Respiratory distress in children

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Overview

- Background and definition
- First five minutes
- History and physical exam
  - Key historical features
  - Signs and symptoms
- Possible causes and differential diagnosis
- Investigations
- Management
- Critical documentation
- Disposition

Definition of wheezing

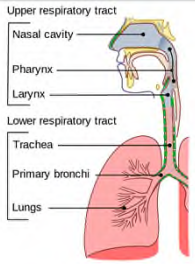
- A high-pitched, musical sound
- Usually refers to expiratory noise originating from lower airways
- Most commonly associated with asthma
- Originates from any size airway
- May be inspiratory or expiratory
- Caused by vibration of narrowed airway passages

Wheezing in children

- Children wheeze more often than adults because of physical differences
  - Smaller bronchi
    - URI may cause viral wheezing in child
  - Trachea, bronchi and rib cage more compliant
    - Increased likelihood of wheezing

"All that wheezes is not asthma"

- Asthma is most common cause of wheezing in children
- Foreign body, infection, and congenital malformation are other important differentials
- Obstruction may occur at any level



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FIRST FIVE MINUTES

First five minutes

- Vital signs with oxygen saturation
- Oxygen
- Epinephrine 1:1000 if severe
  - 0.01mg/kg IM (max 0.5mg)
- Address impending airway collapse

First five minutes

- Focused history and physical
  - Possible choking?
  - Possible anaphylaxis?
  - Recent fever or URI?
  - History of similar?
  - Cardiac?
  - Listen: wheeze or stridor?
    - Wheeze: Expiratory dominates → Lungs problem
    - Stridor: Inspiratory → Upper airway (trachea) problem

First five minutes

- Choking
  - Complete obstruction → maneuvers
    - Heimlich
    - Abdominal thrusts
    - Endotracheal intubation with direct removal if visualized
    - Endotracheal intubation with intentional right-mainstem, pushing object into R bronchus, and selective ventilation of left lung
  - Partial obstruction → keep child calm, support respiratory effort, oxygen, ENT for exam in OT

First five minutes

- Wheezing
  - Originates in lungs, most commonly reactive airway or asthma
  - Albuterol
  - Epinephrine IM
  - Positive-pressure ventilation EARLY!

First five minutes

- Stridor
  - Croup, epiglottitis, bacterial tracheitis, choking, compressive mass, congenital
  - Keep child calm.
  - Sit upright, positioned leaning forward.
  - No oral exam
  - If possibly infectious, racemic epinephrine nebulization, epinephrine IM

History and PHYSICAL EXAM

Key historical features

- Extensive differential diagnosis. History is key.
- Characterize nature of wheezing
  - Onset, progression
    - If infant, ask about difficulty feeding
  - Exacerbating factors
  - History of similar
  - Family history
- History of possibly related conditions
  - HIV
  - Cardiac
  - Immunosuppression, TB, malignancy

Key historical features

- Frequent or continuous since birth?
  - Consider congenital malformation
- Acute, severe, persistent?
  - Consider choking
- Intermittent, episodic, family history?
  - Consider asthma or reactive airway
- Gradually progressive and persistent?
  - Consider anatomic obstruction or compression; mass-effect

Key historical features

- Infectious
  - Fever?
  - Upper airway: Voice change? Drooling?
  - Lower airway: Recent URI? Cough?
- Allergic
  - Hives or itching? Allergic exposure? Lip or face swelling?
- Choking
  - Possible foreign body ingestion?

Key historical features

- Cough?
  - Suggests asthma, lower airway
  - Absence of cough suggests congenital, mass, noninfectious, and/or upper airway
- Ingestions or poisoning?
- Trauma? Previous intubations?
  - Consider tracheal stenosis or injury
- Difficulty feeding?
  - GERD? Tracheo-esophageal fistula? Aspiration?

Signs and symptoms

- ABCs
- Focused exam ("D")

Signs and symptoms

- Airway
  - Able to cry or speak?
  - Obvious trauma or deformity?

