Pediatric Respiratory Emergencies

Ritu Malik, MD
Objectives

- List and treat some respiratory emergencies that children suffer from
  - Croup
  - Epiglottitis
  - Foreign Body Aspiration
  - Asthma
  - Bronchiolitis
Respiratory Emergencies

#1 cause of pediatric hospital admissions
#1 cause of death during first year of life (except for congenital abnormalities)
Respiratory Emergencies

Respiratory failure can progress quickly to respiratory arrest and then to cardiac arrest.
Respiratory Emergencies

Promt recognition & Effective management of Respiratory Distress can prevent deterioration into cardiac arrest & improve outcome
Pediatric Respiratory System

- Large head, small mandible, small neck
- Large, posteriorly-placed tongue
- High glottic opening
- Small airways
- Presence of tonsils, adenoids
Pediatric Respiratory System

- Poor accessory muscle development
- Less rigid thoracic cage
- Horizontal ribs, primarily diaphragm breathers
- Increased metabolic rate, increased $O_2$ consumption
Pediatric Respiratory System

Decrease respiratory reserve
+ Increased \( O_2 \) demand =
Increased respiratory failure risk
Respiratory Distress

Signs of Hypoxia

- Tachypnea/Bradypnea (late)
- Tachycardia/Bradycardia (late)
- Palor
- Nasal flaring/Retractions/Abdominal breathing
- Grunting
- Fatigue
- Cyanosis (late)
- Agitation/AMS (late)
Respiratory Distress

**Figure 6: Respiratory Distress**
Signs of respiratory distress include tripod position, nasal flaring, retractions

**Figure 4: Child, Poor First Impression**
Sick child with poor muscle tone, nasal flaring, retractions
Respiratory Distress

Causes

Upper Airway Obstruction
Lower Airway Obstruction
Parenchymal Disease
Disordered Control of Breathing
Respiratory Emergencies

- **Upper Airway Obstruction**
  - Croup
  - Epiglottitis
  - Foreign Body Aspiration
  - Anaphylaxis
  - Peritonsillar or retropharyngeal abscess

- **Lower Airway Obstruction**
  - Asthma
  - Bronchiolitis

- **Lung Tissue Disease**
  - Pneumonia
  - Pulm Edema
    - CHF
    - ARDS
    - Sepsis
    - Pulm Contusions

- **Disordered Control of Breathing**
  - Neurologic Disorders
Laryngotracheobronchitis

Croup
Croup: Incidence

- 3 months to 6 years
  - Mean is 18 months
- Males > Females
- Fall, Early winter
- Most common form of airway obstruction or stridor in 6mo-6yrs
Croup: Pathophysiology

- Viral infection (parainfluenza)
- Affects larynx, trachea
- Subglottic edema; Air flow obstruction
Croup: Signs/Symptoms

- “Cold” symptoms-1-5 day prodrome with cough/coryza
- Low grade fever
- Non toxic
- No drooling
- Stridor (increases with agitation)
- “Barking” cough
- Hoarse voice
- Wheezing/crackles
- Symptoms increase at night
Croup

**Steeple Sign**

- Subglottic narrowing
Croup

Mild

- Occasional barking cough
- No stridor
- No retractions
Croup

**Moderate**
- Stridor at rest
- Retractions
- Good distal air entry
- No Agitation

**Severe**
- Stridor at rest
- Retractions
- Diminished Air Entry
- Agitation
Impending Respiratory Failure

- Poor Air Movement
- Lethargy/Decreased LOC
- Dusky skin
- Decreased O2 sat
Mild Croup

- Reassurance
- Cool Mist
- Hydration
- Fever Control
- **Consider a single dose of Dexamethasone**
**Croup: Management**

### Severe Croup
- Humidified high concentration oxygen
- **Nebulized Racemic Epi**
  - 2.25% Solution
  - 0.05 ml/kg (max 0.5 ml)
  - Observe 2 hours for rebound
- **Dexamethasone** (po/iv/im)
  - 0.6mg/kg
- Consider **Heliox**

### Impending Resp Failure
- High Flow O2
- Assist Ventilations
- Anticipate the need for ETT
- Prepare for a surgical Airway
The good news

- With aggressive ED treatment most patients with croup do not require admission
Croup Admissions

Factors that increase the likelihood of admission

- Poor response to initial treatment
- Stridor at rest
- Inadequate fluid intake
- Re-presentation to the ED within 24 hours
- Age less than 6 months
- Hx of severe obstruction before presentation
- Hx of previous severe croup
- Known structural airway anomaly (e.g., subglottic stenosis)
- Uncertain diagnosis
- Social Issues - parental anxiety/transport issues
Epiglottitis
Epiglottitis: Pathophysiology

- Bacterial infection (H.flu, staph, strep)
- Affects epiglottis, adjacent pharyngeal tissue
- Supraglottic edema

Complete Airway Obstruction
Epiglottitis: Incidence

- Children 2-7 years old (most >4)
- Peds incidence falling due to HiB vaccination
- Now more common in adults than children
Epiglottitis: Signs/Symptoms

