EMITE REVIEW
PEDIATRIC TOPICS
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DISCLOSURES
• Nothing to disclose

POLL EVERYWHERE
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OBJECTIVES
Brief overview of common pediatric illnesses
Review pediatric cases
Board style questions
Pediatric Pearls

11-month-old male presents to the emergency department at 12am with parents for complaint of difficulty breathing. He had noisy breathing and when they found him in bed but was not blue. He had has a barky cough. What is the most likely dx and Tx?

- Asthma give albuterol
- Foreign body aspiration, surgery
- Croup, decongestant
- Choking episode, discharge home
- Viral upper respiratory tract infection, discharge home
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- CROUP
  - Stridor
  - Vaponephrine/ racemic epinephrine
  - Dexamethasone

- EPIGLOTTITIS
  - Young children - unvaccinated
  - Respiratory distress –
    - Tripod position
    - Drooling
    - Early intubation under controlled situation

- BACTERIAL TRACHEITIS
  - Any age, vaccination status does not matter
  - Typical scenario: patient has been sick with cold symptoms for several days and then suddenly has severe respiratory distress.
  - Stridor, fever

- BRONCHIOLITIS
  - 8-month-old who presents with 3 days of worsening difficulty breathing. Runny nose, coughing, congestion, no vomiting or diarrhea, not eating well but drinking OK.
  - Exam: HR 150, RR 40, pulse ox 98% on room air
  - Auscultation: diffuse rales, rhonchi, no nasal flaring, no grunting.

- BRONCHIOLITIS
  - Etiology and pathophys
    - Pulmonary infection of young children characterized by wheezing
    - Most common cause – RSV
    - Most infections occur in the winter
    - Occurs up to 2 yrs of age
BRONCHIOLITIS

• Etiology and pathophys
  • Infection causes death of the cells that line the bronchi, which then slough into the lumen
  • Increased production of mucus
  • Eventual plugging of the bronchi from necrotic epithelium and mucus that produces hyperinflation and atelectasis

• Signs and symptoms
  • Begins and URI
  • Over 2 – 5 days signs of respiratory distress appear
  • Parents often hear the child wheezing
  • Fever in 2/3 of pts
  • Often appear ill – younger are sicker
  • RR often at least 40 but may be 80 – 100
  • Nasal flaring, retractions
  • With ventilatory muscle fatigue may see grunting respirations
  • Only in the most severe cases will you see cyanosis

• Life threatening complications
  • Apnea (considered to be unpredictable)
  • Dehydration
  • Respiratory failure
  • Rarely bacterial superinfection

• Management:
  • Treat the symptoms
  • Hypoxia – oxygen, nasal cannula, high flow!
  • If strong family history of asthma, atopic dermatitis may trial albuterol
  • Severe respiratory distress – vaponephrine
  • DO NOT USE STEROIDS

BRONCHOPULMONARY DYSPLASIA

• Etiology and Pathophys
  • It is a chronic lung disorder secondary to perinatal lung insults.
  • Newborns requiring prolonged ventilation are at risk
  • Diagnosis - Infants who are >28 days old, receiving supplemental oxygen, and who have significant clinical, radiologic or blood gas abnormalities

• Signs and symptoms
  • Tachypnea, retractions at rest or during mild respiratory infections
  • Hyperinflated lungs
  • On auscultation may have crackles, wheezes or decreased breath sounds
  • Some may have dyspnea or FTT
  • Gas – PaCO_2_ >45 often despite RR of 60-80
BRONCHOPULMONARY DYSPLASIA

- Management
  - Hospitalized pts with resp rates > 70-80 bpm or a significant change from baseline
  - Increasing hypoxia or hypercarbia, poor feeding associated with resp symptoms, or new pulmonary infiltrates
  - If sx are mild - consider outpatient with supplemental oxygen, bronchodilators and inhaled corticosteroids
  - Consider antibiotic therapy when risk of bacterial infection appears higher

CYSTIC FIBROSIS

- Etiology and pathophysiology
  - The most common lethal inherited disease among Caucasians in the US
  - Exocrine glands are primarily affected
  - Pathogenesis of symptoms can be categorized into two groups
  - Viscous secretions result in obstructive phenomena in the resp and GI tracts
  - Altered reabsorption results in electrolyte losses in the sweat glands

