ACUTE ASTHMA EXACERBATIONS IN CHILDREN

• Major cause of acute illness in children

• Even children with mild or intermittent baseline asthma can have severe exacerbations requiring ICU admission

• Mortality is rare, but morbidity can be high, with some children requiring days or weeks of hospitalization and recovery

**EVALUATION**
- Rapid clinical evaluation followed by rapid initiation of first line treatment
- Routine CXR & blood gas not indicated

**SIGNOS OF SEVERITY**
Subjective signs & symptoms
- Shortness of breath
- Work of breathing
- Diminished or absent breath sounds
- Inability to speak or count to 10
- Level of alertness
- Anxiety or diaphoresis

Objective signs
- Respiratory rate
- Heart rate
- Pulse oximetry

**PATHOPHYSIOLOGY**
- Bronchial smooth muscle spasm
- Airway inflammation
- Increased mucus production leading to
  - Increased pulmonary resistance
  - Small airway collapse
  - Dynamic hyperinflation & air trapping

Increased work of breathing
- Turbulent airflow
- Increased respiratory muscle workload, including active exhalation
- Positive pressure ventilation reduces airway collapse and can off-load work of breathing

**FIRST LINE TREATMENTS**
- Should be used on all children with status asthmaticus
  - Continuous albuterol
    - Inhaled β₂-agonist
    - Nebulized at 10-20 mg/h
  - Corticosteroids
    - Solumedrol or prednisone (2-4 mg/kg/d ÷ q6-12h)
    - Alternatively, Decadron
  - Supplemental oxygen
    - To maintain sats >92%
  - IV fluid bolus
    - Consider 20-40 mL/kg
    - Dehydration often underestimated in children with status asthmaticus

**SECOND LINE TREATMENTS**
- When first line treatments ineffective
  - No evidence of superiority of one vs another; often several used simultaneously
  - IV magnesium
    - Smooth muscle dilator
    - 25-75 mg/kg (up to 2 g total) over 20 min
  - Nebulized ipratropium
    - Anticholinergic
    - 0.25-0.5 mg every 20 min for 3 doses
  - Noninvasive positive pressure
    - Via HFNC (1-3 mL/kg; 2 mL/kg ≈ CPAP+5 cmH₂O), CPAP, or BiPAP
    - Can improve work of breathing but decreases inhaled medication delivery
  - IV terbutaline
    - IV β₂-agonist delivered via continuous infusion

**RESCUE THERAPIES**
- Unproven and some carry significant morbidity
  - Helium-oxygen
    - Lower density & higher viscosity leads to less turbulent airflow
    - Requires 60%-80% helium
  - Intubation
    - Can be lifesaving, although most children can be treated noninvasively
  - Consider ventilator modes with decelerating flow patterns & PEEP matching auto-PEEP
  - Inhaled anesthetics
    - Bronchodilators (eg, halothane, isoflurane)
    - Requires gas scavenging system
  - Extracorporeal support
    - Last resort therapy and carries significant morbidities in this population

**Cardiopulmonary interactions**
- Decreased RV preload, increased biventricular afterload, and decreased ventricular filling leads to reduced cardiac output
- Exacerbated by medications
- Signs
  - Tachycardia
  - Diastolic hypotension
  - Pulsus paradoxus
  - Exaggeration of normal decrease in arterial pressure that occurs during inspiration

**Hypoxemia**
- Due to ventilation-perfusion mismatching from heterogeneous areas of premature closure and obstruction

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