Pediatric Rapid Review

- Newborn Emergencies
- Infant Bacteremia
- Infant Meningitis
- Infant NEC
- HSP
- Croup
- Epiglottitis
- Bacterial Tracheitis
- Foreign Body Ingestion / Aspiration
- Bronchiolitis
- BPD
- Hydrocele
- Hemia
- Common Pediatric Fractures
- Nursemaid’s Elbow
- Child Abuse and Neglect

Neonatal Emergencies

- Neonates (age 0-28 days) have 5 actions:
  - Sleep, Cry, Feed, Poop and Pee
- Recognizing an abnormality in any of these functions, combined with vital signs, will guide you in determining the source of the emergency.
- Poor sleep, weak cry – think cardiac, ductal dependent congenital heart disease, apnea, cyanosis, bacteremia, meningitis, inborn error of metabolism
- Poor feeding, vomiting or abnormal stooling – Malrotation, pyloric stenosis, GERD, Necrotizing Enterocolitis
- Poor urine output – dehydration, UTI (sepsis), malnutrition

Lethargy &/or Apnea

- Apnea - respiratory pause > 20 sec
  - Central, obstructive or mixed
- Sepsis/Bacteremia
- ICH
  - Trauma, spontaneous bleed
- Hypoglycemia
  - Inborn error of metabolism
  - Nutrition imbalance
- Seizure
- Cardiac
  - Congenital Heart Disease
  - Cyanosis
- Congenital Adrenal Hyperplasia

Ductal Dependent Lesions

- Includes
  - Coarctation of the Aorta
  - Interrupted Aortic Arch
  - Aortic Stenosis
  - Hypoplastic Left Heart Syndrome
  - Transposition of the Great Vessels
  - Mitral Valve anomalies
- Presentation correlates with closure of the Ductus Arteriosus – usually in the 1st week of life, sudden onset of lethargy, weakness, cyanosis
- Give Prostaglandin E1 (0.1 mcg/kg/min) to open it back up.
- Fluids – treat for shock

Cyanosis

- Central
  - Lips and mucous membranes
  - Systemic arterial oxygen desaturation
  - Pneumonia, Right-left shunt, pulmonary edema, methemoglobinemia
- Peripheral
  - Hands and feet, perioral
  - Perfusion issue, cold, hypotension
Tetralogy of Fallot

- Most common cyanotic lesion > 1 year old
- Boot shaped heart on Xray
- Four components:
  - Right ventricle outlet obstruction (pulm stenosis)
  - Right ventricle hypertrophy
  - Ventricular septal defect
  - Dextroposition / overriding aorta

Bacteremia

- 10% of febrile neonates will have a serious bacterial infection (Pediatrics 2010;125(2):228-233)
- Evaluate for infection of blood, urine and CSF
  - Rochester criteria
  - Modified Philadelphia criteria

Most Common Bacterial Cause of Sepsis

- Neonate:
  - E. coli
  - Group B Strep
  - Staphylococcus aureus
- Older Children:
  - Staphylococcus aureus including MRSA
  - Coagulase-negative Staphylococcus especially in neonates or young infants with indwelling vascular catheters
  - Streptococcus pneumoniae
  - Streptococcus pyogenes
  - Group B streptococcus
  - Pseudomonas aeruginosa including carbapenem-resistant strains
  - Escherichia coli, including those with extended spectrum beta-lactamase activity (ESBL)
  - Enterococci species, including vancomycin-resistant species
  - Klebsiella species, including those with ESBL activity

Most Common Viral Cause of Sepsis

- Influenza
- Herpes simplex virus**
- Epstein Barr Virus
- Cytomegalovirus
- Adenovirus**
- Enterovirus**
** - more likely for neonates

Meningitis

- Occur in 1% of < 3 months old with a fever
  - E. Coli, Group B Strep, Lysteria
- > 3 months
  - S. pneumonia, n meningitidis, s. aureus
- CSF WBC > 10 cells/mm3 indicate infection
- Antibiotics for sepsis
- Steroids – give before antibiotics

Inborn Errors of Metabolism

- Single-gene defects resulting in abnormal metabolism of protein, fat, and carbohydrates.
- Results in toxic products accumulating in the body – resulting metabolic disturbance
- Failure to Thrive is most common complaint
  - Vomiting
  - Ill looking without a fever
  - Seizure
  - Irritable or lethargic
  - History of doing well, and now deteriorating
- Most common IEM:
  - Deficiency of ornithine transcarbamylase (Urea cycle enzyme)
  - Fatty acid oxidation defect
  - Carbohydrate intolerance
  - Disorders of gluconeogenesis
Inborn Errors of Metabolism