- Signs and symptoms
  - Initial presentation
    - FTT
    - H/O chronic respiratory and/or GI symptoms
  - Resp symptoms may vary from a mild but persistent cough to recurrent pneumonia and atelectasis
  - Signs and symptoms
    - Frequent passage of pale, bulky, loose and excessive foul-smelling stool
    - Don’t misdiagnose these pts with chronic diarrhea or a milk allergy

- Signs and symptoms
  - Meconium Ileus [Infants]
    - Rectal Prolapse (<3 yrs)
    - Intestinal Obstruction
    - Hypo-electrolytemia and metabolic acidosis (Older)
    - Pneumothorax (older children)
    - Hemoptysis
    - Pulmonary Exacerbation
    - Cor Pulmonale
    - Respiratory Failure

- Signs and symptoms
  - Meconium Ileus
    - Usually, history is that after the first few feedings the infant develops abdominal distention and begins vomiting
    - H/O passing little to no meconium
    - Peristaltic waves
    - Palpable abdominal mass

- Signs and symptoms
  - 3 view abd x-ray – dilated loops of bowel and a bubbly, granular density in the lower abdomen
  - Air fluid levels usually not seen
  - If uncomplicated cases tx with enema with diatrizoate methylglucamine (Gastrografin)
  - If complicated (free air) perform laparotomy
CYSTIC FIBROSIS

• Rectal Prolapse
  - Usually occurs in kids <3 years
  - Perform a sweat test on any child with rectal prolapse
  - In a child with known CF this usually occurs secondary to inadequate pancreatic enzyme replacement
  - Treatment – lubricated glove for manual reduction

• Hypoactive sweat test
  - Common in CF
  - Perform sweat test on any child with rectal prolapse

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CYSTIC FIBROSIS

• Hemoptysis
  - Expectoration of a small amount of blood, usually as streaking of the sputum, is a common occurrence
  - Significant hemoptysis is defined as 30 – 60 mL of fresh blood
  - Mechanism – erosion of an area of local bronchial infection or bronchiectasis into a bronchial vessel
  - Treatment – Hospitalize for significant hemoptysis, IVF, type and cross, IV Abx against staph and pseudomonas

INFANT

BRIEF RESOLVED UNEXPLAINED EVENTS (BRUE)

• Definition:
  - Clinicians should use the term BRUE to describe an event occurring in an infant ≤1 year of age when the observer reports a sudden, brief, and now resolved episode of ≥1 of the following:
    - cyanosis or pallor
    - absent, decreased, or irregular breathing
    - marked change in tone (hyper- or hypotonia)
    - altered level of responsiveness
  - Diagnose a BRUE only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination

BRUE

• What to do?
  - May briefly monitor patients with continuous pulse oximetry and serial observations
  - Should offer resources for CPR training to caregiver
  - Should educate caregivers about BRUEs.
  - Should use shared decision-making
OPHTHALMIA NEONATORUM
• Cases occurring in the 1st month of life
• Bacterial causes must be suspected within 2 weeks of birth
• Gram stain and culture
• Fluorescein staining...always
• Need STD Hx & prenatal care Hx from mother
• Neonate should be examined for evidence of systemic gonococcal infection
  Blood and CSF testing with hospitalization

A 12 day old who was delivered at home and received no prenatal care is brought in for evaluation of a purulent eye discharge and cough. Examination reveals diffuse conjunctival injection and greenish discharge. What is the most likely etiologic agent?

Staph aureus
Adenovirus
Chlamydia trachomatis
Nisseria Gonorrhoea

A 3 wk old infant is brought in for a staccato cough. His mother states he was born by NSVD and that, aside from some nasal congestion and eye inflammation over the past few days, had been well until yesterday. On exam, the child is afebrile but quite tachypnic with bilateral conjunctivitis, SpO2 is 94%. CXR shows bilateral interstitial infiltrates. What is the most likely organism causing this constellation of signs and symptoms in an infant of this age?

