

Hindsight is 20/20

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Disclosure

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Case 1

- Toddler siblings are jumping on the couch
- Larger one lands on top of the smaller one, both landing on the tile floor
- The smaller child cries out and develops respiratory distress. 911 activated
- Vitals: RR 62, HR 168, afebrile, crying
- EMS transports her to the nearest hospital



Case Progression

- Upon arrival, oxygen saturation in 70's and severe respiratory distress
- Supplemental oxygen not helping!
- Decreased breath sounds bilaterally!
- No reported tracheal deviation
- Difficult to ventilate and oxygenate!
- Bilateral chest tubes are placed!
- She's Intubated!
- Still difficult to ventilate and oxygenate!

Case Progression

- Differential Diagnoses?

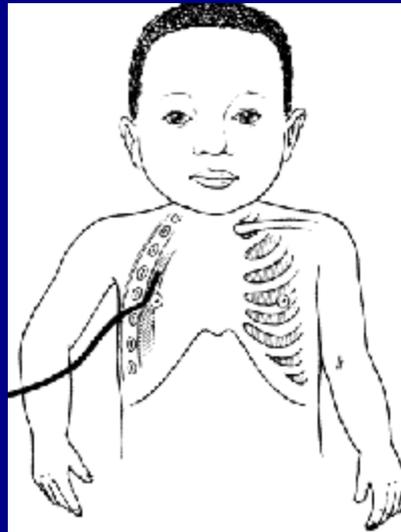


Differential Diagnoses?

- Pulmonary contusion?
- Traumatic pneumothorax?
- Hemothorax?
- Crush injury? Transection?
- Underlying problem?????
 - Asthma
 - Pneumonia
 - Cystic fibrosis



Perplexing Case



Pediatric Pearl

- If it doesn't make sense, go back to the basics.
- What were they doing right before the fall?



Something We Don't See Everyday! or Do We????



What the Heck!!



Epidemiology

- 92,166 cases reported to Poison Centers in 2003
- Peak incidence 6 months to 3 years
- 600 children die annually
- Majority present to EDs



2003 Annual Report of the American Association of Poison Control Centers Toxic Exposure Surveillance System
Am J Emerg Med 2004; 22:335-404

Foreign Bodies

- Food
- Coins
- Toys
- Munchausen Syndrome by Proxy
- Abuse



Location

- Gastrointestinal
- **AIRWAY**
- External Auditory Canal
- Nasal
- Subungual
- Vaginal
- Subcutaneous



Gastrointestinal Foreign Bodies

- Coins (usually pennies)
- Chicken, fish bones
- Toy parts
- Screws
- Batteries
- Jewelry



Foreign Body Ingestions

- Developmentally normal children
- Own homes
- Parents' care
- Often witnessed



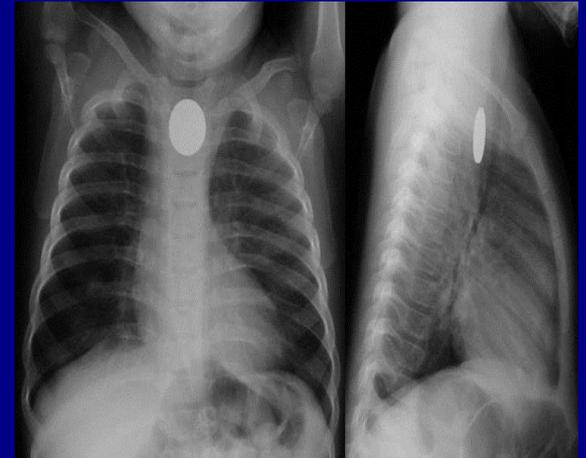
Clinical Presentation

- Classic: toddler gags, chokes or vomits at time of ingestion
- Majority are asymptomatic
- Small percentage, neck, throat or chest pain
- Even fewer, drooling or wheezing



