Common Pediatric Pulmonary Issues

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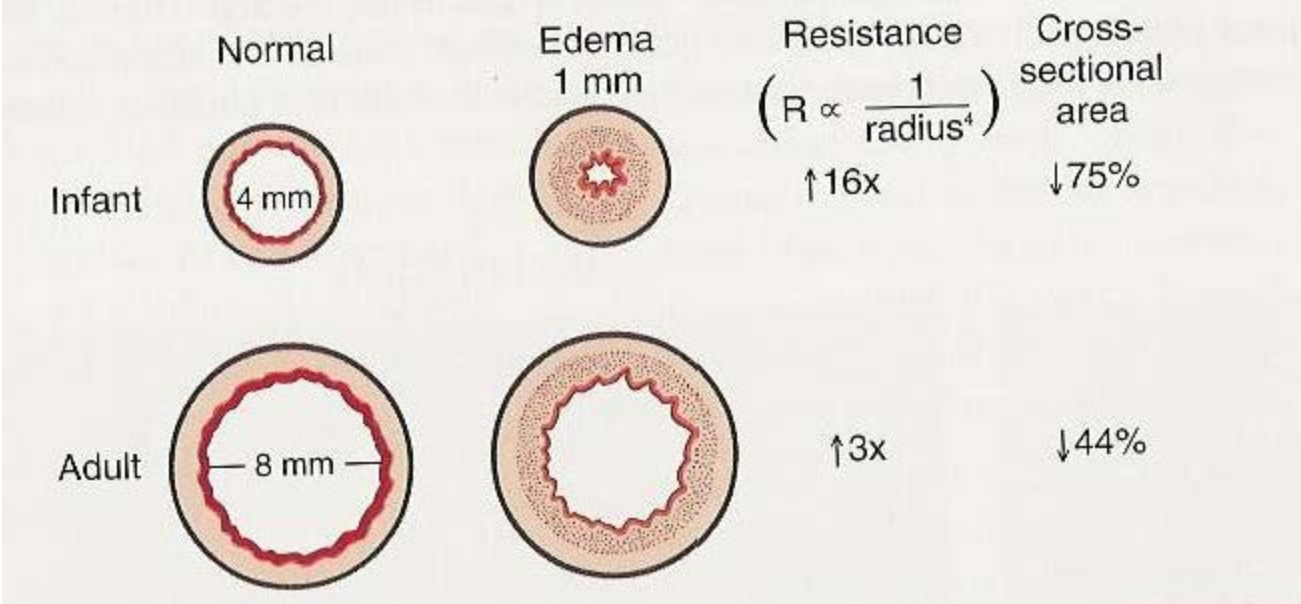
Objectives

- Learn common causes of upper and lower airway disease in the pediatric population
- Learn basic management skills for common pediatric pulmonary problems

Upper Airway Disease

- Extrathoracic structures
  - Pharynx, larynx, trachea
- Stridor
  - Externally audible sound produced by turbulent flow through narrowed airway
  - Signifies partial airway obstruction
  - May be acute or chronic

Remember Physics? Poiseuille's Law



Acute Stridor

- Febrile
  - Laryngotracheitis (croup)
  - Retropharyngeal abscess
  - Epiglottitis
  - Bacterial tracheitis
- Afebrile
  - Foreign body
  - Caustic or thermal airway injury
  - Angioedema

Croup - Epidemiology

- Usually 6 to 36 months old
- Males > Females (3:2)
- Fall / Winter predilection
- Common causes:
  - Parainfluenza
  - RSV
  - Adenovirus
  - Influenza

Croup - Pathophysiology

- Begins with URI symptoms and fever
- Infection spreads from nasopharynx to larynx and trachea
- Subglottic mucosal swelling and secretions lead to narrowed airway
- Development of barky, “seal-like” cough with inspiratory stridor
- Symptoms worse at night