A. Group B strep
B. Chlamydia trachomatis
C. Staph. aureus
D. Mycoplasma pneumoniae

CONJUNCTIVITIS
PEARLS
• MCC is viral, up to 50% of viral infections are adenovirus
• Antacid use should be judicious...wait, what? Yes, judicious.
• Other causes include:
  • Bacterial
  • Chemical-including antibiotics
  • Allergic and vernal (seasonal allergy)
CASE #1

- 2-month-old female with vomiting for the past three days, getting worse today
- The vomitus is nonbloody, nonbilious
- She still is hungry and has normal amount of wet diapers
- No diarrhea, no fever, no cold symptoms
- No known sick contacts, no recent travel
- PMHx – born full term to drug addicted mother, lives with foster mother for the past 5 days
- Other history unknown

CASE #1

- Vitals normal
- Vomiting is getting more forceful
- What test do you order and what is the likely diagnosis?

PYLORIC STENOSIS

- Most common cause of metabolic alkalosis in infancy
- Most common reason for abdominal surgery in the first 6 mo of life
- Incidence 1-250 to 1,000 depending on geographic location
- Boys > girls 4:1
- Greater in Caucasians
- Etiology – unknown (acquired vs. congenital)
- Gastric outlet obstruction results from
  - hypertrophy of the pyloric muscle

PYLORIC STENOSIS – SIGNS/ SYMPTOMS

- Symptoms can start at 3 weeks after birth (range 3 weeks – 5mo)
- Symptoms usually begin as spitting up progressing to emesis, often projectile
- PE may show a dehydrated infant who is an avid sucker
- May palpate and olive-like mass in the upper abdomen

PYLORIC STENOSIS – DIAGNOSIS

- Electrolytes – hypochloremic, hypokalemic metabolic alkalosis
- Loss of acid
- Retention of bicarbonate
- Initially vomiting results in excessive loss of HCl and KCl which
- As intravascular volume decreases (dehydration) the concentration of HCO3 in the plasma increases leading to contraction alkalosis

PYLORIC STENOSIS – DIAGNOSIS

- Abdominal us –
  - Pyloric muscle thickness of >4mm and a pyloric length >16mm have a diagnostic sensitivity and specificity of 89% and 100%
PYLORIC STENOSIS - MANAGEMENT

- Correction of fluids and electrolytes
- Corrective surgery – pyloromyotomy
- Prognosis - excellent

CASE #2

- 20-month-old African-American female
- H/O crying episodes over the past 3 to 4 hours each lasting 1-2 minutes each
- Pt acts OK in between crying episodes
- No abdominal distention, diarrhea, constipation, blood in the stools, vomiting
- No history of fever, or refusal to feed

INTUSSUSCEPTION

- Is the telescoping of one portion of the bowel into another
- Venous engorgement and ischemia of the intestinal mucosa cause bleeding and production of mucous, which results in the classic description of red “currant jelly” stool
- Age – 6mo to 3 years
- 90% are idiopathic
- May have preceding URI or diarrheal illness

INTUSSUSCEPTION – SIGNS/ SYMPTOMS

- Pts present with intermittent pain – occurs at intervals of 10-20 min
- Vomiting with loose or watery stools after 12-24 hours will see bloody stools
- Initially abdominal exam is benign
- Confirm diagnosis with ultrasound
- Treatment – air enema, Curative in 95% of patients
MALROTATION WITH VOLVULUS

- Rotational anomalies occur because of an arrest in normal rotation of the embryonic gut leading to abnormal position of duodenojejunal junction
- Occurs in 1/200 to 1/500 but symptomatic malrotation occurs in 1/6000 births
- 2/3 of patients who require surgery are <1 month of age
- 30-60% of pts have an associated anomaly

MALROTATION WITH VOLVULUS

- Presents as acute abdominal pain in a previously healthy child
- Must suspect in any child with bilious emesis
  - >90% of patients present with this
  - Need to go to surgery within hours to prevent systemic decompensation
  - Can result in infarction of the entire small intestine