Presentation

- Tracheal compression (large esophageal foreign bodies)
- Dysphagia and drooling with upper and mid-esophageal FBs
- “Café syndrome” symptoms develop with meat
- 40-70% of esophageal FBs are asymptomatic



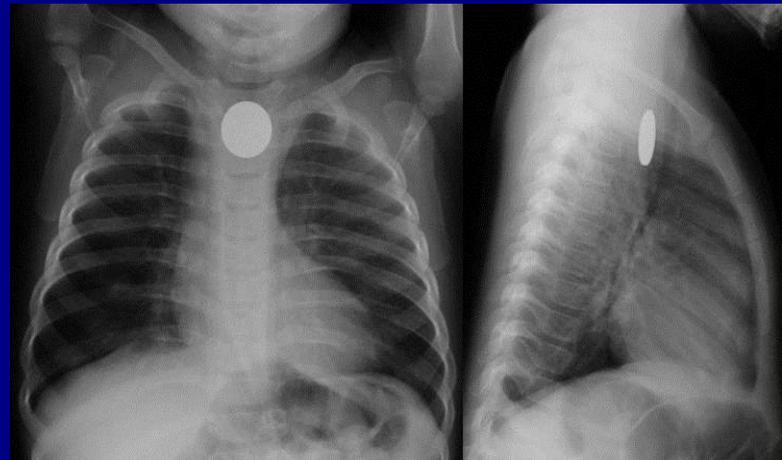
Natural Course of Gastrointestinal Foreign Bodies

- 80-90% pass spontaneously
- 10-20 require endoscopic removal
- 1% surgical intervention



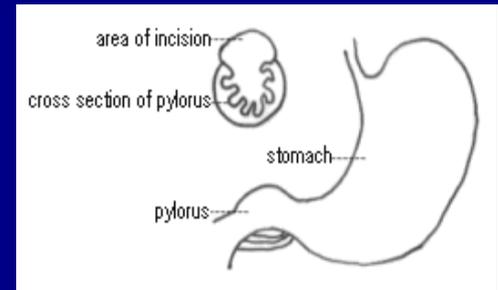
Esophageal FBs

- Lodge at thoracic inlet (45-63%), GE junction (20%), level of aortic arch (10%)
- If makes it to stomach, should pass through on own
- Exceptions?



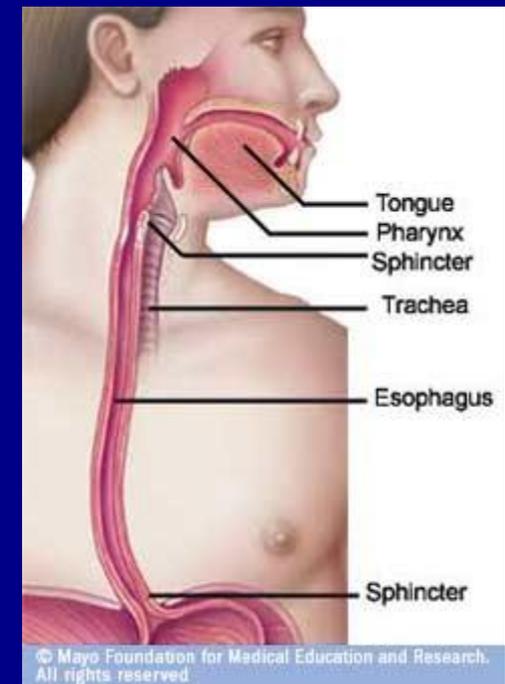
Exceptions

- Pyloromyotomy
- Objects wider than 2 cm
- Objects longer than 5 cm
- Entrapment in a Meckel's diverticulum or appendix



Esophageal Foreign Bodies

- Anatomic narrowing
 - Cricopharyngeus
 - Aortic arch crossing
 - Gastroesophageal junction



Complications of Impacted Foreign Bodies

- Airway obstruction
- Retropharyngeal abscess
- Tracheoesophageal and esophageal-aortic fistulae
- Lead poisoning
- Esophageal/intestinal perforation

