Shortness of breath
Objectives

- Recognizing respiratory distress
- Initial approach to a patient with respiratory distress
  - Actions to take
  - History
  - Physical examination
- Specific conditions that present with respiratory distress
Case #1

- 24 yo F with hx of asthma presenting with shortness of breath, wheezing, dry cough for two days, worsening today; no fever or chills, no chest pain; no congestion. Tried inhaler every 2 hours at home for past 6 hours without relief.

- What do you do first?
Things you want to know

- What usually triggers your asthma?
- Prior ED visits, hospitalizations, ICU admissions? Prior intubations?
- Current medications
  - Frequency of inhaler use
  - Recent steroids
- Baseline peak flow values
- Fevers, recent infections, and sick contacts
Why is all that so important?

- Risk factors for sudden death from asthma:
  - Past history of sudden severe exacerbations
  - Prior intubation for asthma
  - Prior asthma admission to an ICU
  - In the past year:
    - 2 or more hospitalizations for asthma
    - 3 or more ED visits for asthma
    - Hospitalization or an ED visit for asthma within the past month
Start with the ABCs

- **Airway**
- **Breathing: How much respiratory distress?**
  - Can't speak in complete sentences
  - Tachypnea (if not tachypneic may be getting fatigued)
  - Accessory muscle use
  - Retractions, nasal flaring, grunting
  - Cyanosis
  - Hypoxia (decreased pulse ox)
  - Wheezing (may not hear wheezing if they are not moving any air at all!)
  - Decreased air movement

- **Circulation**
Differential Diagnosis for SOB

Most Common
- Obstructive: Asthma, COPD
- Congestive heart failure
- Ischemic heart disease
- Pneumonia
- Psychogenic: Panic, anxiety

Urgently Life Threatening
- Upper airway obstruction
  - Foreign body
  - Angioedema/anaphylaxis
- Tension pneumothorax
- Pulmonary embolism
- Neuromuscular weakness
  - Myasthenia gravis
  - Guillain-Barre
Immediate Actions (First 10 minutes)

- Supplemental oxygen
- Pulse oximetry with complete vital signs
- BVM if decreased RR, shallow/weak respirations
- Decide need for endotracheal intubation
- IV access, labs, and ABG
- Portable chest x-ray – STAT
- EKG if concerned for cardiac etiology
- Brief history and focused physical exam
- Form initial differential, begin treatment
Focused Physical Exam

- **Vital signs**
  - RR, HR, BP, temp, O2 Sat

- **Mental Status**
  - Alert, confused, lethargic

- **Heart**
  - JVD, muffled heart sounds, S3, S4

- **Lungs**
  - Rales, wheezing, diminished or absent BS, stridor
  - Respiratory accessory muscle use

- **Abdomen**
  - Hepatomegaly, ascites

- **Skin**
  - Diaphoresis, cyanosis

- **Extremities**
  - Edema
  - Unilateral leg swelling

- **Neurologic**
  - Focal neurologic deficits

**Reassess respiratory status frequently especially in the first 15 minutes or so**
Back to our asthma case....

- What tests do you want?
Evaluation of acute asthma

- Peak flows
  - Helpful in determining attack severity
  - Can follow after treatments
  - Want to be >80% of "predicted"
- Continuous pulse oximetry
- CXR if you suspect a secondary problem
  - Pneumothorax
  - Foreign body
  - Pneumonia
- ABG might be helpful in severe attacks
  - Tachypnea should lead to decreased PCO2, and a normal or high PCO2 indicates fatigue
Remember pathophysiology

- Asthma is an inflammatory disease
- Bronchospasm is only a symptom
- Many possible causes:
  - Allergies
  - Irritants
  - Infections
- Poiseuille's Law - Radius has a huge affect on flow
What medications and treatments do you want to give?
Treatments

- **Supplemental oxygen**
- **$\beta_2$ agonists (Albuterol)**
  - Nebulized: 2.5-5 mg nebs q20 minutes, can be continuous if needed
  - MDI with spacer: 6-12 puffs from MDI q20 minutes (4-8 in children)
- **Anti-cholinergics (Atrovent)**
  - Adding Atrovent has been shown to decrease admissions
  - Albuterol/Atrovent combination for first treatment
  - 500 mcg in adults (250 mcg in kids) q6 hours
Treatments

