Birth Injuries in Neonates: Diagnosis and Management

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Objectives

• Describe common birth injuries
• Delineate current evaluation and management

Introduction

• Impairment of the neonate’s body function or structure due to adverse event occurred at birth
  – Avoidable, or unavoidable
• Despite skilled and competent obstetric care
  – Prolonged labor or with an abnormal presentation.
• Include injuries related to use of intrapartum monitoring:
  – FHR, fetal scalp blood for acid-base assessment
• Do Not Include injuries related to: amniocentesis, intrauterine transfusions and injuries after resuscitation procedures

Incidence of birth injuries

• 1981-birth injuries ranked 6th for neonatal death. 23.8 deaths per 100,000 live births
• 1993-birth injuries ranked 11th for neonatal death. 3.7 deaths per 100,000 live births
• 2009-no mention as on of leading causes of death

Risk factors - Macrosomia

- Rosenburg et al, Neoreviews 2003

<table>
<thead>
<tr>
<th>Risk Factors for Traumatic Birth Injury</th>
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<td>Risk are:</td>
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<tr>
<td>* Preterm birth</td>
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<tr>
<td>* Sudden intrauterine asphyxia</td>
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<tr>
<td>* Asphyxiation on birth asphyxia</td>
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<td>* Respiratory distress</td>
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<tr>
<td>* Macrosomia</td>
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<tr>
<td>* Hypotonic labor</td>
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<tr>
<td>* Inappropriate position</td>
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<tr>
<td>* Cord prolapse</td>
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<tr>
<td>* Maternal complications, fetal, birth</td>
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<tr>
<td>* Site of cesarean section, difficult</td>
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<tr>
<td>* Birth complications</td>
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- Risk factors for macrosomia: smoking, AMA, married, DM, HTN and hx macrosomic infant or pregnancy loss
- Risk factors for macrosomic: macrosomic infants (4000-4499 g, 4500-4999 g, and >5000 g infants) vs normosomic 3000-3999g
- Risks of labor complications, birth injuries, and newborn morbidity ↑ with each gradation of macrosomic birth weight
  – Infant mortality rates ↑ infants>5000 g.
  – BWt >4500 g more predictive of neonatal mortality
  – BWt >5000 g better indicator of infant mortality risk

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Risk factors - Macrosomia

- Weight 4000-4500g: risk increases 2 fold
- Weight 4500-5000g: risk increases by 3 fold
- Weight > 5000g: risk increases by 4.5 fold


Risk Factor: Forceps / Vacuum

- 1989-1993 data;
- Comparable Neonatal mortality between vacuum and forceps
- Vacuum: lower risk of birth injuries, seizures & need for assisted ventilation
- Vacuum: more likely than forceps to be complicated by postpartum hemorrhage and shoulder dystocia
- Comparable Risks of ICH, difficulty with feeding, and retinal hemorrhage
- Sequential use of vacuum and forceps associated with increased risk of need for mechanical ventilation and maternal third and fourth degree perineal tears

Demissie et al, BMJ 2004

Risk Factors: Breech

- MOD and Neonatal outcomes in term, nonanomalous singletons
  - Death, assisted ventilation, seizures, or specific birth injury
- VD and C/S both increased
- Higher Neonatal mortality/morbidity in:
  - ≥37 wks after VD
  - C/S in labor
- C/S: reduction in short-term adverse outcomes but not in long-term maternal or child morbidity/mortality

Demissie et al, BMJ 2004
Soft tissue injuries

- Injuries when dystocia to presenting part
- When forceps applied: injury to site of application
  - linear in orientation
- Resolution in few days with no therapy
- Affected areas should be kept clean to minimize risk for secondary infection

Erythema and Abrasions

- Injuries when dystocia to presenting part
- When forceps applied: injury to site of application
  - linear in orientation
- Resolution in few days with no therapy
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Petechiae

- Risk Factors: tight nuchal cord, precipitous delivery, breech
- Sudden increase in intrathoracic & venous pressures and tightening of nuchal cord
  - Localized distribution
  - No subsequent crops of new lesions
  - PLT
- DDx:
  - Neonatal Thrombocytopenia
  - Infections
  - DIC
- Usually fade within 2-3 days
- Usually on head, neck, upper chest, lower back
- Underlying hemorrhagic disorder
  - PLT needs to be measured & followed
- No specific treatment is necessary.
  - No Corticosteroids or heparin

Ecchymoses/Bruising

- Common in traumatic and breech delivery
  - More in premature babies
- Can cause significant hyperbilirubinemia
  - Blood loss: severe enough to cause anemia and, rarely, shock.
- No specific therapy needed.
  - Phototherapy for jaundice as needed
- Spontaneous Resolution ~ 1 week

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Subcutaneous Fat Necrosis

- Ischemia to adipose tissue
  - Trauma, hypothermia
- Few weeks to show
- Firm, indurated nodules and plaques
  - Back, buttocks, thighs, arms
- Self-limiting in 6-8 weeks
- Watch Ca++ levels up to 6 months

Fanaroff and Martin's NPM-Textbook 2015

Subcutaneous Fat Necrosis

- SFN following therapeutic hypothermia (CMH patient)

Lacerations

- Inflicted with scalpel during C-section
- Scalp, buttocks, thighs
- Superficial: butterfly adhesive strips
- Deeper and freely bleeding wounds: sutured with finest material available
  - Rarely required in delivery room.
- Wound left uncovered unless potential soiling
  - Protective plastic.
- Rapid Healing; sutures removed after 5 days.