Clinical Management

- Respiratory distress, emergency management
- Vomiting, abdominal pain, urgent
- Plain radiographs for confirmation and localization
- Coins, flat AP if esophageal

Management

- Objects lodged in upper or mid-esophagus-ENT, rigid scope
- Repeat radiographs just prior to removal
- Asymptomatic, smooth-observe

Esophageal Batteries and Sharp Objects

- Immediate removal, emergency endoscopy (O.R.)!
- Chicken and fish bones, toothpicks, paper clip, needles
- Perforation at ileocecal valve



Disc Button Batteries

- >2,000 annually
- 90% pass spontaneously
- 4% lodge in esophagus
- Esophageal burns (1 hour)
- Full-thickness (4 hours)
- Stomach (daily radiographs)



Options for Removal

- Gold standard: endoscopic removal, general anesthesia (direct visualization, airway protection, removal controlled)
- Upper to mid-esophagus: ENT
- Lower esophagus: GI, flexible scope



Airway Foreign Bodies

- Half of airway FBs are unwitnessed
- Peak incidence, 1-3 years
- Half have triad: wheeze, cough, decreased breath sounds
- Many have an asymptomatic period after aspiration
- Complications: PNA, obstructive emphysema, bronchiectasis

Mis-Diagnoses

- URI
 - Croup
 - Asthma
 - Recurrent PNA
-
- 15-20% treated for other conditions



Management

- Complete Obstruction: Heimlich or abdominal thrusts and back blows
- No blind finger sweeps
- Patent airway: radiographs of neck and chest
- Hyperinflation
- Imaging 73% sensitive and 45% specific



Summary

- Majority diagnosed in a timely fashion
- Delayed diagnosis: severe morbidity/mortality
- Recognize history and index of suspicion



References

1. Textbook of Pediatric Emergency Procedures
(Editors: Fred M. Henretig and Christopher King)
Copyright 1997, Williams and Wilkins
2. Correspondence with Linda D. Arnold,
Contemporary Pediatrics
3. Complete list available (32 articles)

