The Pediatric Airway in Health and Disease II

EMC 420: Maternal & Child Emergency Care

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Objectives

- Discuss management of assessment and management of specific respiratory emergencies in infants and children.
- Distinguish respiratory distress from respiratory failure.
- Identify patients requiring rapid sequence intubation to support oxygenation and ventilation.

Case Study 1: "Breathing Fast"

- A mother brings in her 3-month-old girl who is breathing too fast.
- She is irritable and feeding poorly.
- She is alert; has tachypnea, nasal flaring, intercostal retractions; color is pale.

Initial Assessment (1 of 2)

PAT:

– Abnormal appearance, abnormal breathing, normal/abnormal circulation

Vital signs:

– HR 190, RR 60, T 38°C, O_2 sat 90% on room air, Wt 4 kg

Initial Assessment

A: Open; no stridor
B: Tachypneic with retractions and reduced tidal volume.
C: Color is normal, skin is warm and dry, pulse is rapid but strong and regular.
D: Alert with no focal neurologic signs.
E: No obvious signs of injury

Question

What is your general impression of this patient?

General Impression

- Respiratory distress:
  - Lower airway obstruction
  - Possible bronchiolitis

What are your initial management priorities?

Management Priorities

- O2; monitor
- Administer nebulized ß-agonist.
- Obtain IV access
- Gather airway equipment that may be necessary to support ventilation in this child:
  - BVM device; appropriate size mask
  - ET tubes; appropriate size and 1/2 size smaller
  - Needle cricothyrotomy equipment

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Your First Clue: Bronchiolitis

- Tachypnea
- Cough
- Nasal congestion
- Fever
- Tachycardia
- Otitis media
- Retractions
- Hypoxia
- Apparent life-threatening event
- Apnea

Discussion: Bronchiolitis

- Respiratory syncytial virus (RSV) is the most common cause.
- Most children have been infected by RSV before their second birthday.
- There is no vaccine available.

Bronchiolitis

- Average incubation is 5 days.
- Symptoms can last a month or more.
- Hypoxia is most often due to ventilation/perfusion (V/Q) mismatch.
- Progression to respiratory failure and shunting may be seen with pneumonia and atelectasis.

Severe Bronchiolitis

- Infants at increased risk for severe RSV disease:
  - Premature infants
  - Complex congenital heart disease
  - Chronic lung disease
  - Immunosuppression
  - Neuromuscular disease
  - Metabolic disorders

Diagnosis of Bronchiolitis

- Single best predictor of severe disease in a healthy infant is O_2 sat <95%
- Other factors associated with severe disease include:
  - Age < 3 mo, prematurity, toxic appearance, atelectasis, and tachypnea (RR >70 bpm)
- Diagnosis of bronchiolitis is generally made clinically
  - Age of the child
  - Time of year, and
  - Presence of other cases in the area
  - NP Swab : rapid RSV-antigen detection

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Diagnostic Approach

- Oxygen saturation
- Rapid RSV antigen testing
  - May not add much to management
  - RSV -swab confirmed disease in febrile child, does not rule out a comorbid problem - Such as pneumonia

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Controversies in Management

- Nebulized bronchodilators
  - The old adage that B2's are of NO benefit in bronchiolitis : not completely accurate
    - Albuterol : small transient improvements in acute clinical score.
    - Ipratropium bromide : no effect.
    - Epinephrine : may show some beneficial effect but overall benefit is not clear.
- Methylprednisolone (glucocorticoids)
  - RCTs have shown no benefit.
- Ribavirin

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Case Progression/Outcome

- Our 3-mo old patient received nebulized racemic epinephrine but continued to have respiratory distress.
- severe disease should be monitored very carefully.
- Patient was admitted to PICU where she was intubated for recurrent apneic spells.
- Apnea is seen in up to 18% of patients with RSV, with the risk being higher in premature and young infants.

Case Study : "Breathing Problem"

- A 10-month old boy born at 28 weeks' gestation presents to the paramedics 4 mo after discharge from NICU.
- 2 days ago he developed URI followed by increased RR and increased home O_2 requirements.
- He is alert, shows nasal flaring and retractions, and his color is pale.

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Initial Assessment

PAT:

- Normal appearance, abnormal breathing, normal/abnormal circulation

Initial Assessment

A: Open – no stridor
B: Tachypnea, retractions
C: Skin pale, capillary refill <2 sec, skin warm, dry; pulse strong, rapid
D: Alert
E: No signs of injury, no rash

Focused Assessment

Vital Signs:
- HR 160, RR 60,
- T : 37.9°C (100.2°F),
- O_2 sat 88% on 3L NC, Wt 6 kg

CHEST:
- Diffuse wheezing; no rales

Question

What is your general impression of this patient?

