URI or something else?

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• Respiratory symptoms are the number one cause of visits to pediatricians
• Minor health impact for the kid

Objectives

• Know that upper respiratory tract infections and airway obstruction in infants can lead to respiratory distress.
• Know the clinical presentation of upper airway obstruction, infectious and congenital, how to diagnose it and treatment principles.
• Know that congenital lung malformations can present as mild to moderate respiratory distress.
• Know diagnostic methods for congenital lung malformations and treatment principles.

Disclosures

• I have no disclosures

Case #1

• 60 day-old-female with respiratory distress.
• Admitted and discharged the week before secondary to resp. distress and mild stridor, presumed to be URI and laryngomalacia. Bedside laryngoscopy showed no abnormalities.
• Now again with mild URI symptoms, mild to moderate stridor, respiratory distress.

Fig. 1
Pediatric Airway Anatomy

- Small, short airway
- Large tongue
- Funnel shaped larynx
- Epiglottis is short, narrow and angled away
- Large occiput
- Small peripheral airways

Upper Airway

Respiratory Physiology

- Hagen–Poiseuille law
- Reynolds number (Re)
- Venturi principle
- Bernoulli principle

Resistance is inversely proportional to $r^4$
Extrathoracic Obstruction

Fig. 7

Intrathoracic Obstruction

Fig. 8

Case # 2

• 4 month old, failure to thrive, noisy breathing since birth, currently with URI and significant respiratory distress with inspiratory stridor, what is the most likely diagnosis?
  a) Croup
  b) Laryngomalacia
  c) Bacterial tracheitis
  d) Foreign body

Laryngomalacia

• Collapse of supraglottic structures during inspiration
• Etiology:
  – Delayed maturation or hypotonia
  – Redundant soft tissue in the supraglottis
  – Foreshortened or tight aryepiglottic fold
  – Neuromuscular disorders
  – Supraglottic edema

Clinical Presentation

• Stridor
• 4-8 months is the loudest
• 12 to 18 months when it resolves
• Worsens with URI, supine and when feeding or sleeping
• In some infants, the stridor may be present only during sleep or relaxation

Diagnosis and Treatment

• History and physical examination
• Flexible fiberoptic laryngoscopy
• Severity: Degree of airway obstruction and clinical impact
• Mild laryngomalacia → observation
• Moderate or severe laryngomalacia → Referral to ENT
Moderate or Severe Laryngomalacia

- Cyanosis
- Apnea
- Hoarseness
- Feeding difficulty
- Failure to thrive
- Atypical stridor

Case # 3

- Male 3 y/o previously healthy seen by your partner today diagnosed with viral pharyngitis.
- Patient’s dad is calling you now because he looks sick, running fever, drooling, prefers to stay sit and seems to be having problems breathing, he also has this harsh noisy breathing.
- In the ER (30 min later) patient is freighted, looks toxic, significant respiratory distress, drooling, and inspiratory stridor, no “croupy cough”, has muffled cry.

Fig. 9

Fig. 9. a

Laryngomalacia video

Laryngomalacia surgery

a) Croup
b) Epiglottitis
c) Retropharyngeal abscess
d) URI
e) Foreign body
**Epiglottitis**

- Inflammation of the epiglottis and adjacent supraglottic structures
- Etiology is infectious with some exceptions
- Can progress to life-threatening airway obstruction.

**Infectious Agents**

- **Immune competent host**: H. influenzae type b, H. influenzae (types A, F, and non-typeable), H. parainfluenzae, S. pneumoniae, Staphylococcus aureus, Beta-hemolytic streptococci: Groups A, B, C, F, G
- **Immunocompromised hosts**: Also by Pseudomonas aeruginosa and Candida species
- **Virus**: HSV 1, Varicella zoster virus, Parainfluenza virus type 3, Influenza B viruses, EBV virus

**Clinical Presentation**

- “The four D’s” with abrupt onset
- Difficulty breathing (80 %)
- Stridor (80 %)
- Muffled or hoarse voice (79 %)
- Pharyngitis (73 %)
- Fever (57 %)

**Diagnosis**

- **History**
- **Radiological examination**
  - Lateral neck – classic sign
- **Direct laryngoscopy**
  - Stridor
  - Drooling
  - Dysphagia
  - Respiratory distress


Fig. 10

Fig. 11
Treatment

- Securing airway
- Respiratory support as needed
- Antibiotics

Laryngotracheitis

- Most common infectious cause of upper airway obstruction in children
- Stridor
- Barking cough
- 6 to 36 months
- Parainfluenza types 1 and 2
- Bacterial

Diagnosis

- Clinical signs:
  - Barking cough
  - Hoarseness
  - Stridor (inspiratory)
- Laboratories
- Direct laryngoscopy
- Radiographic studies
Laryngotracheitis
- < 15% hospitalization
- 1-5% require intubation
- Biphasic stridor
- Rapid respiration
- Retractions
- Agitation.
- Oxygen desaturation and cyanosis are late signs of severe obstruction

Treatment
- Mild:
  - Humidified air and a single dose of steroids
- Moderate:
  - Upper airway support capabilities
  - Steroids, racemic epinephrine, humidified oxygen.
- Severe:
  - Moderate plus:
    - Repeated racemic epinephrine
    - Heliox
  - Noninvasive and invasive ventilatory support.