Our Case: Closure

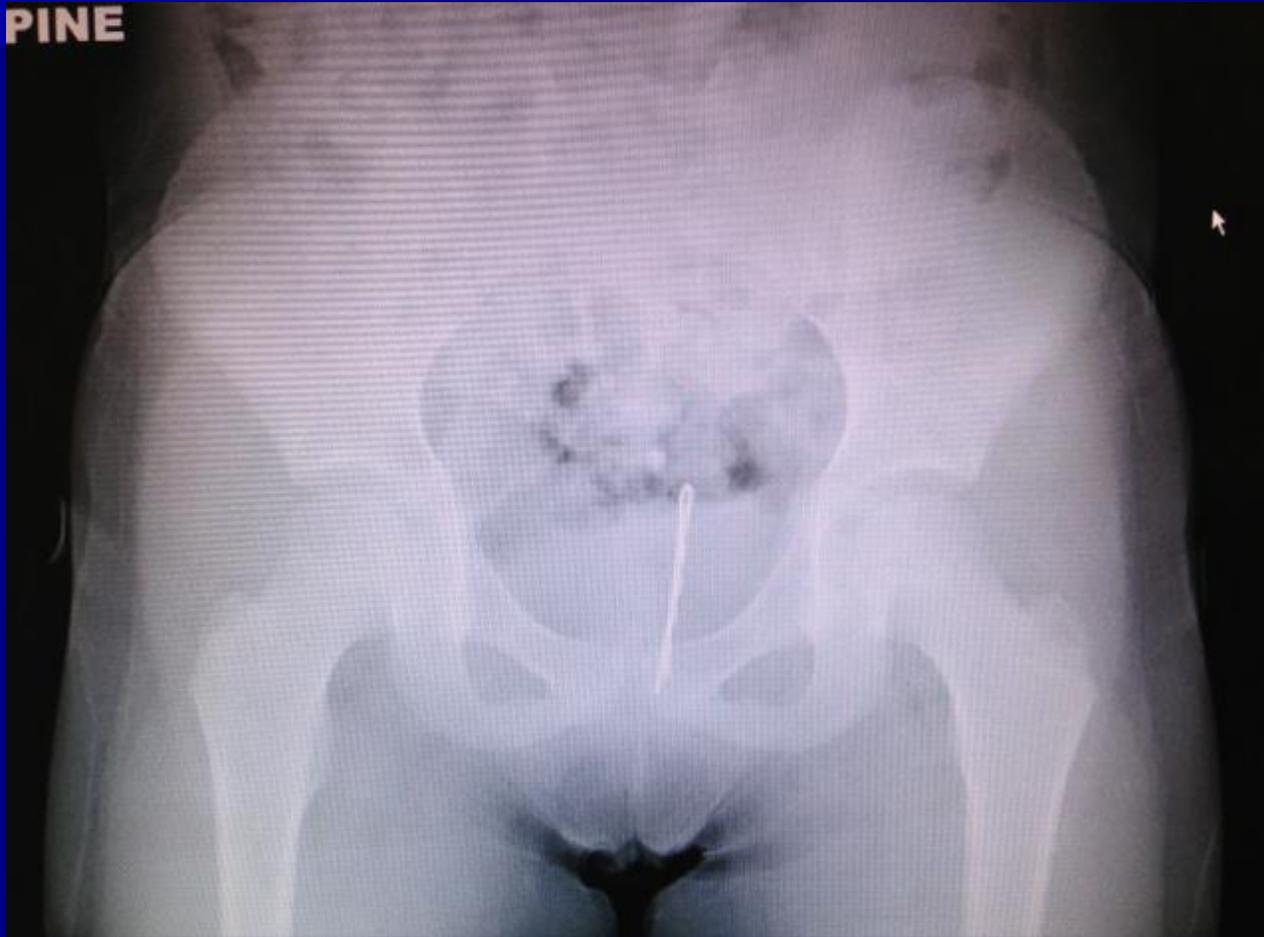
- Re-evaluated the CT scans from the outside hospital.....FBs visualized
- Rigid Bronchoscopy: removal of 4 kernels
- Two in each mainstem bronchi
- Extubated.....Observed
- Chest tubes discontinued
- Discharged, complete recovery!