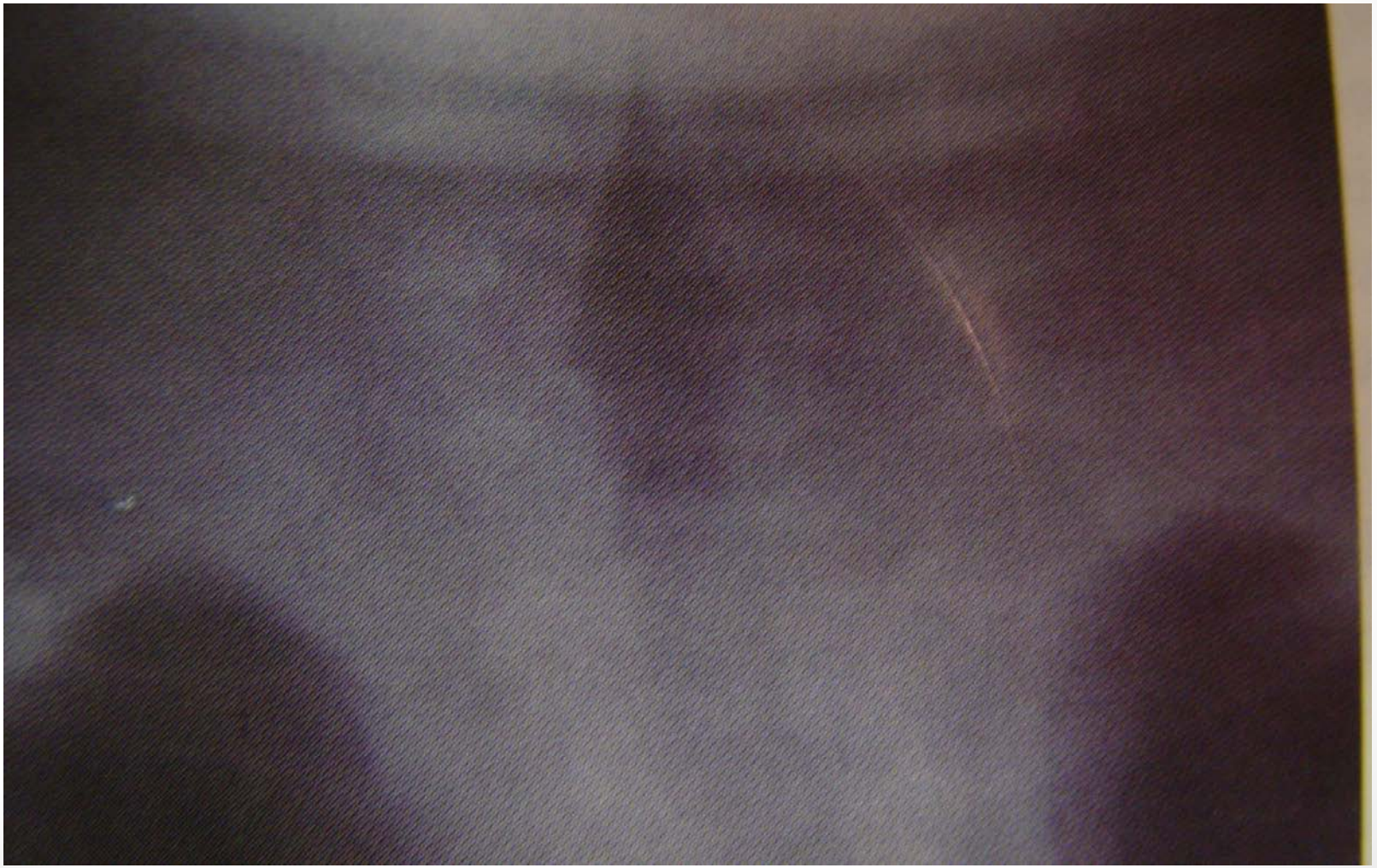
Croup - Management

- Keep child as calm as possible, usually sitting in parent's lap
- Humidified saline via nebulizer
- Steroids (Dexamethasone 0.6 mg/kg)
  - Oral and IM route both acceptable
- Racemic Epinephrine
  - <10kg: 0.25 mg via nebulizer
  - >10kg: 0.5 mg via nebulizer

Croup – Management

- Must observe for 4 hours after use of racemic epinephrine
- Admit if patient has recurrent stridor or any signs of respiratory distress
- Consider AP/Lateral neck films
  - Steeple sign

Croup – Steeple Sign



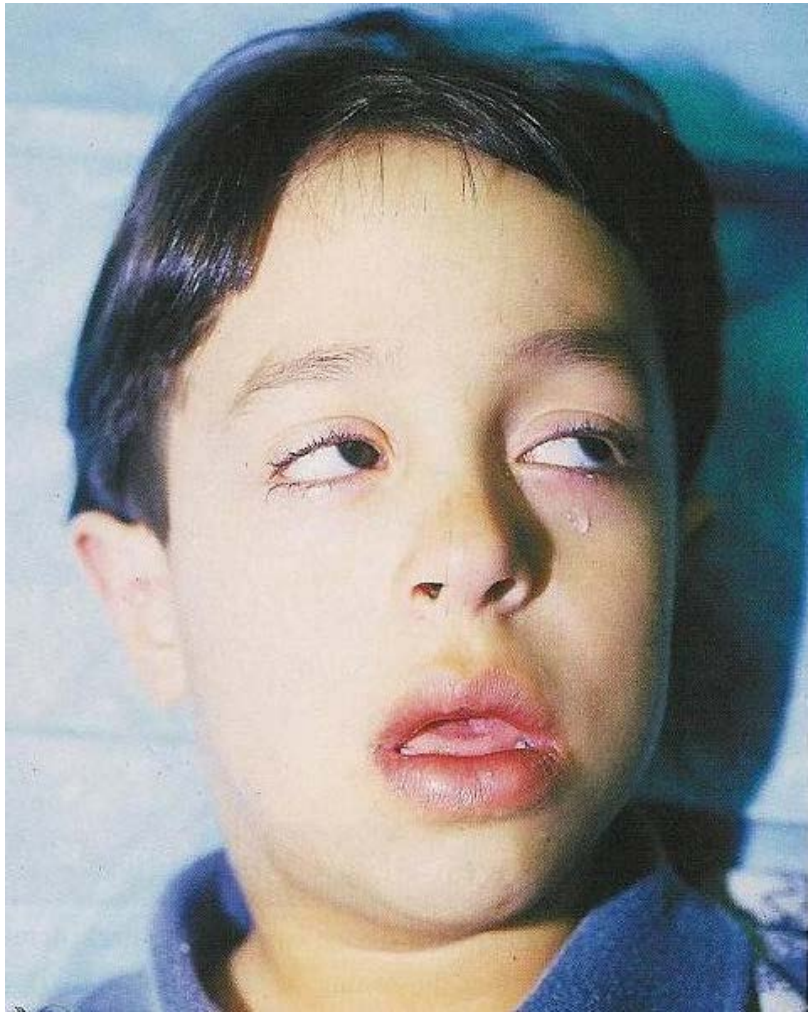
Retropharyngeal Abscess

- Etiology
  - Prior pharyngitis, otitis
  - Penetrating wound to posterior pharynx
- Pathophysiology
  - Cellulitis and suppurative adenitis of lymph node in prevertebral fascia

Retropharyngeal Abscess

- Presentation:
  - Fever
  - Difficulty swallowing
  - Drooling
  - Sore throat
  - Changes in voice
  - Stiff neck

Retropharyngeal Abscess



Retropharyngeal Abscess

- Diagnosis
  - Lateral soft tissue neck X-ray
    - Retropharyngeal soft tissue at level of C-3 is greater than 5mm
    - Retropharyngeal soft tissue is more than 40% of the body of C-4 at that level
  - Soft tissue neck CT
    - Better delineate extent of lesion

Retropharyngeal Abscess

Figure 14.43 Retropharyngeal Abscess

Retropharyngeal Abscess

- Management:
  - Assess and secure patent airway
  - Antibiotic coverage
    - Nafcillin and Clindamycin
  - Analgesia
  - ENT consult for operative incision and drainage of abscess

Epiglottitis

- Life threatening emergency!!!