Signs and symptoms

- Breathing
  - Stridor or wheezing?
    - Stridor: blockage in the throat, inspiratory
    - Wheeze: obstruction in the lungs, expiratory
  - Tracheal deviation?
    - Tension pneumothorax
  - Accessory use?
    - Chest in-drawing, nasal flaring, grunting
  - Posturing
    - Sitting up, leaning forward, tripod positioning

Signs and symptoms

- Circulation
  - Signs of impending collapse?
    - Hypotension, tachycardia, delayed capillary refill, diaphoresis, cool extremities
  - Signs of cardiac failure?
    - Volume overload may cause "cardiac wheeze"
    - Manage as severe CCF

Signs and symptoms

- Oral exam
  - Do not perform in child in distress
    - Distress: leaning forward, drooling, difficulty phonating, stridulous
    - Exam or upset child may cause complete airway collapse
  - Caution if possible epiglottitis
    - Exam to be done in OT with ENT at the ready for possible needle cricothyrotomy
  - If stable: tonsillar hypertrophy? Obvious obstruction?
    - Normal exam does NOT rule out retropharyngeal abscess or epiglottitis, which may not be visualized

POSSIBLE CAUSES AND DIFFERENTIAL DIAGNOSIS

Differential diagnosis

- Upper Airway
  - Allergic/anaphylaxis
  - Infectious
    - Croup or bacterial tracheitis
    - Retropharyngeal abscess
    - Epiglottitis
  - Mass
    - Goiter
    - Abscess

Differential diagnosis

- Upper Airway
  - Congenital
    - Tracheal stenosis
    - Tracheal-esophageal fistula
    - Vascular ring
    - Laryngomalaecia/Tracheomalacia
      - May be congenital, difficulty feeding, no response to bronchodilators or adrenaline, improved when calm, worse with agitation

Differential diagnosis

- Lower Airway
  - Reactive airway disease most common
    - Bronchiolitis/viral
    - Asthma
  - Bronchial foreign body or aspiration
  - Cardiac wheezing
  - Anaphylaxis

INVESTIGATIONS

Chest x-ray

- Indicated in first-time wheezer, fever, possible choking or ingestion
  - Congenital heart disease or malformation
  - Radio-opaque foreign body
  - Hyperinflation of asthma
  - Pneumonia
  - Tracheal stenosis, croup
- Consider lateral neck xray if stridor
  - Epiglottitis, RPA

Investigations

- Other investigations as per suspected cause
- Suspicion for upper airway obstruction (sitting up, drooling, in distress) → examination in OR with ENT standing
- Bronchoscopy for choking

Management

Management

- General therapeutics
  - If in doubt, albuterol and epinephrine
  - IV bolus for shock
  - Positive-pressure ventilation if AMS or severe distress

Management

- Stridor
  - Nebulized racemic epinephrine
    - 0.5mg/kg in 3-5ml NS; max 5mg
  - Croup: add dexamethasone
  - Bacterial tracheitis or retropharyngeal abscess: add broad-spectrum antibiotics, ENT consultation

Critical documentation

Critical documentation

- Document past similar events, current therapy, serial VS including pulse oximetry, initial and serial exams.
- Document all interventions and response to therapy, including peak flow relative to baseline.

Disposition

Disposition

- Have an exceedingly low threshold to admit any child with respiratory complaint
- ICU or transfer if
  - Respiratory distress
  - Minimal improvement after several hours treatment
  - Requiring PPV or intubation
  - Requires specialist consultation (ENT) not available locally
- May consider discharge if
  - Simple asthma exacerbation in known diagnosis
  - Able to obtain necessary medications
  - Parents possess good understanding
  - No complicating acute medical issues or infection
  - Able to return quickly if condition worsens

CASES

Wheezing child

- Mother running into Emergency with 2yo child. Sudden onset wheezing. Unwitnessed onset. No known medical problems.
- Child is severely tachypneic, chest retractions, audible inspiratory and expiratory wheezing, diaphoretic, in severe distress.

