Infectious Upper Airway Obstructions

Kerry Leupold, DO
Clinic Instructor
Department of Pediatrics
Division of Pediatric Emergency Medicine
UMDNJ
Background Info

- Respiratory infections are common in children
- 10% of pediatric hospital visits
- 20% of pediatric admissions
- Viral and bacterial etiologies
- Infections can be upper or lower airway
- Signs and symptoms of upper and lower airway infections may overlap
Important because…

• Distinguishing between upper and lower airway disease important
• Children can be difficult to examine!
• Important to initiate appropriate treatment
• Important to assess how sick the child is
• Potential for rapid airway compromise
Objectives

• Identify children that present with respiratory distress
• Identify children with upper airway disease
• Initiate appropriate treatment
• Call appropriate consults as necessary
• Make appropriate dispositions
Radiologic Anatomy

Lateral airway x-ray shows normal anatomy. Notice the wafer–thin epiglottis.
Interpretation

- Check c-spine
- Neck position
- Prevertebral tissue
- Step-off
- Epiglottis
- Vallecula
- Subglottis
Infectious Causes of Upper Airway Obstruction

• Pharyngotonsillar
  – Pharyngitis/ Tonsillitis
  – Peritonsillar infections

• Laryngotracheobronchial infections
  – Croup
  – Epiglottitis
  – Bacterial tracheitis

• Deep neck space infections
  – Peritonsillar abscess
  – Retropharyngeal abscess
  – Parapharyngeal abscess
History

- Immunization status
- Presence of viral prodrome
- Gradual or insidious onset
- Signs and symptoms of respiratory distress
Signs and Symptoms

• Respiratory distress
  – Retractions
  – Nasal flaring
  – Grunting
  – Stridor
  – Drooling
  – Quality of voice
  – Fever
  – Cough/ URI
Pharyngotonsillar infections

• Varied causes but overlapping presentations
• Most commonly viral in all age groups
  – Influenza
  – Parainfluenza
  – Adenovirus
  – Rhinoviruses
  – Coxsackie virus
  – Echoviruses
  – Epstein-Barr virus
Bacterial pathogens

- *Mycoplasma pneumonia*
- *Chlamydia pneumoniae*
- *Neisseria gonorrhea*
- *Archanobacterium haemolyticum*
- Most commonly Group A Streptococci
  - Important because of complications
  - Only common cause of pharyngitis that requires antibiotics
Group A Strep (aka strep throat) 
Symptoms

- Sore throat
- Fever
- Headache
- Pain with swallowing
- Abdominal pain
- Nausea/ vomiting
- Scarletiform rash
- Enlarged, tender anterior cervical nodes
Centor criteria

• Tonsillar exudates
• Swollen and tender anterior cervical lymph nodes
• Absence of cough
• History of fever

* The sensitivity and specificity of these are too low to abandon diagnostic testing
GAS complications

- Suppurative
  - Otitis media
  - Sinusitis
  - Peritonsillar
  - Retropharyngeal abscess

- Non suppurative
  - Acute rheumatic fever
  - Acute glomerulonephritis
Rapid strep (RADT)

- Sensitivity variable
- Most studies agree that culture should be sent if rapid strep negative
- In our institution:
  - Sensitivity
  - Specificity
Treatment

• Indicated to eradicate GAS from throat
• Shortens clinical course
• Decrease risk of transmission
• Decrease risk of suppurative sequelae
• If started within 9 days of onset, shown to prevent Acute Rheumatic Fever
• penicillin, amoxicillin, penicillin G benzathine, macrolides
• NSAIDS
• Single dose of dexamethasone
Case #1

• A 20-month-old boy is brought to his PMD with a barky cough, slight fever and hoarse voice. He has had a restless night.

• On exam, he is playful, smiling and interactive. He has a typical “seal bark” cough but no audible stridor. His chest is clear on auscultation, there is no tracheal tug or chest-wall recession, and his respiratory rate is normal.

• His mother asks whether her child will get worse tonight. The PMD replies that it is possible, and discusses with James’s mother the arguments for and against giving a single dose of oral corticosteroid.
Laryngotracheobronchitis 
-ie Croup

- Most common cause of stridor in children
- Peaks late fall and winter
- Overall incidence 1.5-6%
- Admission rates vary wildly but up to 30%
- 6 mos-3 yrs, peaks at 2 yrs
- Parainfluenza, RSV, influenza A/B, rhinovirus
- Fever, barky cough, hoarse voice, worse at night
- Causes subglottic airway inflammation
- Inspiratory stridor- varying degrees of distress
- Treatment options include cool mist, racemic epinephrine, steroids, and heliox
<table>
<thead>
<tr>
<th>Mental status</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stridor</td>
<td>None</td>
<td>With agitation</td>
<td>Mild at rest</td>
<td>Severe at rest</td>
</tr>
<tr>
<td>Retractions</td>
<td>None</td>
<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>Air entry</td>
<td>Normal</td>
<td>Mild decrease</td>
<td>Moderate decrease</td>
<td>Marked decrease</td>
</tr>
<tr>
<td>Color</td>
<td>Normal</td>
<td>N/A</td>
<td>N/A</td>
<td>Cyanotic</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>Restless when disturbed</td>
<td>Restless</td>
<td>Lethargic</td>
</tr>
</tbody>
</table>
Croup