- Clinical presentation:
  - Sudden onset high fever
  - Moderate to severe respiratory distress
  - Stridor
  - Drooling
  - Toxic appearing child
    - Sits leaning forward in a sniffing position with an open mouth

Epiglottitis

- Not seen as frequently today
  - *Haemophilus influenza* type B vaccine
- Other bacterial causes include staphylococcus and streptococcus
- Diagnosis:
  - Lateral soft tissue neck
    - Epiglottis is rounded and blurred (thumbprint sign)

Epiglottitis

Figure 14.40 Epiglottitis

Epiglottitis

Figure 14.38 Epiglottitis

Epiglottitis

- Management:
  - Keep child as calm as possible, preferably in parent's lap
  - Surgical consult to establish definitive airway in operating room
  - Start broad spectrum antibiotic coverage
    - Second or third generation cephalosporins

Bacterial Tracheitis

- Bacterial complication of a viral URI
  - *Staphylococcus aureus*
  - *Haemophilus influenza*
  - Streptococci and pneumococci

- Pathophysiology:
  - Swelling of tracheal mucosa below vocal cords
  - Thick, purulent secretions may lead to mucous plugging

Bacterial Tracheitis

- Presentation similar to croup
  - More toxic appearing child
  - Does not respond well to typical croup treatment
  - Outside the typical age group for croup

- Soft tissue neck film
  - Edema with an irregular border of the subglottic tracheal mucosa
  - “Subglottic membrane”

Bacterial Tracheitis

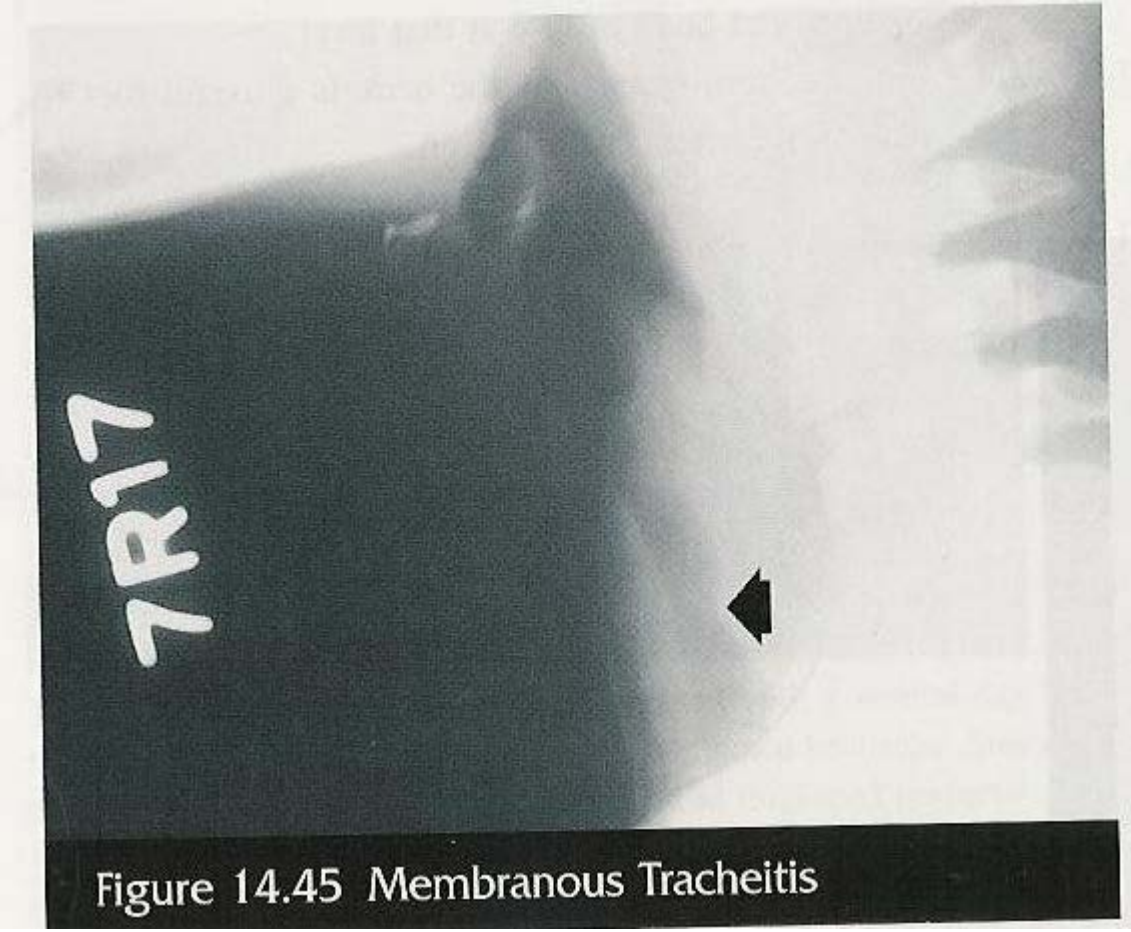


Figure 14.45 Membranous Tracheitis

Bacterial Tracheitis

- Management
  - Assess and maintain patent airway
  - Frequent suctioning if intubated
  - ENT consultation
  - Broad spectrum antibiotic coverage

Foreign Body Aspiration

- Consider this when:
  - Child has recurrent wheezing or stridor unresponsive to typical therapy
  - Afebrile
  - Recurrent pneumonia in same location

- Symptoms may be:
  - Acute – large item in large airway
  - Chronic – small item in small airway; asymptomatic period common

