Paediatric Upper Airway Obstruction

Objectives

• Clinical Presentation and differential diagnosis of Pediatric upper airway obstruction.

• Pathophysiology, microbiology and management of croup

• Identify signs of respiratory distress in young infants with upper airway obstruction.

• Indications for respiratory support and intubation.

• Clinical presentation and management of other causes of pediatric upper airway obstruction.
Background

• Benign and “noisy” nuisance illness like laryngomalacia or rapidly progressing life threatening emergency like epiglottitis/ bacterial tracheitis.

• Stridor is the most characteristic feature of upper airway obstruction.

• Important to implicate a cause and identify signs of respiratory distress in a child presenting with stridor.
The Case

- Timmy is a 3 month old child, brought to urgent care with 2 days history of barking cough and hoarseness.
- Tonight while putting to bed his parents noticed noisy breathing.
History

What would you ask?
History

- Onset, course, duration of illness.
- URTI symptoms, sick contacts any fever?
- Previous episodes of stridor.
- History suggestive of foreign body aspiration.
- Drooling, ability to swallow, voice changes characteristics of stridor.
- Immunization status.
- Allergies, anaphylaxis?
Physical Exam

What would you look for?
Physical Exam

- General appearance
- Vitals (Fever, resp rate, O2 sats, perfusion)
- Work of Breathing
- Stridor
- Cervical adenopathy
- HEENT.
- Air entry, wheezing, crepitations, transmitted sounds.
Workup

What would you order?
Workup

- Croup is a clinical diagnosis.
- Investigations not routinely necessary unless unclear of diagnosis.
- May order NPS for sick patients requiring admission.
- CXR (if unclear diagnosis, suspecting foreign body)
- CBC diff in case if toxic and suspecting bacterial etiology.
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>LARYNGOMALACIA</th>
<th>SUPRAGLOTTIS (EPIGLOTTITIS)</th>
<th>LARYNGOTRACHEITIS (CROUP)</th>
<th>BACTERIAL TRACHEITIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected site</td>
<td>Supraglottis</td>
<td>Supraglottis</td>
<td>Subglottis</td>
<td>Trachea</td>
</tr>
<tr>
<td>Common ages</td>
<td>2–4 weeks, resolves around 18 months</td>
<td>2–6 years</td>
<td>6–36 months</td>
<td>3 months to 6 years</td>
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<tr>
<td>Onset</td>
<td>Slow</td>
<td>Rapid</td>
<td>Slow</td>
<td>Rapid</td>
</tr>
<tr>
<td>Stridor</td>
<td>Inspiratory</td>
<td>Inspiratory, biphasic</td>
<td>Biphasic</td>
<td>Biphasic</td>
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<tr>
<td>Toxic appearance</td>
<td>Uncommon</td>
<td>Yes</td>
<td>Uncommon</td>
<td>Yes</td>
</tr>
<tr>
<td>Drooling</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hoarseness</td>
<td>No</td>
<td>Uncommon</td>
<td>Yes</td>
<td>Possible</td>
</tr>
<tr>
<td>Cough</td>
<td>No</td>
<td>Possible</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Microbiology</td>
<td>None</td>
<td>Bacterial: <em>Haemophilus influenzae</em>, <em>Streptococcus pneumoniae</em>, <em>β-hemolytic streptococci</em>, <em>Staphylococcus aureus</em></td>
<td>Viral: parainfluenza</td>
<td>Bacterial: <em>S aureus</em>, <em>S pneumoniae</em>, <em>H influenzae</em>, <em>Moraxella catarrhalis</em></td>
</tr>
</tbody>
</table>
CROUP:

- Most common cause of stridor in a febrile child.
- Presents in children ages 6 - 36 months, in late fall and winter months.
- Low grade fevers nasal congestion, rhinorrhea.
- Hoarseness and barking cough.
- Signs of lower airway disease are rarely seen.
- Stridor only after significant disease progression.
- Respiratory failure, fever and anxiety is rare
PATHOPHYSIOLOGY:

- Viral laryngotracheitis, most common infectious cause of pediatric upper airway obstruction.
- Inflammation and edema of the subglottis cause airway obstruction.
- Edema cannot expand cartilaginous cricoid ring which projects into the airway lumen.
- May cause collapse of cervical trachea compromising child’s resp status.
Microbiology

• Parainfluenza 1 and 2 virus is predominant.
• Other viruses including RSV, Influenza A and B, human coronavirus, rhinovirus, enterovirus, adenovirus.
• Rarely secondary bacterial infection by S aureus, S pyogenes, S pneumonia.
Radiography:

- Not routinely recommended.
- May identify site of upper airway obstruction if diagnosis is unclear.
- Subglottic narrowing on AP and lateral neck X rays.
- Steeple sign: Progressive narrowing of tracheal air column towards the subglottis.
Steeple Sign on A-P neck X Ray.
Management:

• Commonly mild and self limited.
• Rarely severe episode with significant upper airway obstruction and Respiratory failure.
• Most children outpatient management.
• Less than 15% requiring hospital admission.
• 1-5% requiring intubation during hospitalisation.
• Important to differentiate between milder croup and more aggressive illness.
Rx of Mild Croup:

- (No stridor tachypnea or retractions at rest, may present when agitated)
- Humidified O2 and single dose of oral Dexamethasone 0.6 mg/kg in the ER or clinic.
- Maybe discharged in the care of the parents.
- Parental education about signs of disease progression.
- Humidification and antipyretics.
Moderate Croup:

- Barking cough and stridor with mild to moderate retractions at rest.
- Little or no agitation with normal air entry.
- Managed in ER or in clinic equipped to support children with airway obstruction.
- Oral Dexamethasone (reduced rate of admission by ~86%)
Treatment of Moderate Croup.

• Nebulized racemic Epinephrine.
• Local vasoconstriction will cause rapid improvement of symptoms.
• Observe the child for ~3 hrs for signs of rebound edema.
• Discharge under the care of parents with supportive treatment and education.
Signs of severe illness:

- Biphasic stridor
- Stridor at rest (may improve as disease worsens)
- Tachypnea
- Severe Retractions
- Agitation/ lethargy.
- Desaturations and cyanosis are late signs of severe obstruction.
• Prompt recognition of severe obstruction.
• Rapid and aggressive treatment.
• Decreasing stridor in presence of worsening overall status may be sinister.
• Nebulised epinephrine (repeated every 15-20min)
• Humidified O2 and corticosteroids
• HELIOX
• Avoid interventions causing further agitation and anxiety which may exacerbate respiratory obstruction.
• BMV and intubation very rare (<1% in ED setting).
• Considered only after other means of noninvasive support have been exhausted.
• Non cuffed ETT 0.5 mm less than usual, anticipate difficult intubation.
Recurrent or Atypical Croup:

- Spasmodic Croup/ Nocturnal Croup.
- Similar symptoms.
- Nighttime symptoms, begin suddenly and resolve rapidly.
- Mild viral prodrome.
- Maybe allergic origin, possible role of GERD.
Causes of Recurrent Croup

- Subglottic pathology
- Subglottic stenosis with previous intubation, or subglottic hemangioma if none
- Vocal cord palsy
- Tracheomalacia
- Foreign body
Indications for ENT referral:

- Prolonged course of croup.
- Multiple/ recurrent episodes.
- Outside the usual age of 6 months to 36 months.
- Previous history of intubation.
Bacterial Tracheitis

- Bacterial Croup or membranous croup.
- Rare, potentially life threatening, secondary bacterial infection of the subglottic mucosa.
- Clinical Diagnosis, lower airways are frequently involved.
- High fevers, toxic child, leucocytosis, prefer to lie flat.
- Tracheal cultures polymicrobial, Staph aureus most common. X ray non specific, upper airway endoscopy confirmatory.
Treatment of Bacterial Tracheitis:

- Pulmonary toileting if intubated.
- Vancomycin, to target MRSA and Ceftriaxone to cover Gram negative. (10–14 day course with oral therapy)
- Grams stain and sensitivity of tracheal secretions.
Laryngomalacia