Extracranial Head Injuries

- Edematous swelling of scalp above periosteum
- Prolonged engagement of head or use of vacuum
- Extends across suture lines
- Benign; resolves within few days
  - Hyperbilirubinemia
  - Rarely may present with shock and require blood transfusion
- Head imaging if:
  - No improvement in large caput 48-72 hours
  - Enlargement of swelling 24 hours
  - Neurologic deficits and/or hemodynamic instability
Cephalhematoma

- Subperiosteal collection of blood due to rupture of vessels beneath periosteum
- Does Not cross the suture lines
- Usually no significant blood loss
- 1-2% of all deliveries
- Mostly due to forceps or vacuum extraction
- Resolve over the course of 3-4 weeks

DDX:
- Subgaleal hematoma
- Caput Succedaneum
- Cranial meningocele: pulsations

Complications:
- Infection and sepsis
  - E. coli: present as erythematous, fluctuant masses
  - CT or MRI
  - Needle aspiration, I&D, debridement of necrotic skull, prolonged ABX
- Rarely may result in blood loss severe enough to require transfusion.

Calcified Cephalhematoma

- Calcification:
  - Skull deformities
  - Often disappears over 3 to 6 months
  - Persistent calcification: ? surgical excision

http://newborns.stanford.edu/PhotoGallery/Cephalohematoma1.html

Subgaleal Hemorrhage

- Collection of blood between epicranial aponeurosis and periosteum of skull
- Incidence-
  - 4/10000 in non-instrumented deliveries
  - 64/10000 in vacuum extraction deliveries
- Can result in 20-40% blood loss
- Mortality ~12-14%; shock and coagulopathy
- Early recognition is crucial

- Fluid wave
- "Handling water balloon"
- Very fluctuant, shifting mass without discernible limitations.
- Ears

Fanaroff and Martin’s NPM-Textbook 2015

Subgaleal Hemorrhage

- Hx of difficult operative delivery
- Ongoing monitoring, frequent VS
- Serial measurements of H/H and HC
  - Each 1 cm increases ~ 40 mL of blood loss
- CT or MRI
- Coagulation studies
- Aggressive volume resuscitation
  - N/S, PRBC, PLT, and FFP
- Rarely brain compression that require surgical evacuation of the hematoma
Intracranial Injuries

Subdural Hematoma

- Most common ICH in neonates
- Hematoma between dura and arachnoid membrane
  - Tentorial & interhemispheric
- CT for diagnosis
- Symptomatic by 24-48 hours of life
  - Respiratory depression, apnea, and/or seizures
  - Neurologic dysfunction: irritability, altered tone, focal
  - Rarely: ↑ ICP, ↑↑ ICP, tense fontanelle, apnea, bradycardia

Subdural Hematoma

- Term baby
- Rt subdural hemorrhage
- Seizures
- Surgical decompression within 24 hours due to midline shift

Subdural Hematoma

- Treatment:
  - Conservative if no signs of herniation.
  - Surgical evacuation if signs of herniation or in posterior fossa
  - Serial H/H to assess for ongoing blood loss
  - Volume replacement
- Investigation of a congenital coagulopathy
Posterior Fossa Subdural Hematoma

- Posterior Fossa SDH
- Rare but severe and life threatening
- Delayed presentation; with/without signs of hydrocephalus
- Low-pressure venous bleeding
  - Brainstem compression and neurological deterioration.
  - Obstructive hydrocephalus as consequence of obstruction of Magendie foramina.

Subarachnoid Hemorrhage

- 2nd most common ICH in neonates
- Caused by rupture of bridging veins in subarachnoid space
- Symptoms appear at 24-48 hours
- Diagnosis by CT
- Treatment is conservative
- Rarely requires surgery

Epidural Hemorrhage

- Very rare in neonates
- Injury to middle meningeal artery
- Linear skull fracture most of the time
- Presents with hypotonia, seizures, bulging fontanelles and change in LOC
- Diagnosis-CT
- Treatment
  - Conservative if no signs of herniation
  - Surgical evacuation if signs of herniation

Intraventricular Hemorrhage

- Usually with premature delivery
- Reported as a consequence of birth injury in term infants
- 4% in one study in healthy asymptomatic term infants
- Risk of IVH increases with operative deliveries, (highest in combined vacuum and forceps deliveries)
Facial Nerve Injury

• Incidence is 0.5-1% of live births
• Compression of facial nerve by forceps
  – rarely agenesis of facial nerve nucleus (Mobius syndrome)
• Mandibular branch: most commonly affected
• Less movements on affected side
• Traumatic facial palsies resolve in 2-3 weeks of birth

Facial Nerve Injury

• Loss of nasolabial fold
• Partial closing of eye
• Inability to contract the lower facial muscles on affected side
  – “drooping” mouth
• When crying, the mouth is drawn over to the unaffected side

Facial Nerve Injury

• Same infant!
• Asymmetry in eyelid closing
• Partially open lid on affected side
• Involvement of both eye and lip: differentiate facial from other diagnosis

Facial Nerve Injury

• This infant has asymmetric crying facies
• Unaffected eye and forehead muscles
• 22q11
• Absence of depressor anguli oris muscle

What is the Diagnosis?