- Stabilize patient – treat shock, fix vital signs
- Labs: Ketones, Ammonia level will be elevated, glucose will be low, ph acidotic or alkalotic, liver dysfunction not uncommon, lactate elevated
- Restrict food as many are related to diet
- Admit for further evaluation

Malrotation with Midgut Volvulus

- In malrotation, the angle of Treitz and cecum are side by side, the narrow base allows the gut to twist around the superior mesenteric vessel
- A previously healthy infant now has bilious vomiting, FTT, lethargy and severe abdominal distension
- Melena is a late finding

Malrotation

- Abnormal rotation of the mesentery and lack of fixation during embryonic development
- Progresses to midgut volvulus
- Distal duodenum or proximal jejunum
- Gut will become necrotic within hours
- Usually occurs in 1st month of life
- See on Upper GI study

Omphalitis

- Infection of the umbilical stump in first 2 weeks of life
- Starts as a superficial cellulitis
  - Spreads to abdominal wall
  - Necrotizing fasciitis
  - Staph, strep and e.coli
- Purulent drainage from stump initial sign, then fever, sepsis, irritability, poor feeding
- Evaluate for cellulitis
  - CBC, CRP, Culture
  - X-ray – gas in abdominal wall
  - Ultrasound
  - CT – necrotizing fasciitis
- Treat: Aggressive antibiotics – Amp / Vanco / Gent / Flagyl
  - Surgical consult

Necrotizing Enterocolitis

- Early neonate – newborn period
- Vomiting, abdominal distension, lethargy, occult or grossly bloody stool
- Apnea, respiratory failure, temperature instability, hypotension
- Mostly premature infants but can affect term infants (10% of cases) within first 10 days (linked to small birth weight and hypoxic stress during delivery)
- Pneumatosis intestinalis on x-ray (gas in the intestinal wall)
- Treatment: NPO, NG decompression, antibiotics (Amp/gent/flagyl), surgical consult

Pneumatosis Intestinalis
Bronchopulmonary dysplasia (BPD)

- Impaired alveolar development due to prematurity, extremely low birth weight, supplemental oxygen therapy, positive pressure ventilation and inadequate nutrition
  - Caused by inflammation and injury to the lungs.
  - Possible genetic component

Bronchopulmonary Dysplasia (BPD)

- Exam findings:
  - Tachypnea
  - Hypoxia
  - Crackles and wheezes
  - Failure to thrive
- Radiographic Findings:
  - Hyperinflation
  - Obscured cardiac border
  - Cystic areas with signs of fibrosis

Bronchopulmonary Dysplasia (BPD)

- Complications seen in the ED:
  - Higher risk of respiratory failure with minor respiratory illness (RSV).
  - Failure to thrive
  - Asthma-like symptoms, may require bronchodilators but often do not respond.
  - Pulmonary hypertension
  - Tracheobronchomalacia
  - Subglottic stenosis
  - Obstructive sleep apnea
- Management:
  - Resuscitation
  - Oxygen
  - Hydration
  - CXR for pneumonia
  - Bronchodilators
  - Corticosteroids
  - Diuretics
  - Immunizations

Choking / Upper Airway Obstruction

- Most common between 1 and 3 yrs old
- Food and Toys most common items
- Back Blow
- Chest Thrust
- Avoid Heimlich and blind finger sweep under age 1 year
- Direct laryngoscopy and removal with Magill forceps
- Intubate and dislodge object distally if needed to protect airway

Lower Airway Foreign Body

- 75% are radiolucent
- 90% end up in the bronchi, evaluate with PA and lateral CXR
  - Focal atelectasis and consolidation
- Inspiration / Expiration films show obstructive emphysema
  - Valve-type obstruction causing hyperinflation of affected side on expiratory films
- Bronchoscopy definitive treatment for removal

Foreign Body Ingestion

- 2 main barriers where they lodge:
  - Proximal esophagus
  - Pylorus
- Irregular bordered items have potential to lodge distal to pylorus
- Beware of all magnets, particularly multiples
- If in esophagus, present with sudden onset:
  - Refusal to eat, gagging or choking with eating
  - Vomiting
  - Stridor
  - Pain
  - Drooling
Foreign Body Ingestion