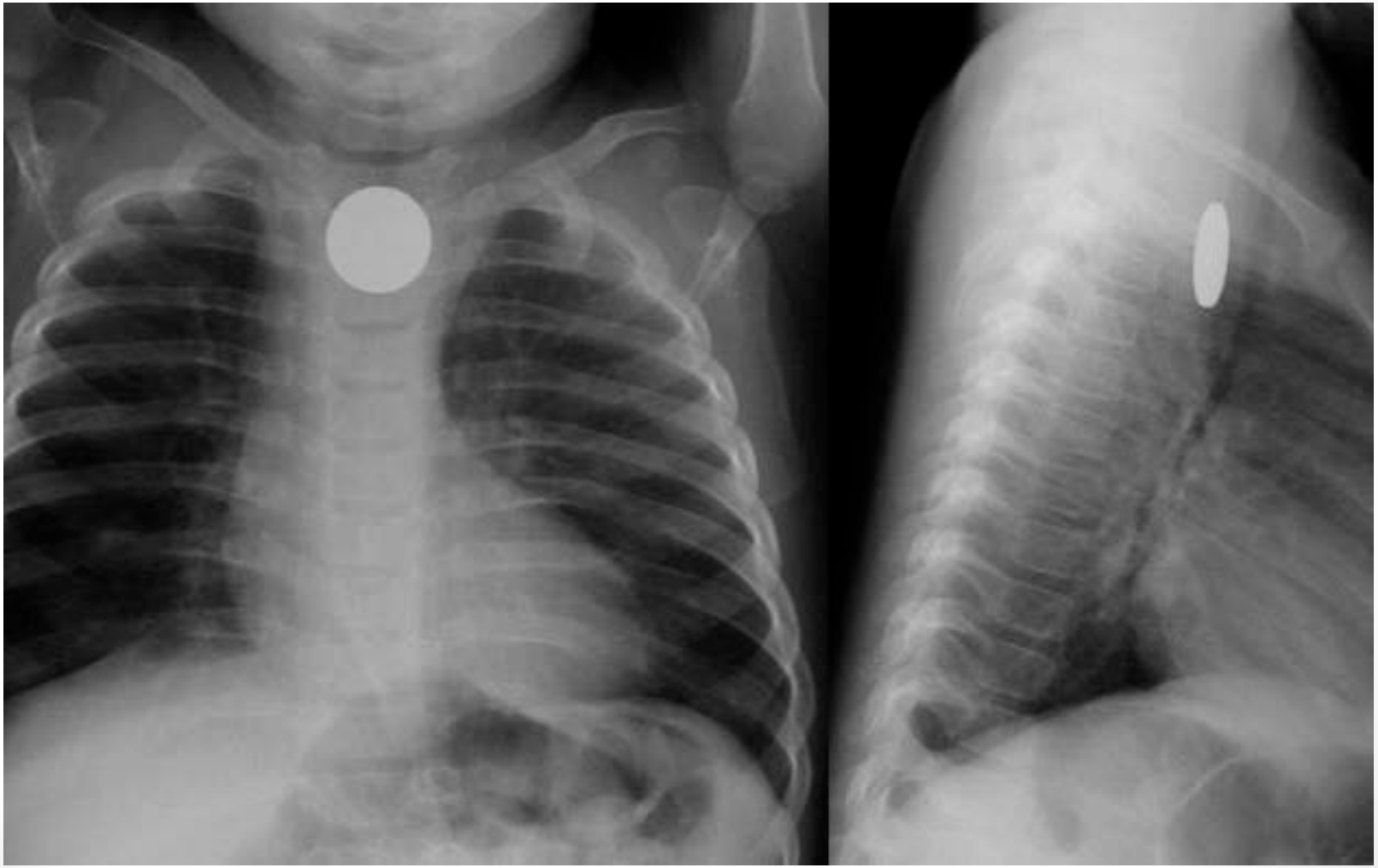
Foreign Body Aspiration

- Common items found:
  - Coins
  - Nuts or seeds
  - Popcorn, small candy
  - Beads, buttons, safety pins
  - Balloons, latex gloves
  - Toys with small or loose parts

Foreign Body Aspiration

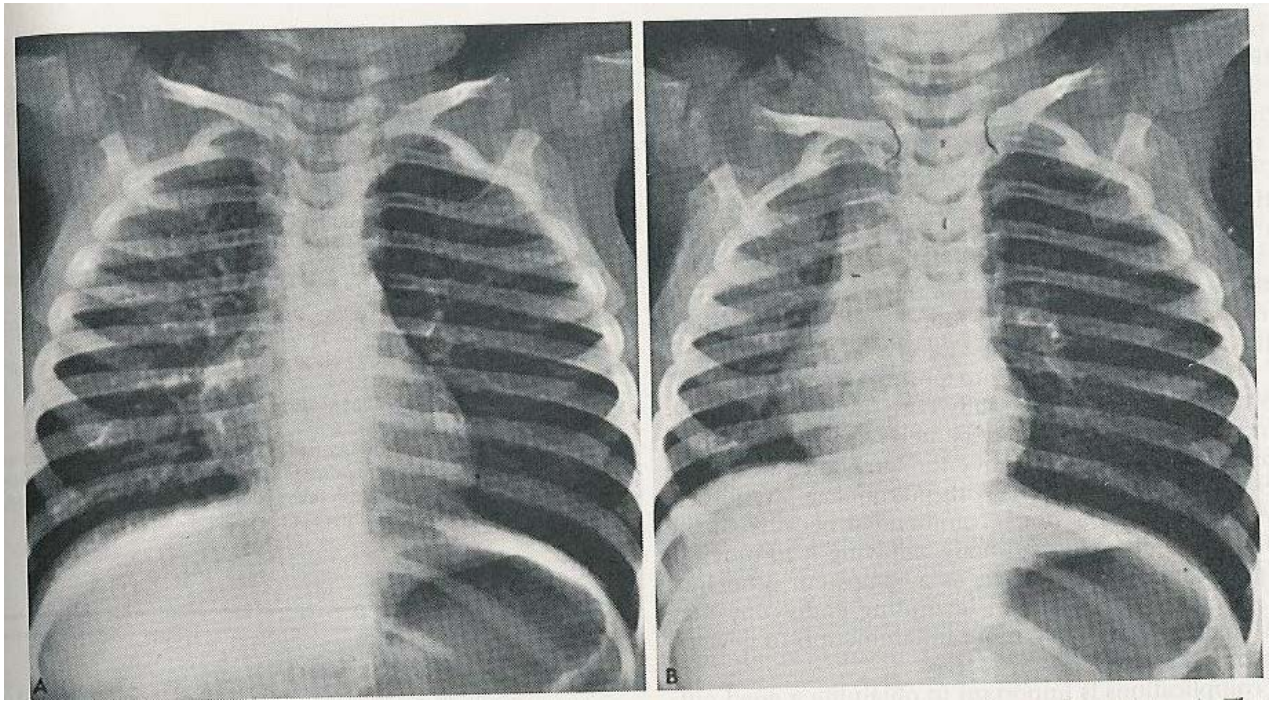
- Diagnosis:
  - Soft tissue films of neck
  - PA and lateral chest films
  - Bilateral decubitus films
  - Inspiratory and expiratory chest films
    - Look for air trapping, mediastinal deviation, atelectasis
    - Foreign body itself may be radio-opaque or radio-lucent