• Prolapse of supraglottic structures into the laryngeal airway on inspiration.
• Most common cause of inspiratory stridor in young children.
• Develop symptoms at birth or in the first 2 weeks of life.
• Maximum symptoms 2-4 months of age.
• Self limited and resolves by 1 yr-2 yr of age.
Laryngomalacia

A

Epiglottis

Short A-E Fold
Redundant arytenoid tissue

B
Differential of congenital stridor:

- Vocal cord palsy
- Tracheal stenosis
- Vascular anomalies
- Subglottic hemangioma
• Clinical diagnosis confirmed by bedside flexible fiberoptic laryngoscopy.
• Treatment for GERD as common accompaniment.
• Resolution of symptoms between 12-24 months.
• ENT evaluation if failure to thrive, cyanotic episodes, worsening stridor.
Epiglottitis

- Inflammation of the Epiglottis.
- Supraglottitis (inflammation of the supraglottic structures)
- Lower incidence due to routine Hib vaccination.
- Strep pneumo, Staph aureus, H paraflu, Klebsiella, Pseudomonas.
• Respiratory distress, high temperatures, muffled voice, drooling and dysphagia.
• Stridor seen.
• Commonly sit in the tripod position
• Clinical diagnosis.
• Avoid oropharyngeal exam may precipitate complete airway obstruction.
• Neck X ray is not necessary but can show thumb print sign, of the enlarged epiglottis.
• Parental antibiotics 3rd gen cephalosporin, vancomycin or clindamycin, narrowed based on culture.
• Role of steroids not established.
• Elective intubation better outcome, visualise the supraglottic structures pre extubation.
Thumb Print sign.

Swollen Epiglottis
Retropharyngeal abscess

- Presents with sore throat, fever, dysphagia, voice change and stridor, may have trismus, neck stiffness.
- Bacterial infection of the retropharyngeal space.
- Anaerobic organisms with aerobic organisms, (Bacteroides, Staph, Strep, H paraflu and Bartonella henselae.)
Figure 4. Lateral XR Showing Retropharyngeal Abscess

Note the widening of the prevertebral soft tissue spaces at the level of the upper cervical vertebrae

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Complications:

- Upper airway obstruction
- Jugular vein thrombosis
- Aspiration pneumonia
- Necrotising fasciitis.
- Sepsis and erosion in the carotid artery.
Management:

- Assess Airway and Breathing, support as needed.
- Imaging (MRI neck and base skull)
- CBC diff, blood C/S
- IV antibiotics (Cetriaxone, Metronidazole)
- ENT consult for drainage, with Culture of aspirate.
Tracheomalacia:

- Defect of tracheal cartilage, dynamic collapse during respiration.
- Primary or Secondary.
- Airway collapse seen on expiration.
- Stridor, wheezing, recurrent barking cough, frequent resp infections.
- Definitive diagnosis during bronchoscopy with child breathing spontaneously.
- PPV at night or with respiratory infections. Tracheal stent placement in severe cases.
Test Your Knowledge

3 month old presents with worsening stridor in the past month, mother notes that it is better when the child is prone, worsens with feeding supine position, agitation. Most common cause of congenital stridor in infants?

A. Absence of aryepiglottic folds
B. Paralysis of vocal cords.
C. Tracheomalacia
D. Laryngomalacia
The Answer

- Laryngomalacia
Test Your Knowledge

• 3 year old child presents to the ER, rapid onset of respiratory distress, high temperature, muffled voice, drooling, prefers to sit leaning forward on outstretched hands, which of the following is true re

A. Steeple sign is classic finding on lateral neck X ray.
B. Diagnosis should be confirmed with flexible fibreoptic laryngoscopy.
C. Most common organism is Hemophilus influenzae type B.
D. Can send the child home after oral dexamethasone.
The Answer

• Most common organism is Hemophilus influenzae b.
Summary

• Croup is a clinical diagnosis
• Identify the need for respiratory assistance (assess ABC’s, agitation, fatigue, retractions, paradoxical breathing)
• Consider other causes in differential for child with upper airway obstruction
• In a child with respiratory distress differentiate between upper and lower tract signs.
• PO dexamethasone lowers hospitalization rates in croup.
• Provide an action plan and educate about the red flags when sending a child with croup home.