MALROTATION WITH VOLVULUS

- Diagnosis
  - Abd x-rays – usually not helpful
  - Upper GI – see corkscrew or birds beak appearance
  - The imaging features in approximately 15% of upper GI tract examinations are equivocal and lead to a false-positive or false-negative interpretation

MALROTATION WITH VOLVULUS

- Get the patient to surgery
- Correct any electrolyte imbalances and treat for signs of sepsis
- Patients can do very well if treated appropriately and quickly
KEURO

CAUSES OF SEIZURES

- Any age:
  - Isolated event with no obvious cause
  - Infectious (meningitis)
  - Tumor
  - Hypocalcemia, hyponatremia
- Infants
  - Perinatal asphyxia or in utero stroke
  - Genetic syndrome
  - Younger Children
  - Fever
  - Older Children
  - Tumor or a neurodegenerative

KIDS ARE DIFFERENT

- Children >6 yrs tend to have seizures that are similar to adults
- Younger children/infants have less complex behavior
- Difficult to determine a change in consciousness in infants and young children
- Typical generalized tonic-clonic and absence seizures are extremely uncommon in the first two years of life and never occur in the newborn

FEVERLE SEIZURES

- Seizure occurring between 6 months and 5 years of age that is associated with a fever [temp >38C (100.4F)] but without the evidence of intracranial infection or other defined cause of neurologic disease
- Are the most common seizure disorder in childhood
- Affect 2–5% of children between the ages of 6 months and 5 years

FEVERLE SEIZURE: TWO TYPES

<table>
<thead>
<tr>
<th>Simple Febrile</th>
<th>Complex Febrile</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months – 5 years of age</td>
<td>6 months – 5 years of age</td>
</tr>
<tr>
<td>Febrile before, during or after seizure</td>
<td>Febrile before, during or after seizure</td>
</tr>
<tr>
<td>Seizure lasting less than 15 minutes</td>
<td>Prolonged (lasting more than 15 minutes)</td>
</tr>
<tr>
<td>Generalized seizure, and</td>
<td>Focal seizure, or</td>
</tr>
<tr>
<td>Occurs once in a 24-hour period</td>
<td>Occurs more than once in 24 hours</td>
</tr>
</tbody>
</table>

FEVERLE SEIZURE

- Family history of febrile seizures in an immediate family member in 25% to 40% of cases
- After the first febrile seizure, approximately 33% of patients will have at least one recurrence and about 9% will have three or more episodes
- 75% of recurrences will happen within 1 year
- Less than 5% chance of subsequent epilepsy
CAUSES OF NEONATAL SEIZURES

- First 24hrs:
  - Hypoxic ischemic encephalopathy
  - Infection (TORCHES)
  - Direct drug effects
  - Metabolic (hypoglycemia, hypocalcemia)
  - Intracranial hemorrhage
  - Pyridoxine dependency

- > 24hr
  - Infection (Meningitis, sepsis, herpes)
  - Intracranial hemorrhage and malformations
  - Metabolic
  - Drug withdrawal

The most important complications of Kawasaki's Disease are:

- Hematologic
- Gastrointestinal
- Neurologic
- Cardiovascular
- None of the above

Which of the following is not a criteria used to diagnose Kawasaki syndrome?

- Fever >/= 5 days
- EKG changes
- Polymorphous rash
- Bilateral nonsuppurative conjunctivitis
SICKLE CELL

What's the big idea?

Sickled RBC's can't pass freely through systemic microvasculature.

Sickled RBC’s are fragile → chronic hemolytic anemia.

The most appropriate management for a young child with Kawasaki syndrome is:

- Admission for IV gamma globulin and high dose ASA therapy
- Admission for high dose antibiotics and steroids
- Discharge on high dose ASA therapy with follow-up within 3 days
- Discharge on high dose ASA therapy & cost 2nd gen cephalosporin

None of the above.
SICKLE CELL COMPLICATIONS

• Infections
• Priapism
• Acute Chest Syndrome
• Cerebrovascular Accidents
• Arthropathy
• Renal papillary necrosis
• Thrombotic or fat emboli

Other sequelae:
• Avascular necrosis
• CHF (rare in peds)
• Leg ulcers
• Retinal infarctions/detachement
• Renal insufficiency/nephrotic syndrome