Recurrent or Atypical Croup
AKA Spasmodic or Nocturnal
- Night time symptoms
- Begin suddenly and resolve rapidly
- Allergic
- Alternative diagnoses should be considered
- Atypical presentation, frequency or length of the disease should raise concerns.

Bacterial Tracheitis
- Bacterial infection of subglottic area
- Almost always a secondary infection
- Mucosal inflammation
- Purulent secretions
- Pseudomembranes
- Polymicrobial: S. aureus, S. pneumonia, S. pyogenes, H. influenza, and Moraxella catarrhalis

Clinical Presentation
- Preceding URI
- Rapid deterioration with fever, resp. distress
- Lower airway involvement
- ~ 50% will have concurrent pneumonia
- Airway obstruction in this disease is often profound (53%–91%) will require intubation
Diagnosis

• Biphasic stridor non responsive to medical treatment.
• Able to swallow their secretions
• Often prefer to lie flat.
• Neck radiography: no pathognomonic sign.
• CXR: may show lower airway involvement
• Airway endoscopy

Management

• Respiratory support
• Antibiotics
• Bronchoscopy may be needed.
• Extubation is recommended when patient is:
  – Afebrile
  – Secretions are manageable
  – Air leak is present

Case # 4

• 3 y/o with asthma, admitted for asthma exacerbation.
• Positive end expiratory wheezing – loud
• Respiratory distress
• Patient is alert and awake.
• 4th admit in last 3 months
Tracheomalacia

- Abnormal tracheal cartilage.
- Intrinsic abnormality – Type I: weakens the typically rigid tracheal rings
- Extrinsic compression – Type II
  - cardiovascular structures, tumors, lymph nodes, or other masses
- Acquired – Type III: usually secondary to prolonged intubation or tracheostomy.

What happened with case # 1?

CONGENITAL LUNG MALFORMATIONS

http://embryology4genius.weebly.com/development-of-lung-buds.html
**Phases Of Lung Development**

http://ehp.niehs.nih.gov/0901856/

**CONGENITAL LUNG MALFORMATIONS**

- Pulmonary agenesis
- Pulmonary hypoplasia
- Congenital cystic malformation
- Pulmonary sequestration
- Bronchogenic cysts
- Lung hernia

**Pulmonary Agenesis**

- Complete absence of the lung
- Bilateral is incompatible with life
- Unilateral: presents as central airway complications.
- Associated with other congenital anomalies (VACTERL)
- CT is diagnostic

**Pulmonary Hypoplasia**

- Decrease in number of alveoli and airway generations
- Results from interruption of normal lung development due to lung constraint
- Bilateral: oligohydramnios, abnormal rib cage.
- Unilateral: Diaphragmatic hernia
- Later presentation can be seen with stress or respiratory viral infection.

**Congenital Cystic Malformation**

- Congenital pulmonary airway malformation (CPAM)
- Hamartomatous or dysplastic lung tissue
- Generally confined to 1 lobe
- Embryologic injury before the 35th day of gestation
- Five histologic types
### Clinical Presentation

- Newborn period or early infancy
  - Respiratory distress
  - Recurrent respiratory infections
  - Pneumothorax
- Mid-childhood
  - Recurrent respiratory infections
  - Chest pain

### Diagnosis

- Prenatal ultrasound
- High index of suspicion
- Physical:
  - Diminished breath sounds
  - Mediastinal shift away from lesion
- CXR
- CT Scan

### Treatment

- Surgery is indicated for symptomatic patients
- Asymptomatic infants
  - True resolution is very rare
  - Sarcomatous and carcinomatous degeneration have been described
  - Surgical resection by 1 year is recommended
Pulmonary Sequestration

- Lung tissue that does not connect to the bronchus
- Arterial supply is central
- Venous drain is to the cava or pulmonary veins
- Originates from a diverticular outgrowth of the esophagus, or inflammation.

Clinical Presentation

- Solid space occupying lesion in the thorax
- Systolic murmur can be heard.
- Recurrent pulmonary infections
- Intrapulmonary sequestration
  - Hemoptysis
- Extrapulmonary sequestration
  - Recurrent pneumonias
  - CHF

Always keep your eyes open for atypical presentation of respiratory problems.
References

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