Brachial Plexus Injury

• Paralysis of upper arm muscles following
• Trauma (stretch) to spinal roots C5 to T1
• 4 pathologies:
  1. Neurapraxia: nerve is shocked but not torn
  2. Neuroma: damage some nerve fibers, scar tissue may press on remaining healthy nerve
  3. Rupture: nerve torn apart; will not heal
  4. Avulsion: nerve is torn from the spinal cord

Brachial Plexus Injury

Erb’s palsy:
• Most common > 80%
• Upper portion (C5, C6, C7)
• Weakness of shoulder/biceps muscles
• Arm adducted, internally rotated, with extension at elbow, pronation of the forearm, and flexion of wrist
Brachial Plexus Injury

Klumpke’s palsy
- Involves lower roots (C8, T1)
- Typically affects hand muscles
- Claw Hand

http://pixshark.com/claw-hand-klumpke-palsy.htm

Total plexus involvement
- All five nerves are involved (C5-T1)
- Loss of movement at shoulder, arm or hand.

Horner’s syndrome
- Associated with avulsion.
- Sympathetic chain injury T2 to T4 region.
- Ptosis, miosis, anhydrosis

Conservative management
- Physical therapy
- Nerve reconstruction
  - Nerve root avulsion
  - Between 6-9 months
- Botulinum toxin injections
  - Improves range of motion
- Pain management

Favorable Outcome:
- Early clinical improvement
- Elbow flexion at 3 months
- Normal or near-normal strength at 3 months
- Antigravity strength in biceps, triceps and deltoid muscles by 4.5 months

Yang et al, Seminars in Perinatology 2014

Phrenic Nerve Injury

- Often with brachial plexus injury
- Breech delivery and lateral extension of neck
- Avulsion of C3-5 nerve roots
- Clinical signs: recurrent episodes of cyanosis followed by respiratory distress

Fanaroff and Martin’s NPM-Textbook 2015

Management
- Infant positioned on the involved side
- O2 and IV fluids
- Plication of diaphragm, or pacing if no definite improvement after 1 month

Prognosis
- Spontaneous recovery
- Susceptibility pneumonia

Phrenic Nerve Injury
Fractures

- Clavicle Fracture
  - Most common; 1:1.5%
    - Operative delivery
    - Shoulder dystocia
    - Higher birth weight
    - Increased maternal age
  - Diagnosis:
    - Displaced fracture in newborn period
    - Non-displaced in days to weeks
  - Conservative treatment

- Long Bone Fracture
  - Humerus Fracture
    - Incidence: 0.2/1000 deliveries
    - RF: shoulder dystocia, macrosomia, C/S, breech and LBW
    - Decreased arm movement, localized crepitation, pain with palpation
    - Diagnosis: radiography
    - Immobilization with elbow in 90 degrees
    - Outcome is excellent
  - Femur Fracture
    - Incidence: 0.13/1000 deliveries
    - RF: Twin pregnancies, breech, prematurity, diffuse osteoporosis
    - Asymptomatic or pain response to handling, pop or snap on delivery
    - Diagnosis: radiography
    - Pavlik harness is an optional newborn
    - Outcome is excellent

- Skull Fracture
  - Linear and Depressed
    - Depressed fracture: 3.4/100000 births
    - Depressed fracture: increased possibility of intracranial process
    - Further imaging with CT
    - Neuroimaging and Neurosurgery consultation
    - Depressed fracture <1cm with no neurodeficit: conservative management

- Ocular injuries
  - Minor Injuries: Subconjunctival/retinal hemorrhages and lid edema
    - Spontaneous resolution
  - Ophthalmologic consultation for Significant Injuries:
    - Hyphema (blood in anterior chamber)
    - Vitreous hemorrhage,
    - Orbital fracture,
    - Lacrimal duct injury
    - Disruption of descemets membrane of cornea (astigmatism and amblyopia)
Points to remember

• Incidence of birth injuries has dramatically decreased in last 2 decades
• Macrosomia and instrumental deliveries are major risk factors
• Subgaleal hemorrhage is an emergency. Close monitoring and aggressive resuscitation is key
• Forceps: most common cause of facial nerve injury; usually self limiting

Points to remember

• Erb’s palsy: most common brachial plexus injury. Management is conservative until 3-4 months of life
• Shoulder dystocia: major risk factor for brachial plexus injury
• Management of clavicle, skull fracture (unless neurodeficit), humerus and femur fractures is conservative
• Planned C-section for breech presentation decreases mortality and morbidity

Points to remember

• Posterior fossa hematoma can cause brain stem compression leading to respiratory compromise and needs close monitoring

References

• Farrowing A. 2015. Neonatal Facial Nerve Injury