- Rapid onset, severe distress in hours
- High fever
- Intense sore throat, difficulty swallowing
- Drooling
- Toxic appearing
- Stridor
- “sniffing” position
- Voice pitch can be altered, muffled
- \( \frac{1}{3} \) present unconscious, in shock
Epiglottitis

Respiratory distress + Sore throat + Drooling = Epiglottitis
Thumb Print
Epiglottitis: Management

- High concentration oxygen
- IV Access
- Do not attempt to visualize airway in the ED
- Laryngoscopy- ENT/Anesthesia consultation
- IV 2nd/3rd Gen Cephalosporin
Epiglottitis

- Mild swelling on laryngoscopy
  - Close ICU observation
- If Signs/Symptoms of Airway Compromise
  - ETT-preferably in the OR
- If resp failure/obstruction
  - Immediate ETT
  - Emergent cricothyrotomy
  - Needle jet insufflation
Foreign Body Aspiration
Foreign Body Aspiration

- Peak at 1-3 years
- 90% < 4 years
- Food and toys
Choking Hazards

Round

Hard

Tough

Sticky

Slippery

Dry

Non-edible parts

www.childhealthonline.org
FB Aspiration

Suspect in any previously well, afebrile child with sudden onset of:

- Tachypnea/ Respiratory distress
- Choking/Gagging
- Coughing
- Stridor
- Wheezing
- Hoarseness
- Diminished Breath Sounds (distal to obstruction) on affected side
- Hyperresonance (hyperinflation) or dullness to percussion (atelectasis)
- Blood streaked sputum
CXR Findings

- Normal (25%)
- Radiopaque FB
- Localized Hyperinflation

- Atelectasis
- Mediastinal Shift
- Pneumonia
**Management**

**Mild-Moderate Symptoms**

- Minimize intervention if child is conscious and maintaining own airway, avoid agitation
- 100% oxygen as tolerated
- **Wheezing**
  - Object in small airway
  - Avoid trying to dislodge in field
If conscious...

- Inadequate ventilation
- Infant: 5 back blows/5 chest thrusts
- Child: 6-10 Abdominal thrusts (Heimlich maneuver)
If unconscious

- Jaw thrust/ head tilt-chin lift
- Look in the mouth, remove visible FB
- BVM
- If you cannot provide adequate ventilation
  - move on to chest compressions & attempt ventilation (even if pulse is present)
  - Before you give each breath look for FB, sometimes chest compressions can help displace object
- Attempt ETT
- Definitive Treatment- ENT/Anesthesia
Foreign Bodies

Do NOT perform BLIND oropharyngeal finger sweeps!

Remove the object with your finger **ONLY if you can see it**
Asthma Pathophysiology

- Lower airway hypersensitivity to:
  - Allergies
  - Infection
  - Irritants
  - Emotional stress
  - Cold
  - Exercise
Asthma: Pathophysiology

- Bronchospasm
- Bronchial Edema
- Increased Mucus Production
Asthma: Pathophysiology

- **Cartilage**
- **Airway Lining**
- **Muscle**

**Normal Airway**

**Muscle Contraction**

**Inflammation & Swelling**

**Mucus Plugs**
Asthma: Pathophysiology

Cast of airway produced by asthmatic mucus plugs
Asthma: Signs/Symptoms

- Coughing
- Expiratory wheezing
- Tachypnea
- Dyspnea
Asthma: Signs/Symptoms

- Signs of respiratory distress
  - Nasal flaring
  - Accessory muscle use
    - Tracheal tugging
    - Suprasternal, intercostal, epigastric retractions
    - Paradoxical thoraco-abdominal movement
  - ALOC (agitated, drowsy, confused)
  - Cyanosis
Asthma

Silent Chest equals Danger
Asthma: History

- How long has patient been wheezing?
- How much fluid has patient had?
- Recent respiratory tract infection?
- Medications? When? How much?
- Allergies?
- Previous hospitalizations?
Asthma: Physical Exam

- Patient position?
- Drowsy or stuporous?
- Signs/symptoms of dehydration?
- Chest movement?
- Quality of breath sounds?
Risk Factors Associated with Asthma Deaths

- Prior ICU admissions
- Prior intubation
- >3 emergency department visits in past year
- >2 hospital admissions in past year
- >1 bronchodilator canister used in past month
- Use of bronchodilators > every 4 hours
- Chronic use of steroids
- Progressive symptoms in spite of aggressive Rx
Status Asthmaticus

Asthma attack unresponsive to B2 adrenergic agents
Asthma: Management

- Airway

- Breathing
  - Sitting position
  - Humidified O2 by NRB mask
    - Dry O2 dries mucus, worsens plugs
  - Encourage coughing
  - Consider intubation, assisted ventilation
Asthma: Management

- Circulation
  - IV
  - Assess for dehydration - IV Fluids
  - Cardiac monitor
Mild Asthma

- High flow O2
- Bronchodilators
  - Albuterol inhaler/nebulizer
- Steroids- PO
Severe Asthma