Foreign Body Aspiration



Foreign Body Aspiration

Foreign Body Aspiration



Other Upper Airway Problems

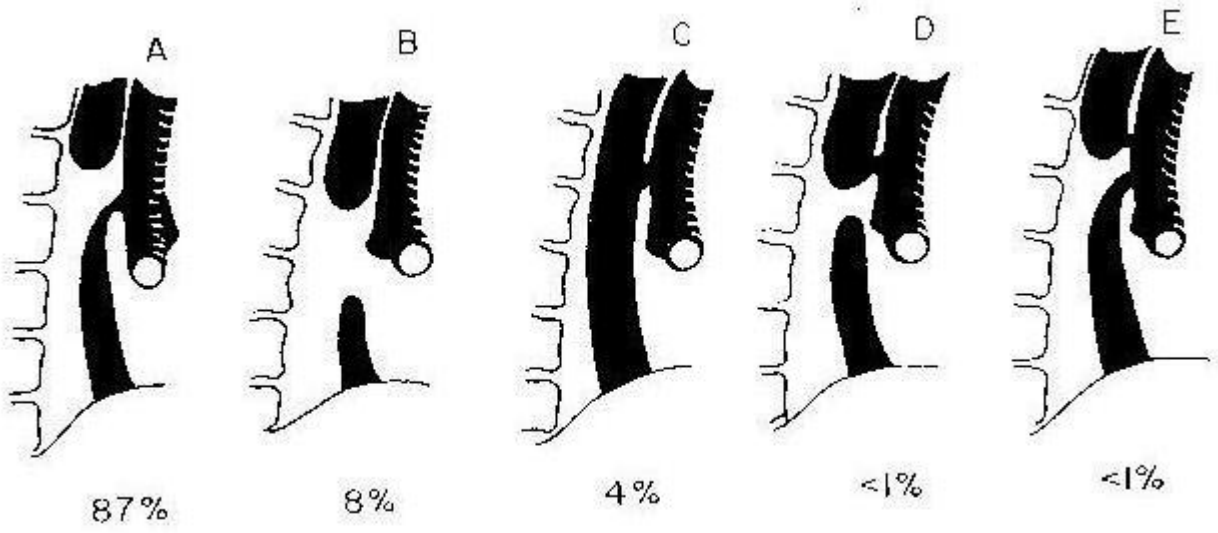
- Peritonsillar Abscess
  - Asymmetry of tonsilar pillars
  - Deviation of uvula
- Subglottic Stenosis
  - Common in premature infants that underwent prolonged intubation
- Tracheo/Laryngomalacia
  - Absence of abnormal breath sounds when infant prone

Other Upper Airway Problems

- Neoplasms:
  - Papilloma
  - Vocal cord nodules
- Bronchogenic cysts
- Cystic hygroma (Lymphangioma)
- Vascular rings
- Tracheo-esophageal fistulas
- Laryngeal webs

Papillomas

Tracheo-Esophageal Fistulas



Lower Airway Illnesses

- Intrathoracic Structures
  - Mainstem bronchi, bronchial tree, bronchioles
- Wheezing and Rales
  - Obstruction of intrathoracic airway
  - Heard during expiration and inspiration
  - Air trapping and atelectasis
  - Diminished air movement

Lower Airway Illnesses

- Asthma
- Bronchiolitis
- Bronchopulmonary dysplasia
- Pneumonia

Asthma

- Reversible airway obstruction:
  - Bronchospasm of lower airway
  - Swelling of airways and increased mucous production (inflammation)

Asthma - Triggers

- Atopic conditions
  - allergic rhinitis, eczema, chronic sinusitis
- Allergen exposures
  - Cigarette smoke
  - Pets
  - Carpeting, ceiling fans (dust mites)
  - Cockroaches
- Viral illnesses

Asthma - Presentation

- Cough
- Wheeze
- Shortness of breath
- Chest tightness
- Vomiting
- History:
  - Frequency, duration of symptoms
  - Previous admissions, PICU stays
  - Previous steroid use, varicella exposure