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VASO-OCCLUSIVE PAIN CRISIS

#1 cause of ED visit
Severe unremitting pain: back, abdomen, chest, long bones

Workup:
• CBC, Retic count - r/o crises
• UA, CXR, cultures as indicated

Treatment:
• Analgesia
• Appropriate D5 (1.5x maint)
• Exchange transfusion*

Dispo: admit PRN, if pain controlled then d/c

SPLENIC SEQUESTRATION

Often in the young 6mo-6yrs
Abd pain, splenomegaly, pallor, shock

Workup:
• CBC (Hgb 1-2!), Retic count OK
• May be pancytopenic

Treatment:
• Analgesia, IV fluids
• Blood transfusion
• Exchange transfusion considered in refractory cases
• Surgical consult for splenectomy

8-year-old with sickle cell disease (Hb SS) present with fever and chest pain for 1 day. What constellation of findings will lead you make the diagnosis of acute chest syndrome?
ACUTE CHEST SYNDROME

- Older children
- Pleuritis, fever, cough, dyspnea
- Exam: look for 5 findings
  - New infiltrate on CXR
  - Hypoxia
  - Fever
  - Chest pain
  - Tachypnea

Workup:
- Labs, CXR (infiltrate)
- Any chest symptoms

Treatment:
- Treat infection, O2, and hydration
- Transfusions if deteriorate despite tx

OTHER SEQUELAE

INFECTIONS: MCC of death
Pts functionally asplenic → Sepsis, Meningitis, PNA, OM

Admit:
- any child < 1 year old or:
  - High risk findings or signs of sepsis
  - 3rd gen cephalosporin + Dz specific tx

OK to D/C:
- > 1 yo if:
  - Identified source (otitis, strep throat)
  - Isolated fever but well appearing
  - 4 hr OBS in ED w/o change in status

The most common cause of osteomyelitis in children with Sickle cell anemia is:

Staph aureus
Salmonella
Shigella
Coxsackie virus
E. coli

IDIOPATHIC THROMBOCYTOPENIA PURPURA (ITP) F6

- Most common platelet disorder in children
- Serious bleeding is rare (2-4% of children)
- Age ~ 1-4 yrs
- The risk of serious bleeding decreases sharply after the 1st wk of illness
IDIOPATHIC THROMBOCYTOPENIA PURPURA (ITP)

• Clinical Manifestation –
  • Well appearing child with
  • Newly acquired petechiae and ecchymoses
  • Thrombocytopenia
  • Usually, pts have simple bruising and petechiae rather than
    epistaxis, gum bleeding and hematuria
  • The life threatening complication – intracranial hemorrhage
  • Symptoms may be subtle – mild headache
  • Unusual once platelets >20,000
  • Incidence - <0.5%

• Management –
  • Pts >1yr of age, with no active bleeding, close follow-up is
    ensured, treatment - observation, limit ASA and NSAIDs
  • Pts <1yr of age, sufficient bleeding to cause mod to
    severe anemia, pt who remain severely thrombocytopenic (<10,000) for several wks after
    diagnosis, or for pts whose physical activities cannot be
    effectively restricted – hematology consult and treatment

• Treatment –
  • IVIG – 0.8 to 1g/kg x 1 dose, may repeat at 24 hrs if platelet count remain below
    40,000 – 50,000
    • S/E – headache, fever, chills, flushing, rash

HEMOLYTIC UREMIC SYNDROME

• Common causes of acute renal failure in children
• Typically occurs in children under age 5; mean age 3 yrs
• May occur in outbreaks related to the most common offending agent
  • E. coli O157:H7: Shiga toxin aka verotoxin or verocytotoxin
  • Frozen ground beef products and spinach, fast food ground beef, etc.
  • Also Shigella, Yersinia, Campylobacter, Salmonella
• ARF in 55-70% of pts (85% recovery rate)
• Mortality 5-15%

Which of the following is not a part of the classic triad found in Hemolytic Uremic Syndrome?