• Treatment
  – Steroids (decadron, orapred)
  – Racemic epinephrine- effective, requires observation period
  – Humidified mist
  – Heliox
Case #2

- A 10-month-old previously healthy male presents to the ED in acute respiratory distress with stridor. He had a 1 day hx of fever, cough with hoarseness, and no drooling. The patient had been seen earlier in the day at his PMD’s office and was diagnosed with croup. Immunizations were up to date, including Prevnar®. His elder siblings exhibited similar symptoms of croup.
Case #2 continued

• On presentation to the ED, the patient’s vitals were T 39C/103F, P 180 bpm, RR 40, RA sats 88-90%, and BP wnl. The patient was in moderate respiratory distress with appreciable inspiratory stridor at rest. His lungs were CTA.

• He was administered one nebulization of racemic epinephrine and Dexamethasone IM with improvement in stridor and RA sats of 94%. He was then admitted for further observation with a diagnosis of croup.
Case #2 continued

• The next morning patient was found to have worsening stridor and associated RA sats of 86%. A nebulization with racemic epinephrine was given. However, he required oxygen supplement with 1-liter per minute with nasal cannula to maintain SpO2 at 90%.
• CBG: pH was 7.35 with pCO2 of 41.
• CBC showed significant bandemia (44%).
• CXR was nml.
• Lateral neck x-ray revealed subglottic narrowing.
• He was transferred to the PICU for elective intubation. ENT and ID Services were consulted.
Case #2 continued

- During intubation, purulent secretions were immediately evident. Gram stain showed 4+ Gram positive cocci and 3+ PMNs. Culture isolated 4+ *Streptococcus pneumoniae*, 3+ *Hemophilus influenzae* and 3+ *Moraxella catarrhalis*. He was empirically started on Vancomycin, Clindamycin and gentamicin pending culture.

- The patient was extubated within 72 hours and did well with no residual stridor. RA sats was 96%. He became afebrile without any neurological or pulmonary sequelae. He completed a 7-day IV course of Vancomycin and Clindamycin. He was discharged from the hospital after 8 days to complete another 3 days of oral Clindamycin.
Bacterial tracheitis

- Similar to croup and epiglottitis
- Luminal infection with intratracheal membranes
- High fever, toxic, purulent secretions, left shift
- Up to 4-6 years
- Frequently follows viral URI
- Staph aureus- most common etiology
- Antibiotics, intubation, endoscopy
- Xray: shaggy air column, pseudomembranes
Bacterial Tracheitis: Diagnosis

• Diagnosis is based on the presence of upper airway obstruction and one of the following three criteria:
  – (i) Radiographic evidence of intratracheal membranes
  – (ii) laryngotracheal inflammation or purulent secretions on bronchoscopy
  – (iii) tracheal aspirate positive for leukocytes on gram stain or positive culture

• Laboratory studies overall not helpful:
  – Tracheal culture
  – May have elevated WBC count
  – May have a bandemia
  – Blood cultures generally negative
Case #1

• A 6 month previously healthy male infant presented to his pediatrician’s office with a 3 day history of decreased oral intake, cough, drooling, and fever of 101.5°F. He had been evaluated earlier and placed on amoxil for AOM. The infant was not immunized due to religious practices. The infant seemed nontoxic on initial PE with mild to moderate respiratory distress and both inspiratory and expiratory stridor.
A lateral neck radiograph was obtained.
Findings on xray consistent with epiglottitis
Child immediately brought to OR and tracheally intubated under general anesthesia
Culture of airway secretions and blood were negative
He was treated with ceftriaxone and extubated after repeat intraoperative evaluation of the airway 3 days later.
Epiglottitis

- Potentially life threatening bacterial infection
- Includes epiglottis and surrounding tissue (aryepiglottic folds, arytenoids, and supraglottic larynx)
- Some authors prefer the term supraglottitis because these structures more severely affected
- Vocal cords and subglottic airway are usually normal in appearance
- Inflammation and edema can lead to abrupt and rapid obstruction of upper airway
Epiglottitis

- *H. Influenza* type b (Hib) historically the most common cause
- *Streptococcus pneumoniae*, group A B-hemolytic streptococci, nontypable b *H. influenza*, and *Staphylococcus aureus*
- Hib vaccine dramatically decreased the incidence of epiglottitis
  - 1987: 41 cases per 100,000 in children < 5 years old
  - 1997: 1.3 cases per 100,000
Evolving disease...