General Impression

- Respiratory distress:
  - Lower airway obstruction
  - Bronchiolitis vs. bronchopulmonary dysplasia with viral infection

What are your initial management priorities?

Management Priorities

- Leave patient in position of comfort.
- Place patient on monitor.
- Administer nebulized albuterol with O2.
- Increase oxygen to 4L by nasal cannula after nebulized treatment.

Background: BPD

- Bronchopulmonary dysplasia (BPD) is a severe form of chronic lung disease.
- Most commonly seen in low birth weight infants.
- Diagnosis is based on the following 3 criteria:
  - Mechanical ventilation in neonatal period
  - Continued need for supplemental O_2 at day 28 of life
  - Pulmonary insufficiency

Case Progression/Outcome

- Our 10-month-old infant with BPD received inhaled albuterol, ipratropium bromide and oral steroids in the ED.
- His RR is 50 and O_2 saturation improves to 95%.
- Further assessment shows right otitis media and he is discharged home with next day follow up.

Case Study : "Fever"

- A 6-month-old boy with history of two days of fever is brought to the ED by his father.
- The boy developed respiratory distress today.
- He is poorly responsive to his surroundings with marked intercostal retractions, and his color is pale to gray with circumoral cyanosis.

Initial Assessment

PAT:

– Abnormal appearance, abnormal breathing, abnormal circulation

Vital signs:

– HR 60, RR 40, O_2 84% on room air

What is your impression and management priorities?

General Impression

- Respiratory failure/cardiopulmonary failure
- Immediate airway management is necessary to prevent cardiopulmonary arrest.

Management

- Place on cardiorespiratory monitor.
- Begin bag-mask ventilation.
  - O_2 sat improves to 97% and HR increases to 100 bpm
- Establish vascular access.
- Prepare for rapid sequence intubation (RSI).

Case Discussion: RSI

- **S:** Suction
- **O:** Oxygen
- **A:** Airway equipment
  - Miller 1 blade and ETT size 3.5 mm
- **P:** Pharmacology
  - Atropine
  - Ketamine or etomidate
  - Succinyl choline or rocuronium
- **ME:** Monitoring equipment

Case Progression

- Patient is intubated and thick green sputum is suctioned from airway.
- Chest radiograph reveals RLL and left lingular pneumonia.
- Patient is placed on cefuroxime and transferred via transport team to regional pediatric center.

Background: Pneumonia

- Incidence of 4% per year in children younger than 5 years, 2% in children 5 to 9 years, and 1% in children older than 9 years.
- Viral etiology most common
  - peak incidence between ages 3 to 5 years
- Bacterial pneumonia has higher mortality (2-3 times) and morbidity.
  - Pneumococcus is the leading cause of community-acquired bacterial pneumonia.

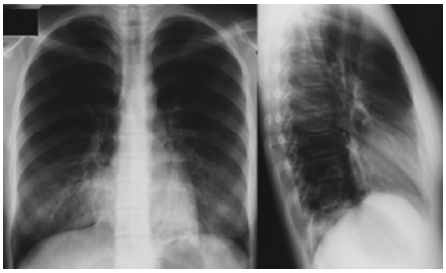
TABLE 3-18 Risk Factors for Pneumonia

- Young age
- Male
- Pollution
- Nutritional status
- Immunodeficiency
- Anatomic airway abnormalities
- Metabolic disease
- Socioeconomic factors

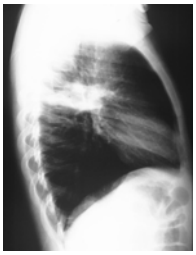
Your First Clue: Pneumonia

- Cough
- Fever
- Chest pain
- Shortness of breath
- Tachypnea
- Malaise
- Abdominal pain
- Hypoxia

Radiology: Diffuse Patchy Infiltrates



Focal Infiltrates



Management: Pneumonia

- For the child in respiratory distress:
  - Supplemental O_2, antipyretics, and bronchodilator therapy is given in addition to IV antibiotics.
- Hospital admission considered:
  - Infants with a lobar infiltrate
  - Respiratory compromise
  - Dehydration
  - Pleural effusion
  - Failed outpatient management

Six Mainly Preventable Causes of Childhood Death Worldwide

- Pneumonia (19 %)
- Diarrhea (formerly most common)
- Malaria
- Infection (many : measles, tetanus, HIV, newborn)
- Pre-term delivery
- Complications of childbirth ("oxygen-deprivation")

WHO data [please disregard the footer; this is NOT a APLS slide]

The Bottom Line

- Infants and children are at higher risk for complications due to specific respiratory emergencies.
- Immediate support of oxygenation for all patients with respiratory distress and support of ventilation in patients with respiratory failure can be life saving.