Pediatric Pearl

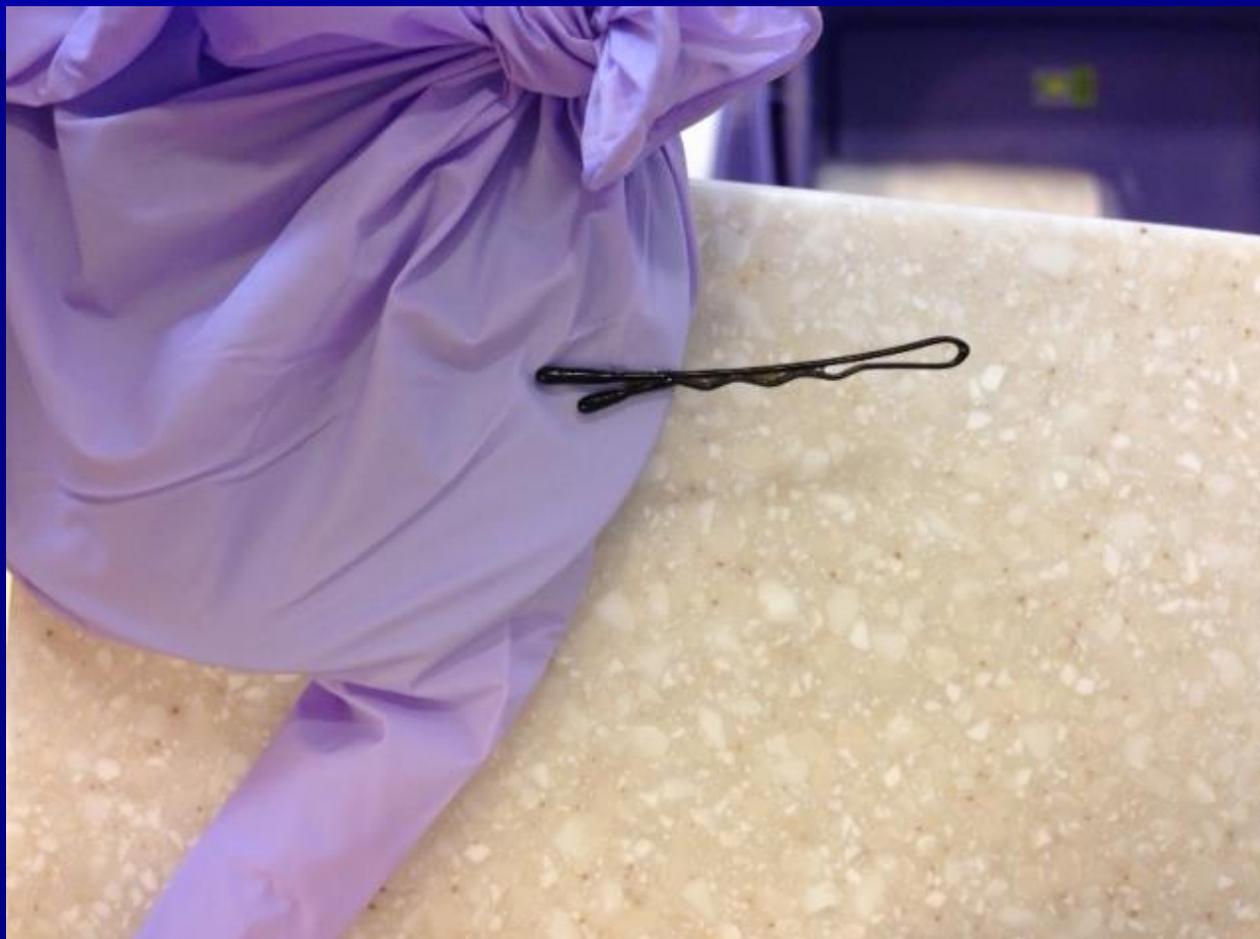
- Remember developmental status
- Environment
- Risk factors
- **Foreign bodies** in pediatric age group



Recent Case



Management



Pacer Magnet





Case 2

- Busy overnight shift in the PED
- 0330, 10 year old girl, known asthmatic presents in severe respiratory distress!

- RR 58 and labored, temp 38.1 C, HR 138, BP 136/87, Wt 53 kg
- Increased work of breathing!!
- Nurse starts an albuterol/atrovent neb

Physical Exam

Overweight caucasian female in severe respiratory distress

HEENT: tripodding, flaring, no drooling, tongue stained black!

Chest: intercostal, subcostal retractions, no audible wheezing! So tight? 100% on nebulizer

Abdomen: non-distended, tender

Extremities: cool to touch, pulses 2+, cap refill 2 secs

Past Medical History

- Asthma
- Admitted for asthma
- Admitted to the PICU and intubated
for status asthmaticus in the past

She was getting nebs q 4 hrs at home, then q 2 hrs and **NOT WORKING!!** Getting worse! Unable to sleep...so difficult to breath!



History of Present Illness

- She was getting nebs q 4 hrs at home
- Then q 2 hrs and NOT WORKING!!
- “Getting worse!”
- “Unable to sleep...so difficult to breath!”
- Fever too!



Progression

- After treatment “still working very hard to breath”
- Had a fever to 39 C,
- Dad gave Motrin® and Pepto Bismol® for stomach pain
- Differential: status asthmaticus, pneumonia, urinary tract infection, anaphylaxis, sepsis, others.....