- Post-vaccination era changes
  - Presentation may be atypical
  - Older age of presentation
    - Mean age of 5.8 years from 1992-1997
    - Mean age of 11.6 years from 1998-2002
Post Hib changes in presentation (typical vs atypical)

- Toxic appearing
- Anxious
- Tripod position
- No viral prodrome
- Rapidly progressive
- High fever
- Drooling
- Dysphagia
- Dyspnea
- Muffled voice
- Stridor is late sign

- Brilli et al reviewed 41 children < 2 years and found:
  - +/- low grade fever
  - Significant viral prodrome
  - “croupy” cough

- Singer and McCabe:
  - Dysphagia, drooling, and changes in voice present < 50% of the time
The point is...

- Not common anymore in its classic form
- Requires high index of suspicion since most of us have never seen it!
- Every attempt to keep child calm
- If lateral neck xray obtained, try hyperextension of neck and look for thumbprinting sign
- Diagnosis made via direct laryngoscopy
- Treatment with broad spectrum abx against b-lactamase producing organisms
- Improvement generally within 24 to 48 hours
Epiglottitis
Peritonsillar abscess

- Extension of tonsillar infection
- More common in adolescents and adults (although pharyngitis/tonsillitis common in all age groups)
- Polymicrobial (aerobic and anaerobic)
- Management depends on degree of infection (cellulitis vs abscess)
PTA: Signs and Symptoms

- Fever
- Trismus
- Drooling
- Hot potato voice
- Poor oral intake
- Uvular deviation
- Unilateral swelling
PTA: Diagnosis

• Clinical diagnosis
• Can be difficult to distinguish cellulitis from abscess
• CT with contrast if unclear
• Ultrasound
PTA: Treatment

- Antibiotics to cover B-lactamase-producing bacteria and anaerobes
- Incision and drainage
- Complications
  - Airway obstruction
  - Mediastinitis
  - Lemierre syndrome- caused by *F. necrophorum*, potentially fatal thrombophlebitis of head and neck veins and systemic dissemination of septic emboli
Retropharyngeal abscess

- Potential space between posterior pharyngeal wall and prevertebral fascia
- 6 months-6 years, peaks at 3 years
- Etiology:
  - lymph node infection
  - penetrating injury
  - vertebral body osteomyelitis extension
  - pharyngitis extension
- Pathogens:
  - GABHS, Strep viridans
  - Staphylococcus aureus and staph epidermidis
  - anaerobes
- Fever, neck swelling, neck pain, and torticollis
- Drooling, decreased po, cervical lymphadenopathy, trismus
Retropharyngeal abscess

- Posterior wall asymmetry- not sensitive
- Treatment
  - Antibiotics- shown to be 75-90% successful
  - incision and drainage
- Complications: aspiration, mediastinitis, airway obstruction, vessel erosion, fascial extension, sepsis
- Imaging:
  - lateral neck: prevertebral soft tissue thickening
  - CT scan with IV contrast – still not always able to differentiate between cellulitis and abscess
Retropharyngeal cellulitis

Retropharyngeal abscess
In Summary

• Respiratory complaints are a common in the Peds ED
• History important (vaccination status, prodrome)
• Observation is an important part of the physical exam! (stridor at rest, drooling, respiratory distress, anxious)
Quick Facts

- **Croup**: gradual prodrome, 6mo-4yrs, winter, barky cough, nontoxic, nml or hoarse voice, low grade fever
- **Epiglottitis**: rapid onset, 2-8yrs, yearlong, high fever, no cough, drooling, tripod, muffled voice, toxic appearance
- **Bacterial tracheitis**: viral prodrome then rapidly deteriorates, 6mo-8yr, winter, high fever, no cough, nml voice, toxic
- **RPA**: viral prodrome then rapidly deteriorates; <5yrs, yearlong, high fever, no cough, (+) sore throat, tripod, muffled voice, toxic
For corticosteroid:
- It will reduce even mild symptoms.
- It will reduce the risk of hospital admission.
- It is relatively safe as a single dose.
- It is easy to administer.

Against corticosteroid:
- Mild symptoms do not require any treatment.
- Before steroids became popular in croup treatment, the risk of hospitalization was low (about 1 in 80).\(^1\)
- The reduction in risk of reattendance within a week after a single dose of corticosteroid given in an emergency department is small. (In one study, 12 children needed to be treated with dexamethasone to avoid 1 reattendance within a week.\(^{13}\))
- Parents may inappropriately use any remaining prednisolone to treat other illnesses.
Case (croup)

• A 23-month-old boy presents to the ED with croup. He has been hospitalized for croup on three previous occasions, twice requiring PICU admission. Between bouts of croup, he is well. He has become agitated since waking 30 minutes earlier. He has loud inspiratory stridor at rest, has subcostal and suprasternal retractions, and has obvious tracheal tug with palpable pulsus paradoxus. His parents gave him a dose of oral prednisolone earlier in the evening.