- **Nebulized Bronchodilators**
  - Albuterol - β2 agonist - 0.5 mg/kg/hour
  - Ipratropium - anticholinergic - 0.5 mg every 4-6 hours

- **Steroids**
  - Prednisolone - 1-2 mg/kg/day PO
  - Solumedrol - 4 mg/kg/day IV/IM

- **Magnesium (IV)**
  - 25-100 mg/kg IV over 20 mins
Severe Asthma

- Subcutaneous Beta agents
  - Terbutaline
    - 0.01 mg/kg q 15-20 mins (max 0.25 mg) SQ
  - Epinephrine 1:1000
    - 0.01 mg/kg q 15-20 mins (max 0.3 mg SQ)

POSSIBLE BENEFIT IN PATIENTS WITH VENTILATORY FAILURE
Severe Asthma

Other treatment options

- Heliox (mixture of O₂ + Helium)
- Halothane
- Nebulized Lasix
- IV Leukotriene modifiers
Impending Respiratory Failure

- Consider BiPAP

- Prepare for Intubation
  - Ketamine
    - has bronchodilator properties
    - 1-2 mg/kg IV
  - Consider a cuffed tube
Admission Criteria

- Needs O2 supplementation
- Refractory Asthma - A child who does not respond after 2 hours of continuous treatment
- PF <50% of predicted
- PF 50-70% with social issues
- PaCO2 >40
Consider other causes....

ALL THAT WHEEZES IS NOT ASTHMA

- Pulmonary edema
- Allergic reactions
- Pneumonia
- Foreign body aspiration
- Bronchiolitis
Bronchiolitis: Pathophysiology

- Viral infection
  - RSV (50-70%)
  - Others
    - Parainfluenza, rhinovirus, adenovirus, influenza

- Inflammatory bronchiolar edema

- Air trapping
Bronchiolitis: Incidence

- Children < 2 years old
- 80% of patients < 1 year old
- October – May
- Extremely contagious
Bronchiolitis: Signs/Symptoms

- Coughing, nasal/eye drainage, fevers
- Wheezing
- Poor feeding
- Can progress to severe respiratory distress
- Extreme tachypnea (60 - 100+/min)
- Retractions, Cyanosis
Distinguishing between Bronchiolitis and Asthma in the wheezing infant can be difficult
Asthma vs Bronchiolitis

- Asthma
  - Age - > 2 years
  - Temperature - usually normal
  - Family Hx - common
  - Hx of allergies - common
  - Response to Epi - positive

- Bronchiolitis
  - Age - < 1-2 years
  - Fever is common
  - Family Hx - negative
  - Hx of allergies - negative
  - Response to Epi - negative
Bronchiolitis: Management

- Humidified oxygen by NRB mask
- Cardiac Monitor
- IV Hydration
- Oral/Nasal Suctioning prn
- +- Bronchodilators
- +- Racemic Epinephrine- then 4 hour observation
- Anticipate need to intubate, assist ventilations
Bronchiolitis Management

- Randomized controlled trials have shown **mixed results** with bronchodilators and steroids

- **Consider a trial of bronchodilators if the diagnosis is unclear**
  - There is little downside

- Some infants respond to Nebulized Epi or Albuterol, while others have worsening of their symptoms
Risk of Apnea

- <6 weeks of age
- h/o prematurity
- Apnea of prematurity
- Low o2 sat on admission
Bronchiolitis Admissions

- Age < 4-6 weeks (early in the disease process)
- Moderate to Severe distress (retractions)
- h/o Apneic spells
- Dehydration
- Sustained RR>60-70/min
- O2 sat<92-94%
- Underlying Chronic Disease-h/o BPD, CHD, & Immunocompromised
- Social Issues
Initial Management of Respiratory Distress
1° Assessment

**Airway**
- Support Airway
  - Let child assume position of comfort
  - Open airway (manual maneuvers)
- Clear Airway
  - Suction, remove, visualized FB
- Insert OPA/NPA
- Is it maintainable?

**Breathing**
- Assess RR, Effort, Tidal Volume, Breath sounds
- Monitor O2 sat
- Assist Ventilation (BVM)
- Provide O2 (humidified)
- Prepare for ETT
- Medicate
1° Assessment

**Circulation**
- Monitor heart rate, Color, Temp, BP, Cap Refill
- Monitor Organ Perfusion
  - Mental Status
  - Palor, mottling, cyanosis
  - Urine Output

**Disability**
- Pupils
- GCS
- AVPU- Pediatric Response Score

**Exposure**
- Undress
Focused H & P

SAMPLE

- Signs/Symptoms
- Allergies
- Meds
- Past Med Hx
- Last Meal
- Events
3° Assessment

Ancillary Studies

- Labs
  - CBC, Blood Cultures
  - ABG

- Radiographs
  - CXR
  - Lateral Neck
  - Decub Films
Respiratory Emergencies

- Then use specific goal directed therapy as mentioned for the causes identified
My Pride and Joy