Progression

- IV access, CBC, blood cultures
- Wanted a CXR ? PNA, Atelectasis or Pneumothorax
- Urine dip and UCG (pre film)

Nurse comes **running back** from the
"dirty utility room"

Pregnant at 10 years of age!?
OMG!!!



NO NOT PREGNANT

But.....

Urine Dip

- 3+ glucose!!
- Large ketones!!
- UCG negative



- How could I miss this?! *^#&*@! Crud !

Diabetic Ketoacidosis

- VBG
- Fluid bolus, 20mL/kg and re-assess
- pH 6.98!!! $\text{HCO}_3^- < 5$
- pCO_2 20 and glucose 789 mg/dL!
- After bolus pH 6.92, insulin drip started after flushing the line (0.1 u/kg)
- pH 6.91 then ventricular dysrhythmia!
- Sodium bicarbonate and intubation (PICU)

Progression

- PICU for three days
- Intubated for 24 hrs until electrolytes could be corrected/normalize
- Sent to the floor for insulin teaching
- Did Well!

Pediatric Pearl

- Rapid breathing is not always tachypnea
- Hyperpnea: rapid/deep breathing
- Respiratory compensation for a metabolic acidosis!
- No wheezing....take the time to see...oxygen 100% on room air!
- Ask me if I've ever been burned before!



Third Case

- Wintry Sunday morning in the Pediatric ED
- Incoming: 4 year old previously well little girl, fever to 103 F and increased work of breathing
- Upon arrival by car...tachypneic, tripodding.....I dipped a urine and checked for FB risk factors!!!
- Apprehensive, stridor at rest, not drooling!

Past Medical History/HPI

- Fully immunized
- Born full-term
- No chronic meds
- No prior admissions
- No pets
- No travel....attends daycare

One day history of high fever, sore throat,
decreased PO

Physical Exam

- T 40 C, RR 54, HR 154, BP 116/68

Anxious, tearful and fearful little girl

- HEENT: stridor at rest, leaning forward, no drooling
- Chest: transmitted upper airway sounds
- Abdomen: full but soft
- Extremities: warm, 2+ pulses and brisk cap refill

Differential?

Shout em out!

Differential

- Laryngotracheobronchitis
- Retropharyngeal abscess
- Bacterial Tracheitis
- Foreign Body
- Upper Airway Obstruction
- Epiglottitis
- Anaphylaxis



Classification, Definition, Clinical Features of Croup Illnesses

Definition Characteristics	Spasmodic Croup	Epiglottitis	Acute Laryngotracheitis	Bacterial Tracheitis
Age at Occurrence	3 mos to 3 yrs	2 to 8 yrs	3 mos to 3 yrs	3 mos to 3 yrs
Prodrome	Minimal coryza	Minimal coryza	Usually coryza	Usually coryza
Onset	Well child, night sudden onset	Rapid progression	Variable, fever	2-5 days, gradual
Symptoms on Presentation	Hoarseness Barky cough	Fever, Dysphagia, stridor is late	Hoarseness Barky cough	Severe insp stridor, toxic
Signs	No fever	Fever	Fever 37.8 to 40.5	Fever 37.8 to 40.5
White blood cells	Normal	Elevated > 70% neutr	Mildly elevated > 70% neutr	Elevated or abn low
Microbiologic Findings	Like in croup	HiB, Strep, Staph, Pneumococci	Paraflu 1, 3, Flu, RSV, Adeno, Measles, Rhino, HMNV	First viral, Staph, Strep, H flu

Progression

- Thinking bacterial tracheitis
- Keep her calm (and you try to stay calm too!)
- Racemic epinephrine via nebulizer
- Dexamethasone (0.6 mg/kg, max 10 mg)
- Second racemic epi...uh oh!
- Fever....little response to racemic....
- IV access: CBC blood cultures
- Obtain a lateral neck film in the major treatment room (not radiology suite...)