Asthma – Physical Exam

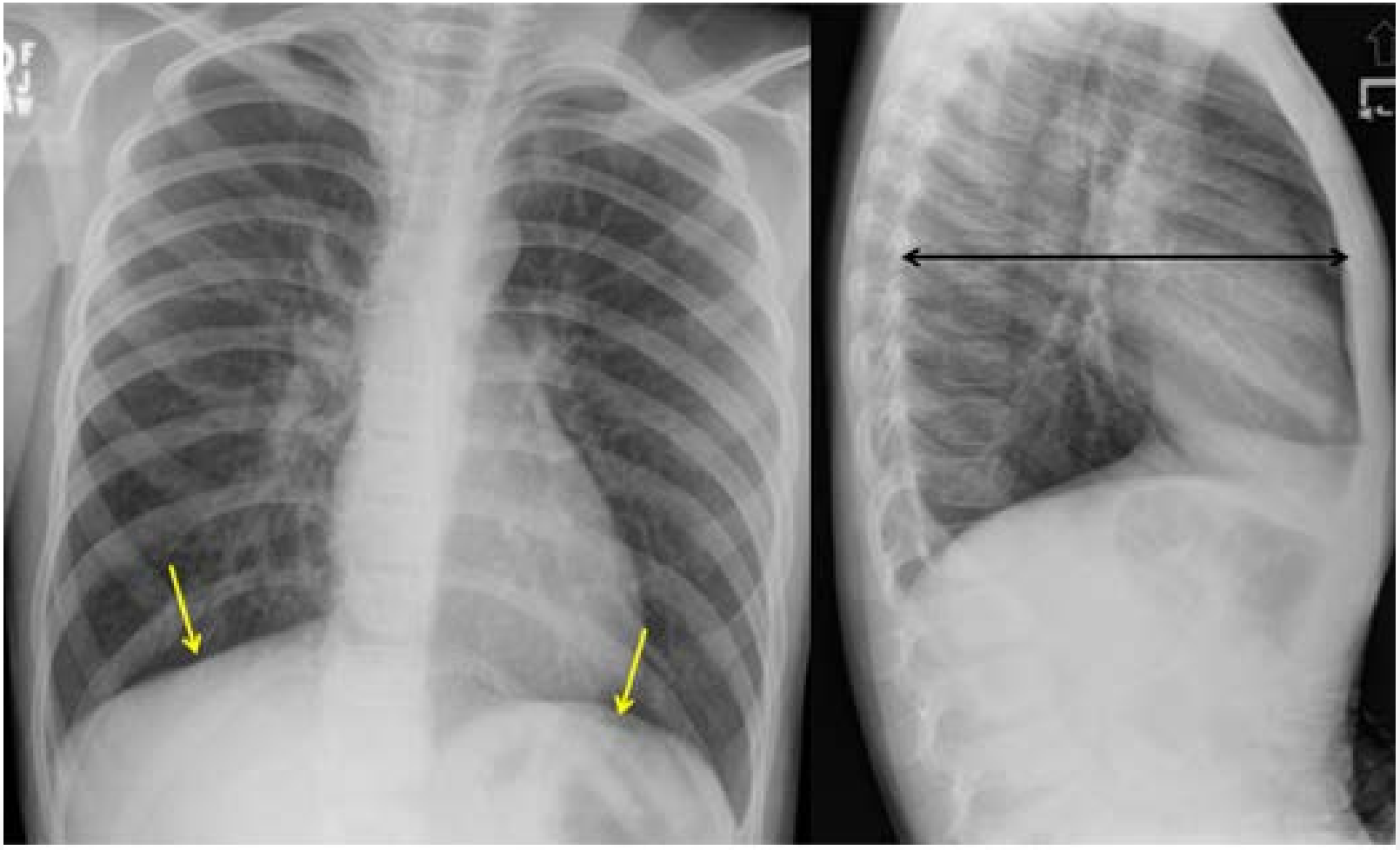
- Assess work of breathing
  - Retractions
  - Nasal flaring
  - Increased respiratory rate
- Assess for hypoxia
- Lung exam
  - Wheezing
  - Prolonged expiratory phase
  - Rhonchi or rales
  - Air movement
  - Absence of wheezing is worrisome

Asthma

- When to order X-ray?
  - Hypoxia
  - Asymmetric lung sounds
  - First time wheezing

- Chest X-ray findings:
  - Hyperinflation
  - Peribronchial cuffing
  - Atelectasis

Asthma – Chest x-ray



Asthma - Management

- Bronchospasm
  - Beta-2 agonists
    - Albuterol – administer via nebulizer with oxygen
      - <10kg: 2.5 mg
      - >10kg: 5.0 mg
  - Anticholinergics
    - Atrovent (peanut allergy a contraindication for atrovent administered by metered dose inhaler, not for nebulized solution)
      - <10kg: 250 mcg
      - >10kg: 500mcg

Asthma - Management

- Inflammation
  - Corticosteroids
    - Prednisone
      - Loading dose 2mg/kg
      - Max dose 60mg
      - Orapred liquid comes in 15mg/5ml solution – tastes great!
    - Solumedrol
      - Loading dose 2mg/kg
      - Max dose 125mg
      - Use when patient vomiting, unable to hold down oral medications
      - Same efficacy as oral steroids

Asthma – Management

- Non-responsive to traditional care:
  - Magnesium Sulfate
    - 25 mg/kg/dose
  - Continuous albuterol
    - 10mg/hour
  - Terbutaline
    - 0.01 mg/kg/dose SQ every 20 minutes x2
    - 0.1-0.4 mcg/kg/minute drip
  - Epinephrine
    - 0.01 mg/kg/dose SQ every 20 minutes x4
  - Consider ketamine as sedative if patient needs intubation

Bronchiolitis

- Similar to asthma but symptoms are caused by viral etiology:
  - RSV
  - Parainfluenza
  - Adenovirus
  - Rhinovirus
  - Mycoplasma

Bronchiolitis

- RSV induces damage to the bronchial epithelium resulting in lower airway inflammation
- Bronchospasm (with history of atopy)
- Most common in winter, early spring
- Age typically < 3 years old
- Symptoms worse in premature infants