• **Diagnosis:**
  - XR neck, chest and abdomen – AP and lateral view
  - CT scan if suspected and not seen on XR
  - Barium swallow – only if unable to get CT

• **Treatment**
  - Resuscitate if needed
  - Laryngoscopy – more proximal items
  - Endoscopy
  - Glucagon generally not effective

FB Ingestion in Esophagus

• **Urgent Endoscopy indicated for:**
  - Sharp, elongated items
  - Button batteries
  - Evidence of perforation
  - Impacted coin (at the cricopharyngeus muscle)
  - Airway compromise
  - Item present > 24 hours

Special Note about Coins and Batteries

- Coins and button batteries often get trapped at the level of the cricopharyngeus muscle.
- Esophageal items will show the wide, round side on AP view (coronal plane)
- Tracheal items will show the wide, round side on lateral view (sagittal plane)
- There are always exceptions
- Button batteries in esophagus will cause injury and necrosis, must be removed within 6 hours of ingestion
  - Remove with endoscopy
- Button batteries past the esophagus will generally pass within 24-48 hours. Can be monitored, only need removal if symptomatic. Follow-up film necessary

Croup

• Laryngotracheobronchitis
• Most common cause of acute stridor
• 6 mo-3 yrs most affected
• Parainfluenza 1 & 3 most common etiology
• Fall, winter, odd-numbered years (J Infect Dis 176:1423, 1997)
• Symptoms:
  - Barking cough, hoarse voice, inspiratory stridor
  - Symptoms worse at night, improved during the day

• **Diagnosis**
  - Mostly diagnosed clinically, may see steeple sign on XR neck

• **Treatment**
  - Decadron – 0.6 mg/kg po (max 12mg)
  - Nebulized epinephrine
    - Watch for 2-3 hours
  - Humidified oxygen not proven effective
  - Heliox may have short term benefit
• Most do well
Epiglottitis

- With HIB vaccine, now variety of causes
  - Nontypeable H influenza, Haemophilus parainfluenzae, staphylococcus aureus, streptococcus pneumoniae and group A beta hemolytic streptococci
- Abrupt onset fever, drooling, sore throat, muffled voice
- Absence of cough
- Unable to swallow, stridor, respiratory distress are late findings

Bacterial Tracheitis

- 5-8 yrs most common age
- Staphlococcus aureus, S pneumoniae, group A strep, Moraxella catarrhalis or H. Influenzae
- Initially have a viral URI type illness, then progresses to high fever in a toxic, ill appearing child
  - Sore throat, may point to trachea
  - Cough, mucopurulent secretions
  - Purulent tracheal secretions cause mucous plugging
- Airway management as needed
- Treat with Antibiotics
  - 3rd generation cephalosporin, Beta-lactamase resistant penicillin
  - Add Vancomycin if concern for MRSA

Bronchiolitis

- Most involve age 2-8 months, up to 2 years
- Starts as a URI with cough, coryza
- Fever, wheezing, some respiratory distress evolves over 2-5 days
- Hypoxia, tachypnea, dehydration is common
- Treatment: Resuscitation, Oxygen, Fluids

Bronchiolitis – 2014 AAP Guidelines

- Diagnose clinically only
- Do not use testing or CXR to diagnose
- Do not give albuterol
- Do not give epinephrine
- Do not give nebulized saline in the ED – only in the hospital
- Do not give steroids
- Do not give oxygen unless their O2 level is < 90%
- Do not use continuous pulse oximetry to monitor
- Do not do chest physiotherapy
- Do not give antibiotics
- Do give fluids – IV or NG
- Do wash hands
- Do give Oxygen
Henoch-Schonlein Purpura

- IgA mediated vasculitis
- Affects skin, joints, GI tract and kidneys
- Age 3-15, peaks at 4-7 years
- Non-blanchable, Palpable purpuric rash, arthralgia, abdominal pain, nephritis, hematochezia
- 1-5% develop intussusception or bowel perforation in the acute phase
- 55% of children develop nephritis in the first 6 weeks – 6 months
- Steroids still debated – consult nephrology