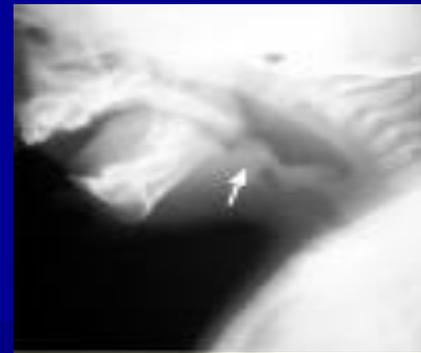


Progression

- At her bedside
- Hydration
- CBC, blood culture: WBC 38,000 +bands.....Abx
- Third racemic epinephrine.....
- Radiology calls with **CRITICAL REPORT** to convey.....probably feathering!!!!
- But no!



THUMB PRINT SIGN!!!



Are you kidding????

Call ENT

O.R.

Anesthesia

Don't Upset her!

Another Thumb Print Sign!

From my hands around ENT's neck, in the PED, where they wanted to scope her!



Case Progression

- Tasered the ENT resident!
- Called Anesthesia again
- Notified Pedi Surgery (? emergency cric)
- Called ENT attending at home
- O.R. being prepared
- Stayed at bedside, Heliox
- Rode with her to O.R.
- ENT arrived as O.R. doors opened



Could not be Intubated!

Epiglottis completely occluded
airway...no visualization of
landmarks!!! What can you do?

Surgical Airway or



Squeeze her chest A-P
Visualize an air bubble!
Pass the tube!

OMG!

Management

- Maintenance of airway
- Airway control precedes diagnostic evaluation!
- Transport to operating room
- Artificial airway if tripodding/respiratory distress



Management

- Epiglottic edema...lingual surface
- Intubation: blade beneath epiglottis rather than in the vallecula
- Tracheostomy if intubation unsuccessful
- Surgical cricothyroidotomy if both unsuccessful

Management

- **Glucocorticoids** are controversial
- **Racemic epinephrine**
- **Antimicrobial therapy**: 3rd generation cephalosporin (ceftraixone or cefotaxime) and antistaphylococcal agent effective against MRSA (clindamycin or vancomycin)...treat 7-10 days
- Swelling better in 2-3 days
- Most patients do well if it is **recognized!**

Pediatric Pearls

- Epiglottitis still exists!
- Bacterial
- Inhalational
- Chemical
- Thermal Injury
- Anesthesia, ENT, O.R.
- Stabilize the airway until swelling resolves

- Index of Suspicion!!



Better!





Case Four

- 10 m/o African American male with 3 day hx of increased work of breathing, URI, low grade fever, decreased PO
- History of developmental delay and reflux (followed by GI); unable to sit up by self
- Strong FHx of **asthma**
- Brought to the PED for evaluation

Presentation

- 10 m/o black male with **severe respiratory distress**, almost panting
- T 38.8 C, **RR 72**, HR 186, BP 92/56
- HEENT: **sunken eyes, dry lips, tacky m/m**
- Chest: Intercostal, subcostal retractions
- Abdomen: soft, no HSM
- Extremities: **cool distally and mottled**

Progression

- Albuterol via nebulizer
- Cardiac and oxygen monitoring
- IV access established and 20 mL/kg bolus of saline administered
- Re-assess
- Still tachypneic and tachycardic
- Another treatment and bolus repeated

Differential (Respiratory Distress)

- Severe Bronchiolitis
- Pneumonia
- Foreign body
- Sepsis
- Severe dehydration
- DKA
- Inborn Error of Metabolism
- Anything else?