Bronchiolitis - Symptoms

- Cough
- Tachypnea
- Accessory muscle use
- High pitched wheezing
- Fine inspiratory crackles; rhonchi
- Copious, thick nasal secretions
- Low grade fever

Bronchiolitis

- Associated findings:
  - Otitis media
  - Pneumonia
  - Apnea (premature infants)
  - Dehydration

- Chest X-ray:
  - Hyperinflation / air trapping
  - Increased perihilar markings
  - Areas of atelectasis

Bronchiolitis - Management

- Mainly supportive
  - Nasal saline spray, frequent suctioning
  - Adequate PO intake (Pedialyte, juice)

- Pharmacologic
  - Albuterol – may diminish wheezing
  - Racemic Epinephrine – may diminish tachypnea
  - Steroids – controversial – consider if history of atopy

Bronchiolitis

- Infants infected with RSV more likely to wheeze with future viral infections due to airway remodeling
- Appropriate Discharge Criteria:
  - No hypoxia
  - Taking PO fluids well
  - No tachypnea or increased work of breathing
  - Wheezing may still be present – consider use of Albuterol MDI with spacer and face mask
  - Reliable parents, follow up

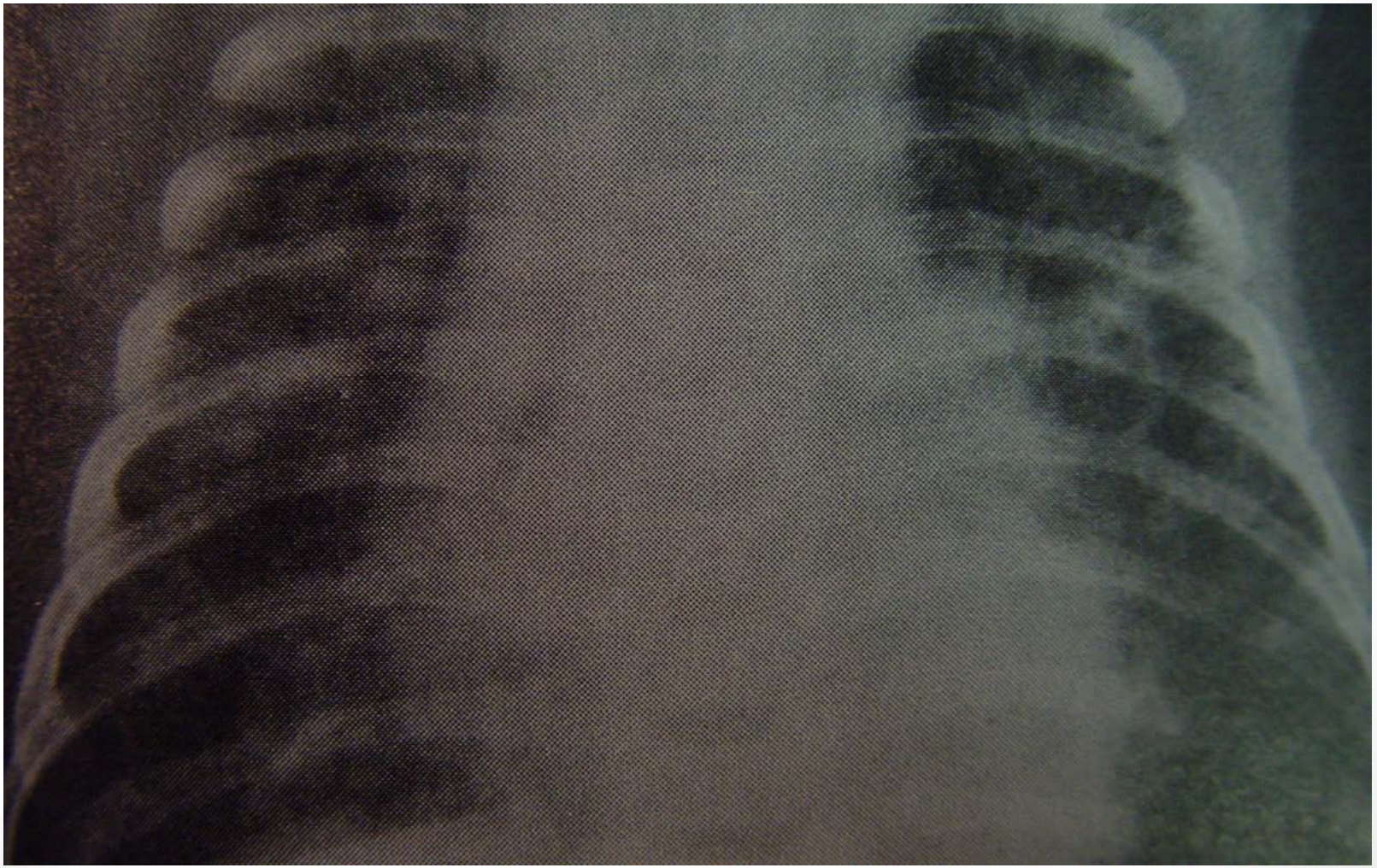
Bronchopulmonary Dysplasia (BPD)

- Chronic lung disease of premature infants that required prolonged respiratory support in NICU:
  - Lung immaturity
  - Oxygen therapy
  - Positive pressure ventilation
  - Infection and inflammation
  - Poor nutrition

BPD

- Symptoms and Findings:
  - Tachypnea, retractions at rest or during mild URI
  - Lungs hyperinflated (increased AP diameter)
  - Crackles, wheezes, decreased breath sounds
  - Chronic CO_2 retention
  - CXR – hyperinflation, cystic areas, atelectasis, coarse appearing

BPD – Chest X-Ray



BPD - Management

- Supportive care
  - Humidified oxygen
  - Frequent suctioning
  - Adequate hydration
  - Assisted ventilation
  - Trial of beta-agonist
- Screen for RSV infection
  - Most infants will receive Synagis