Infant Hydrocele

- Painless scrotal swelling
- Fluid within the tunica vaginalis that surrounds the testis, from leftover fluid when the processus vaginalis closes
- If it changes size with straining, likely communicating – can develop a hernia
- If stable in size, considered non-communicating

Infant Hernias

- Indirect inguinal hernia
  - Patent processus vaginalis – abdominal contents herniate
  - More common with prematurity
  - 2% female
  - 7-30% males
  - 60% risk of incarceration in infancy
  - Well detected, most common pediatric surgery
  - Will increase in size when crying, straining, generally not tender
- Umbilical hernia
  - Incomplete coverage of the umbilical ring
  - Common. More common in African American, Down’s Syndrome, low birth wt. infants
  - Most resolve by age 1, generally not tender
- Epiploceles (epigastric hernias)
  - Between umbilicus and Xiphoid
  - Due to weakness of the linea alba – fat protrudes
  - Usually close spontaneously

Infant Hernia

- Reducible
  - Reduces without difficulty, often returns spontaneously. No tenderness or edema
- Incarcerated
  - bowel loop is trapped - vomiting, nausea, local and general pain
  - Attempt reduction
- Strangulated
  - trapped bowel loop is ischemic – surgery

Infant Hernia

- Reduction technique
  - Trendelenburg position
  - Pain medication or sedation
  - Gentle traction on scrotum
  - Align hernia with your goal for reduction
  - Slow, manual pressure
  - Be patient

HSP

- Infant Hydrocele

- Infant Hernias
Long Bone Fractures

- Fractures unique to pediatrics
  - Physeal Fractures (Physis = growth plates)
  - Torus Fracture
  - Greenstick Fractures
  - Bowing Deformity

Physeal Fractures

- Physis = growth plates
- Peak age is 11-12 yrs
- Most often in upper limbs
- Salter Harris Classifications – 5 types
  - Defines the fracture in relation to the physis

Salter Harris Classification

- Salter Harris 1 & 2
- Salter Harris 3 & 4
- Salter Harris 5

Salter Harris 1 & 2

Salter Harris 3 & 4

Salter Harris 5

https://www.hawaii.edu/medicine/pediatrics/pemxray/v1c18.html
Torus Fractures
- Buckle fracture
- Metaphyseal region - compression load
- Cortex buckles in a small load – Stable

Greenstick Fractures
- Most common Pediatric fracture
- Incomplete fracture at the diaphyseal metaphyseal junction
- Cortex remains intact on one side

Bowing Fractures
- Unique to kids
- Usually a longitudinal force
- No actual fracture – it’s a plastics deformity
- Ortho treatment – needs remodeling

Upper Extremity Fractures
- Forearm
  - Monteggia fracture
    - Ulnar fracture - midshaft
    - Radial head dislocation
    - Elbow pain and swelling with ulnar deformity
  - Galeazzi fracture
    - Radial shaft fracture at middle or distal 3rd
    - Disruption of the distal radio-ulnar joint
- Both require orthopedics
- Isolated bone fractures – radius or ulna
- Dual bone fractures – radius and ulna

Monteggia Fracture

Galeazzi Fracture
Lower Extremity Fracture

- Tibia / Fibula
  - Tibia and Fibula Shaft Fractures
    - Most common lower extremity fractures in kids
    - Stable
    - Non-weight bearing
    - Orthopedics referral
  - Toddlers Fracture
    - Young child refusing to walk, limp
    - Uncertain of trauma
    - May have point tenderness, some edema
    - X-rays initially often negative – appear in 10 days with periosteal new bone formation
    - Abuse suspected if other injuries present – usually more proximal
    - Splinting helps with pain – unneeded if not in pain

Toddlers Fracture

- Toddlers Fracture
  - Young child refusing to walk, limp
  - Uncertain of trauma
  - May have point tenderness, some edema
  - X-rays initially often negative – appear in 10 days with periosteal new bone formation
  - Abuse suspected if other injuries present – usually more proximal
  - Splinting helps with pain – unneeded if not in pain

Annular Ligament Displacement

- AKA: Radial Head Subluxation
- AKA: Nursemaid’s Elbow
- Traction on a pronated hand/wrist causing the annular ligament to slide overtop the radial head and become interposed between the radius and the capitellum.
- Child holds the arm flexed and against his or her body – clinical diagnosis

Annular Ligament Displacement

- Initially evaluate the arm without moving it.
- Palpate the entire bony surface of the upper extremity including shoulder, clavicle, hand and wrist to elicit pain. If not found, and no edema, erythema or deformity noted, attempt reduction. If abnormality noted, obtain x-ray prior to reduction.