Bronchiolitis (just reviewed newer therapies)

- Vitamin D deficiency...hmmm
- 2006 AAP published guidelines
- CXR not usually necessary
- Viral testing (not helpful acutely)
- Supportive Care (mainstay of therapy)
- SABAs and dexamethasone (+/-)
- Nebulized epinephrine

Bronchiolitis

- Nebulized hypertonic saline (3%)
- Macrolide antibiotics: immunomodulatory and anti-inflammatory effects)
- Heliox (improve laminar flow)
- CPAP: continuous positive pressure ventilation

Disposition

- Symptoms worsen over first 3-5 days
- **Safe discharge:** > 2 months, no prior intubation, able to maintain hydration, follow-up possible
- Need supplemental O₂ if < 90% on room air



Progression

- iSTAT 8
- Metabolic work-up
- Concern for an inborn error of metabolism
- Hx of miscarriages, developmental delay, FTT, poor weight gain, followed by GI and on reflux medication and Maalox (Maximum Strength) ®

Lab Results

- pH 7.34, pCO₂ 19, glu 155 (metabolic acidosis: se HCO₃ 9mEq/L) /respiratory compensation)
- **Anion Gap Metabolic Acidosis (23)**
- pH 7.29, pCO₂ 23,
- WBC 12.6K, H/h= 11.2/33
- CXR: hyperinflated, no peribronchial cuffing
- EKG: sinus tachycardia
- Battery of tests and tox screen sent

Anion Gap Metabolic Acidosis

MUDPILES

Methanol

Uremia

Diabetic Ketoacidosis

Paraldehyde

Iron/Isoniazid/Inborn Error of Metabolism

Lactic acidosis

Ethylene Glycol

Salicylates



Salicylate Toxicity

Acute on Chronic

But how?

Sources



Diagnosis

- Salicylate Toxicity!
- Source
- Maalox Maximum Strength ® contains bismuth subsalicylate 525 mg/15 mL and he was getting 30 mL q 4 hours
- 235-320 mg/kg!
- Level 77 mg/dL
- Narrowly escaped hemodialysis with alkalization

Admission/PICU Course

- Considered hemodialysis
 - Unresponsive acidosis
 - Seizure, coma
 - Renal failure, coagulopathy
 - CHF, hepatic compromise or
 - level $>100\text{mg/dL}$

Salicylate Poisoning

- 150mg/kg, refer to ED
- 150-300 mg/kg, mild symptoms (GI upset, tachypnea, tinnitus)
- 300-500 mg/kg moderate toxicity (agitation, fever, diaphoresis)
- >500 mg/kg severe toxicity (seizure, coma, dysarthria, pulmonary edema, cardiorespiratory arrest)

Hospital Course

- Poison Control Center consulted
- Started on D5W with 150 mEq/L of sodium bicarbonate
- Increasing respiratory distress
- Intubated!!!!

(why is that so scary?)



- Oxygen, CPAP, avoid intubation because so difficult to replicate the high minute ventilation and maintain alkalemia... Consider hemodialysis!
- Alkalinization to maintain plasma pH 7.45-7.55 and urine pH 7.5-8
- Blood gases q 2hrs
- Close monitoring
- Activated charcoal (multiple-dose)



Case 5

- 16 year old female with history of asthma and tree nut allergy presents with sneezing, wheezing, throat tightness and urticaria.
- Just ate a veggie burger at lunch
- Diagnosis:
- Prioritization: A, B, C

Anaphylaxis

- Potentially fatal disorder
- Acute onset
- Biphasic anaphylaxis
- Often under-recognized
- Triggers: IgE, in pediatrics mostly food related (nuts, eggs)
- Asthma is an important risk factor

Anaphylaxis Management

- Remove antigen if possible
- **EPINEPHRINE**
- Oxygen
- Fluids
- Bronchodilators
- Antihistamines
- Steroids
- Ranitidine



Disposition

- All patients with severe anaphylaxis need to be admitted
- Those with good response (milder) need 2-8 hours of observation
- Up to 20% may experience a recurrence
- Instruction on the use of epinephrine auto-injectors



Summary

- Signs and Symptoms
- Don't forget possibility of an obstructive process: foreign body (kids will be kids)
- "Respiratory distress" is not always of a **respiratory** origin
- Epiglottitis is still out there!
- More is not necessarily better (Maalox)
- **EPINEPHRINE** in anaphylaxis
- I always wear a Depend ®





Thank you!