Pneumonia

- Etiology differs in age groups
- Chest X-ray may be useful to help differentiate between different etiologies
- Symptoms and findings:
  - Cough, tachypnea, hypoxia
  - Asymmetric breath sounds, rales, decreased air movement
  - Fever
  - Elevated WBC with left shift

Pneumonia - Neonatal

- Bacterial causes:
  - *E. Coli*
  - Group B Strep
  - *Staph aureus*
  - *Listeria monocytogenes*

- Treatment:
  - Ampicillin and Gentamycin

Pneumonia

- *Chlamydia trachomatis*
  - Consider this in 3 week old to 4 month old patients
  - Afebrile pneumonitis with congestion, wheezing, fine diffuse crackles
  - Paroxysmal cough
  - Prior concomitant inclusion conjunctivitis
  - Treat with erythromycin

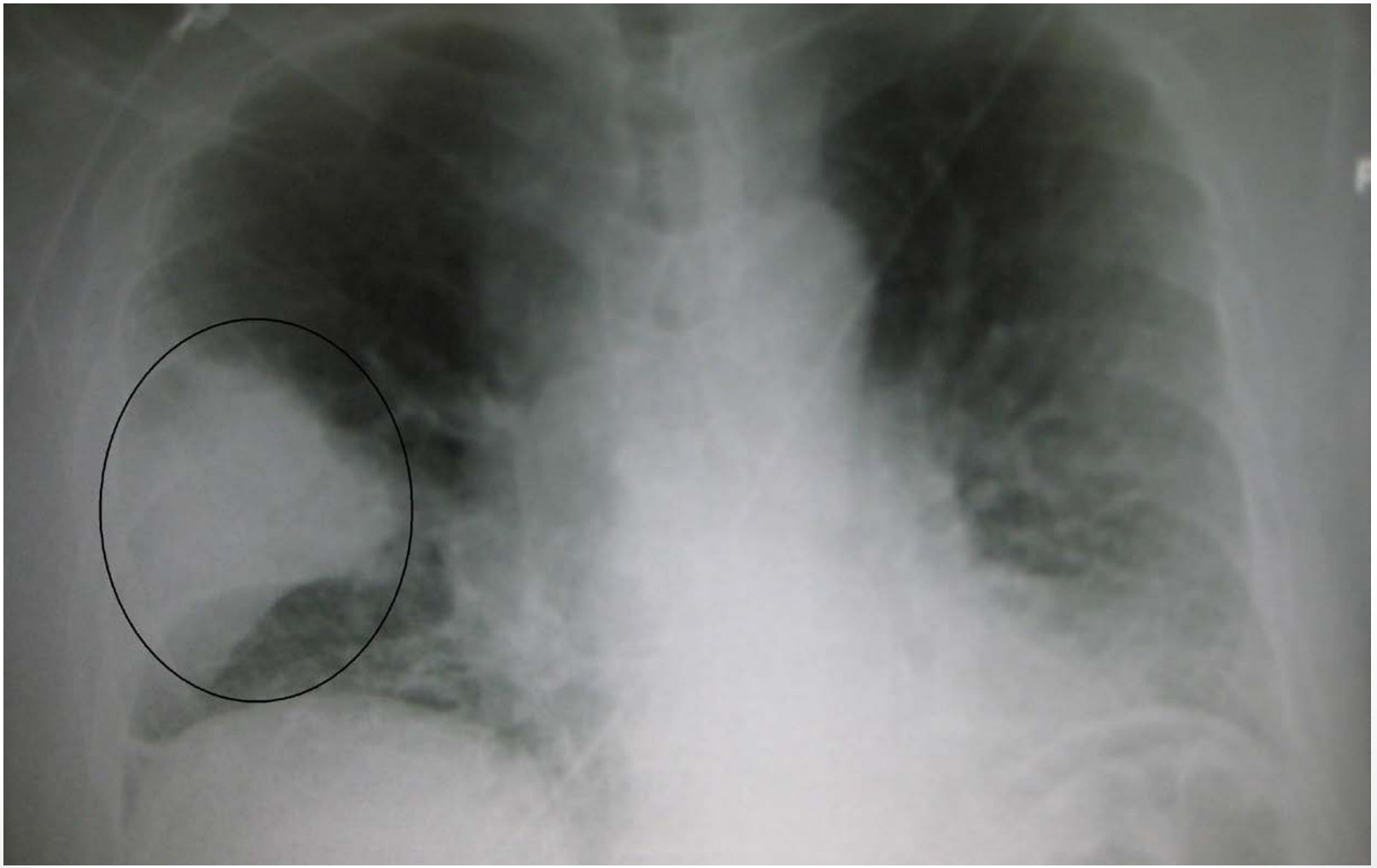
Pneumonia

- *Bordetella pertussis*
  - Severe paroxysmal coughing episodes followed by cyanosis and apnea
  - Sometimes associated with inspiratory “whoop” in older children
  - Ask about immunization history
  - CXR: hyperinflation, perihilar infiltrates, atelectasis, or normal
  - CBC: elevated WBC with lymphocytic predominance
  - Send Bordetella FA and culture (call lab for kit)
  - Treat with Erythromycin

Pneumonia

- Infant / child <4 years
  - Lobar – *S. pneumonia*
    - Amoxicillin – no hypoxia; well-hydrated
    - Rocephin IV
  - Atypical
    - Respiratory viruses
    - Influenza

Lobar Pneumonia - Bacterial



Pneumonia

- Older children
  - Lobar
    - *S. pneumonia*
  - Atypical
    - *Mycoplasma pneumoniae*
    - *Chlamydia pneumoniae*
    - Influenza
  - Treat with Amoxicillin and/or Zithromax (outpatient)
  - Treat with Rocephin and Zithromax (inpatient)