- Differential?
- Management?

- Differential
  - No medical history or preceeding illness
  - Severe, acute onset
    - Allergic reaction/anaphylaxis
    - Choking/aspiration

- Management
  - Oxygen
  - Epinephrine 1:1000 0.01mg/kg IM
  - Position sitting upright, supported
  - Albuterol neb
  - Preparation of positive pressure and intubation equipment
  - IV
  - Vitals, closer physical exam

- Placing an IV, you notice hives and rash over extremities
- Mother states that lips and face appear swollen as well
- Diagnosis and management now?

Anaphylaxis

- Rapid-onset severe allergic reaction
  - Allergen may be unknown
  - May be an allergen to which previously has not reacted
- Respiratory involvement
- May also exhibit lip, face, tongue, eye swelling; hives or rash; hypotension; diarrhoea or vomiting
- Rapidly fatal

Common anaphylaxis triggers

- Foods
  - Nuts
  - Fruits: tomato, mango, banana, papaya
  - Shellfish and fish
  - Milk, egg
- Insect bites and stings
- Medications
  - aspirin, NSAIDs, sulfa, penicillin

Management of anaphylaxis

- Epinephrine (1:1000)
  - Administer 0.01mg/kg IM (max 0.5mg)
    - Do NOT administer subcutaneously!
  - Repeat every 5-15 minutes as needed
  - If more than 2 doses required, inadequate response, impending cardiac arrest or intubation, consider adrenaline infusion
    - 1mg epinephrine in 1 liter normal saline (makes 1 mcg/ml solution)
    - 0.1–0.3 mcg/kg/min. Titrate to response

Management of anaphylaxis

- Breathing
  - Position patient upright
  - High-flow oxygen
  - Positive pressure ventilation
  - Albuterol nebulization
  - Racemic epinephrine nebulization

Management of anaphylaxis

- Circulatory support
  - IVF bolus 20cc/kg over 15 minutes
  - Epinephrine infusion if persistent shock
- Treat allergic reaction
  - High-dose IV steroids
  - Anti-histamine

Case 2

- 2yo child with difficulty breathing. Has had rhinorrhea, congestion, cough, low-grade fever for one week. Dry season, very dusty outside. Has had intermittent episodes of similar previously.
- PMH: negative
- No medications or allergies

Case 2

- T38 HR 180 RR 60 BP 90/50 94%RA
- Gen: Sitting, alert, tachypneic, anxious
- HEENT: no obvious masses, not drooling
- Resp: Visible retractions and indrawing when shirt lifted. No appreciable wheezing on ausculation
- CV: tachycardic
- Extr: peripherally cool

Case 2

- Differential diagnosis?
- Management?

Case 2

- Differential
  - Severe, acute onset respiratory distress in child with URI and history similar illness → suggests asthma
  - Consider also bacterial tracheitis, retropharyngeal abscess, foreign body with post-obstructive pneumonia
    - No drooling or evidence of upper respiratory obstruction, however

Case 2

- Management
  - Epinephrine IM
  - Albuterol nebulization
  - Keep child calm, upright, on mother's lap

Case 2

- After epinephrine and albuterol, child now has wheezing on exam
- Diagnosis?

Asthma

- Absence of audible wheezing indicates SEVERE bronchospasm!
- Airways too narrow to transmit wheezes
- Reactive airway disease, bronchiolitis, asthma vary in definition
  - Emergency management is identical

Asthma

- Chronic disease of airway inflammation
- Bronchial smooth muscle hyper-reactivity and mucosal abnormalities
- Acute attacks of varying severity
  - May be triggered by weather change, infection or inflammation
- Associated with other allergic-type disorders
  - GERD, eczema, seasonal allergies
- Runs in families

Asthma

Asthma: Key historical features

- Attempt to gauge severity of illness
  - Acuity of onset
  - Taking medications regularly?
  - Most recent steroids
  - Past occurences: need for steroids, emergency visits, hospitalizations, intubations
- Any recent triggers?
  - URI, allergic exposures
- In children, always consider other sources of wheezing, especially foreign body!