- Hemolysis
- Thrombocytopenia
- CNS dysfunction
- Acute renal failure
- None of the above
Hemolytic Uremic Syndrome

**Classic Findings**
- Microangiopathic hemolytic anemia
- Acute renal failure or nephropathy
- Thrombocytopenia

**Classic Presentation**
- Watery diarrhea
- Crampy abdominal pain
- +/- fever
- Bloody diarrhea in 89% of pts by day 5
- Increased abdominal pain

Injury to renal vascular endothelium results in hemolysis, platelet aggregation within 1 wk

Which of the following is not a part of the classic triad found in Hemolytic Uremic Syndrome?
- Hemolysis
- Thrombocytopenia
- CNS dysfunction
- Acute renal failure
- None of the above

Which of the following is not an anticipated lab finding in a patient presenting with HUS?
- Hperkalemia
- Hyponatremia
- Elevated direct bilirubin
- Leukocytosis
- Elevated C-reactive protein
HUS WORKUP

CBC – Hgb as low as 5 g/dL; PLT may be less than 50,000.
• +/- leukocytosis
• Hemolysis on peripheral smear
CMP – ARF and associated electrolyte abnormalities (high K, low Na)
U/A – RBC’s and RBC casts, protein
STOOL STUDIES
• Nonbloody diarrhea: stool for fecal leukocytes may prompt W/U
• Bloody diarrhea: stool culture

HUS TREATMENT

• Mainly supportive care
• IVF hydration
• Pain control
• RBC Transfusion – significant anemia
• Platelet transfusion- life-threatening bleeding only
• Dialysis PRN
• Antibiotics?? Controversial but NO
• No Antidiarrheals – need motility to push that toxin out

ABUSE/ NEGLECT

A mother bring her 2 month-old daughter in for evaluation of her swollen ankle. X-ray shows the findings. After review you should do which of the following?
• A. Discharge the patient home
• B. Admit the patient for ortho consult
• C. Place cast for fracture and discharge
• D. File a 3200 for child abuse and neglect, do a full nonaccidental infant work up
• Order blood work and if abnormal consult social work

QUESTION

A mother bring her 2-month-old daughter in for evaluation of her swollen ankle. X-ray shows the findings. After review you should do which of the following?

Discharge the patient home
Main the patient for ortho consult
Place cast for fracture and discharge
File a 3200 for child abuse and neglect
Order blood work and if abnormal consult social work
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- Discharge the patient home
- Admit the patient for ortho consult
- Place cast for fracture and discharge
- Ice a 1000 for child abuse and neglect, 48 h reassess if child wakes up
- Order blood work and if abnormal consult ortho

What is the most common form of child abuse?

- Physical
- Sexual
- Neglect
- Medical
- Emotional
PALS REVIEW – FORMULAS & NORMS

- Weight (kg) = 2 (age in yrs) + 8
- ETT size = \[(age in yrs + 16) / 4\]
- ETT depth: 3 x (ETT diameter)
- ETT: CUFF OK if not newborn
- Hypotension: SBP < 70 + (2 x age)
- Neonate < 60, Infant < 70 mm Hg
- NAVAL: drugs for ETT
- Narcan, atropine, valium, epinephrine, lidocaine

Resp rate:
- Neonate: 40-60
- Infant: 30-60
- Toddler: 24-40
- Child: 18-30

HR:
- Neonate: 120-150
- Infant: 120-140
- Child: 100-120 until age 6

You are attempting to defibrillate a child weighing 20 kg. What dose should you use for your initial attempt?
- 20 Joules
- 60 Joules
- 80 Joules
- 200 Joules
- 40 Joules

What is the correct endotracheal tube (Cuffed tube) size and depth of tube for a 2-year-old who weighs 18 kg?
- Tube size 3 depth 12
- Tube size 4.5 depth 12
- Tube size 4.5 depth 10
- Tube size 4 depth 8
- Tube size 4 depth 8

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QUESTIONS?

• Good luck, you will do great!
• Go with your first answer
• Always remember, this too shall pass

What is the correct endotracheal tube (Cuffed tube) size and depth of tube for a 2-year-old who weighs 18 kg?

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- tube size 4.5 depth 14
- tube size 4 depth 12
- tube size 4.5 depth 10
- tube size 4 depth 8