Annular Ligament Displacement

- Reduction Techniques
  - Consider ice, ibuprofen prior to reduction
  - Supination- flexion maneuver
  - Forced pronation
  - Pronation flexion
  - Once reduced, most spontaneously use arm within 15 minutes
  - If “failed” consider imaging
  - Place arm in sling overnight and fu with physician the next day – most will use it by then
  - Recurrence is common – educate caretakers

Child Neglect

- Most common form of child maltreatment
- Caregiver fails to meet a child’s basic need in provision of food, shelter, clothing, health care, education, supervision and nurturance
- Results in serious impairment of a child’s health or development
- Risk factors: prematurity, disabilities, multiple children, parents with substance abuse, young parents, history of domestic violence, single parents, unemployment, mental health issues
- Physical exam: low weight, fear, poor behavior, withdrawn child, poor hygiene, poor development or not meeting age milestones
- Evaluation: failure to thrive, physical abuse assessment
- Treatment: treat malnourishment, metabolic issues, mandated reporting to child protective services
Child Physical Abuse

- Physical injury inflicted on a child by a caretaker, someone whom the child depends on for basic needs.
- Suspect if history is not consistent with injury, delay in seeking care, or no known event given to explain the injury
- Most common organ injured: Skin
  - Suspect with marks on areas kids can’t reach or land on, or are overly sensitive: (don’t cruise, don’t bruise)
  - Trunk
  - Upper thigh or arms
  - Buttocks
  - Genitals
  - Cheeks, ears, neck
  - Pattern bruising
- Suspect with burns, particularly pattern burns
  - Buttocks, feet
  - Immersion burns
  - Pattern burns – cigarettes

Abusive Head Injury

- Shaken Baby Syndrome
  - Respiratory Distress
  - Vomiting
  - Seizure
  - “maybe a recent accident”
  - Bruising
  - Retinal hemorrhages
- Shaking Impact Syndrome
  - Skull fracture or contusion along with above presentation
  - More likely fatal
- Suspect with:
  - Subdural hemorrhages
  - Cerebral edema
  - Story does not make sense

Suspicious Fractures

- Suspect abuse in any fracture occurring in infants < 1 year - up to 80% are attributed to abuse
- Healing fractures with no explanations
- Rib fractures
- Any Femur Fracture
- Spiral fracture of humerus
- Metaphyseal Chip fracture

Sentential Fractures

- 30% have normal exam
- History is key
- Strongly suspect when you find STD in pre-pubertal child
- Gardnerella vaginalis and respiratory flora - may not be STD
- Hymen irregularity – best noted under colposcopy exam
- Rectal tears other than fissures
- Urethral prolapse – donut protruding from vaginal area – not abuse
- Straddle injury – get good history and correlate with child’s ability.

Pediatric Pearls

- Give Prostaglandin E1 (0.1 mcg/kg/min) for sudden onset lethargy and cyanosis in a 1 wk old infant.
- 4 components of Tetralogy of Fallot:
  - Right ventricle outlet obstruction (pulm stenosis)
  - Right ventricle hypertrophy
  - Ventricular septal defect
  - Dextroposition / overriding aorta
- Most common cause of bacteremia in a neonate:
  - Escherichia coli, Group B Strp, Staphylococcus aureus
- Bilious vomiting in a neonate is a midgut volvulus until proven otherwise
- Omphalitis can lead to abdominal wall cellulitis and Necrotizing fasciitis
- Be concerned for rapid decompensating of the infant with BPD who develops a respiratory infection
- 75% of ingested FB will not show up on xray
- Ingested batteries proximal to the pylorus should be removed, once they pass can be observed for passage within 48 hours
Pediatric Pearls

- Treat croup with Decadron and epinephrine, bacterial tracheitis with antibiotics and epiglottitis with antibiotics and airway support.
- Treat bronchiolitis with oxygen and fluids
- Suspect nephritis and intussusception with HSP
- Communicating hydrocele can lead to inguinal hernia
- Toddler fractures may not show on x-ray
- Examine the suspected nursemaid's elbow injury without moving the arm for the best exam
- Suspect abuse with all cases where the history does not match the presentation

Thank you!