Asthma: Signs and symptoms

- Characterized by bronchospasm
  - Dyspnea, cough, wheezing
  - Tachypnea, tachycardia
  - Prolonged exhalation
  - Decreased air movement on auscultation
  - Inability to speak full sentences without stopping to take a breath
  - Presence of cough with wheezing highly suggestive of bronchospasm

Asthma: Signs and symptoms

- Severe bronchospasm causes respiratory distress
  - Accessory muscle use
  - Tripod positioning
  - Hypoxia
  - Inappropriately quiet or absent wheezes
  - Diaphoresis, cool extremities
  - Altered mental status
  - Inability to speak
  - Cyanosis

Asthma: Signs and symptoms

- Assess for complicating conditions
  - Unilateral decreased breath sounds? Tracheal deviation?
    - Consider tension pneumothorax
  - Fever?
    - Consider pneumonia, viral infection, other source of wheezing

Asthma: Investigations

- ABG: limited role
  - May show decreased pCO_2 in mild/moderate attack
  - Inappropriately increased pCO_2 in severe attack

Asthma: Management

Goals of acute management

- Reverse bronchospasm
- Improve ventilation
- Identify and treat any exacerbating causes

Mild-moderate attack

- Beta-agonists reverse airway obstruction
  - Metered dose inhalers (MDI) and nebulization equally effective
  - If patient can comply, spacers improve efficiency of MDI treatment
  - Albuterol MDI: usual dosing 2 puffs every 2–6 hours as needed
- Steroids: oral prednisolone 1–2 mg/kg daily to max of 60 mg daily for 3–5 days

Severe attack

- Beta-agonists: albuterol
  - MDI: 2 puffs at least every 15 min (10 puffs as replacement for nebs)
  - Nebulization: 2.5 mg every 15 minutes or continuous (10mg/hour)
- Anticholinergics
  - Nebulized ipratropium 500 mcg every 15 min for 3 doses –then Q6h

Severe attack

- Steroids: require 6 hours to maximum effect
  - Use IV if patient unable to tolerate oral
- Magnesium sulfate (conflicting evidence for efficacy)
  - 50 mg/kg IV over 20 minutes (risk of hypotension with more rapid infusion)
- IVF bolus 20ml/kg

Severe attack

- For worsening respiratory failure, consider
  - Epinephrine: 0.3 mg (0.15 mg in children under 30 kg) IM 1:1 000
    - Repeat every 5-15 minutes as needed
    - Consider adrenaline infusion if no response
  - Positive pressure ventilation: CPAP or BiPAP, if available
  - Intubation
    - Be prepared for cardiovascular collapse!
    - Avoid paralytics or respiratory suppressants if possible. Ketamine preferred.
    - Maximize other medications, including adrenaline
    - Ventilate slowly, allowing full exhalation
    - Monitor for tension pneumothorax

Intubating the asthmatic

- Maximize all other medical management
  - Epinephrine
  - Beta-agonists
  - Magnesium
  - IVF
  - NIPPV
- Be prepared for cardiovascular collapse!
- Avoid paralytics or respiratory suppressants if possible. Ketamine preferred.
- Ventilate slowly, allowing full exhalation
- Monitor for tension pneumothorax

Asthma: Ineffective therapies

- Methylxanthines (e.g. aminophylline)
- Inhaled glucocorticoids
  - ineffective for acute attack
- Antibiotics, in absence of co-existing bacterial infection

Disposition

- Mild
  - Entirely resolved with minimal intervention
  - Home with inhaled beta-agonist and oral steroids
  - Able to return if symptoms recur or worsen
- Moderate: observe or admit
- Severe: ICU
- Admit all patients already taking oral steroids at time of attack
- Admit any patient requiring adrenaline