preeclampsia, maternal infections, bleeding during pregnancy or gestational diabetes. Cardiac abnormalities are rare.

Early hand preference or hand fisting noted 81-86%
Seizures 14-15%
Gaze preference 5%

Periventricular Venous Infarct (PVI)

Etiology: germinal matrix hemorrhage prior to 32 weeks gestation

PVI is common in premature infants but new studies have also shown this is a common cause of PPIS.

Presentation
- Early handedness or asymmetry of motor development
- Sensory deficits may be less common since sensory tracts can reroute around the early lesions
- Seizures less common since more of a white matter injury

Risk factors: unknown

Case #3

2 Day old presents with decreased movements, change in responsiveness and poor feeding

Birth History:
- Born at 36 weeks gestation, forceps assisted vaginal delivery
- Apgar 8 and 8
- Pregnancy complicated by GBS and pre-eclampsia

Case #4

25 26 27 28 29 30
Perinatal Hemorrhagic Stroke

Definition: neonate with focal accumulation of blood within the brain

Incidence: 1:6300 live births

Presentation: Encephalopathy, Seizures

Diagnosis: can use Ultrasound, CT scan but MRI imaging of choice

Risk Factors and Etiology

Fetal distress
Post maturity
Emergency C section
Coagulopathy
Thrombocytopenia
Trauma ?
Structural vascular lesions

Management

Treat low platelet counts and coagulation factor deficiencies
Surgical intervention for large hematoma
Ventricular drainage with shunting may be needed
Vitamin K administration for all newborns

Case #5

An 8 day old presents with shaking movements and rhythmic jerking. The previous day had emesis and decreased feeding


What is your differential diagnosis?
Cerebral Venous Sinus Thrombosis (CSVT)

Definition: thrombus in 1 or more of the cerebral veins or sinuses in the first 28 days after birth

Incidence: 1-12/100,000

There is a male predominance

Presentation: seizures, lethargy or irritability

Diagnosis and Risk Factors/Etiology

- Infection
- Dehydration
- Cardiac disease
- Compression of venous sinus
- Coagulation disorder

MRI brain with venogram

Lab tests for etiology

Cerebral Venous Sinus Thrombosis Treatment:

Many centers will treat with low molecular weight heparin

Prognosis:

Variable and depends on if there is associated venous infarction or seizures

Recurrence risk is low

Diagnosis and Risk Factors/Etiology

- Infection
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Video from Children’s Hemiplegia and Stroke Association

http://chasa.org/babies-have-strokes-video/
Stroke in newborn summary

Newborn strokes are not rare with likely incidence even more common than past studies suggest.

Etiology of newborn stroke is multifactorial.

Risk factors can be maternal, fetal or placental.

For perinatal arterial ischemic strokes, the left middle cerebral artery is the most common area affected.

Seizures are a common presentation for most stroke types.

Perinatal and presumed perinatal strokes are a leading cause of cerebral palsy.

Children with history of perinatal and presumed perinatal strokes can have significant neurologic morbidity not only with motor deficits but also behavioral and cognitive concerns.

Early recognition and intervention can improve future outcomes.

Children’s Hemiplegia and Stroke Association Infographic

Colorado Pediatric Stroke Clinic

The clinic is housed within the Hemophilia and Thrombosis Center of the University of Colorado.

This is a multidisciplinary clinic with specialists from neurology, rehabilitation, hematology, neuroradiology, neurosurgery, neuropsychology, pharmacy, neuroradiology, social work, child life and research.

Weekly clinics

Diagnosis:

- Arterial Ischemic Stroke (AIS)
- Hemorrhagic Stroke
- Cerebral Sinovenous Thrombosis (CSVt)
- Perinatal and Presumed Perinatal Stroke
- HIE

Colorado Pediatric Stroke Parent Support Group

The mission is to provide support, education, and advocacy for families impacted by the range of outcomes of all types of pediatric strokes.

Affiliated with the International Alliance for Pediatric Stroke (IAPS)

Funding:

- Local Denver grant (Professional Miracles Foundation)
- Internal funding from Children’s Hospital Colorado

Over 300 families are reached.

Monthly meetings

Guest speakers (Emailed newsletters)

Summer picnics & winter holiday party

American Heart Association’s Heart & Stroke Walk in Denver

National Stroke Association’s Comeback Trail 5k in Denver

Strike out Stroke

References