- **Corticosteroids**
  - Decrease airway inflammation (takes 4-8 hrs)
  - Reduces the need for hospitalization if administered within 1 hour of arrival in the ED
- **Adults:**
  - Methylprednisolone 125mg IV/Prednisone 60mg PO
- **Pediatrics:**
  - Methylprednisolone 1 mg/kg IV or Prednisone 1-2 mg/kg PO
- **Continue steroids for 5 day course**
Treatments

- **Magnesium**
  - Bronchodilating properties
  - Shown to help in severe asthma
  - Peak flow < 25% of predicted
  - Relatively safe
  - Adult dose: 1-2 g IV over 30 minutes
Treatments

- Non-invasive Positive Pressure Ventilation
  - Some evidence BiPAP or CPAP may help in severe asthma
  - Temporary until medications start working
  - Can help avoid intubation
  - Pt must be awake and cooperative
Treatments

- **Intubation**
  - Mechanical ventilation decreases work of breathing and allows patient to rest
  - Indications: Hypercarbia, acidosis, respiratory fatigue
  - Complications:
    - High peak airways pressures and barotrauma
    - Hemodynamic impairment
    - Atelectasis and pneumonia from frequent mucus plugging
  - Special considerations
    - Increased I:E ratio to help prevent breath stacking
    - Permissive hypoventilation with goal >90% oxygen saturation

- **Heli-ox**
Admit or not?

- Depends on: Improvement of symptoms, risk factors for death, social situation, compliance, and patient comfort with going home
- In general:
  - HOME if complete resolution of symptoms and peak flow > 70% of predicted
  - ADMIT if poor response to treatment and peak flow < 50% of predicted
  - ALL OTHERS – Depends on combination of above factors, when in doubt ASK THE PATIENT!
Discharge

- All patients need steroids for at least 5 days
- All patients need $\beta_2$ agonists
- All patients with more than mild intermittent asthma (need inhaler $> 2 \times$ week, peak flow $< 80\%$ of predicted) need inhaled steroids
- Patients with moderate-to-severe asthma (daily symptoms) should measure daily peak flows
- All patients need close follow up
- All patients need education about asthma
- Smoking cessation counseling
Case #2

- 65 yo M with shortness of breath for past several hours, getting increasingly worse; now drowsy and difficult to arouse; pt with hx of smoking 2ppd for many years, is on home oxygen.
- T: 99.9, HR: 98, R: 30, BP: 165/70, O2sat: 89% room air, 92% 2LNC
- Physical exam: barrel chest, pursed lips, wheezing, prolonged expirations, diminished breath sounds throughout
- Likely diagnosis?
- What else is on your differential diagnosis?
COPD

- Chronic airway inflammation
  - Inflammatory cells and mediators
  - Protease / anti-protease imbalance
  - Oxidative stress
- Increases in lung compliance
- Becomes an obstructive process

Ask patients about:
- History of COPD
- Change in cough or sputum
- Fever, infectious signs
- Medications (steroids)
- Environmental exposures
- Smoking history
Physical exam findings in COPD

- Signs of Hypoxemia
  - Tachypnea
  - Tachycardia
  - Hypertension
  - Cyanosis

- Signs of Hypercapnia
  - Altered mental status
  - Hypopnea
COPD

- Chest X-ray
  - Hyperinflation
  - Flattened diaphragms
  - Increased AP diameter

- EKG
  - Wandering pacemaker
  - Multifocal atrial tachycardia (MAT)
  - Right axis deviation
Treatment for COPD

- **Supplemental oxygen**
  - Careful in patients that are CO₂ retainers
    - Loss of hypoxic drive can result in respiratory arrest
    - Goal: 90-92% oxygen saturation
- **Bronchodilators** *(Albuterol and atrovent)*
- **Antibiotics**
  - *(Which antibiotics would be appropriate?)*
- **Corticosteroids**
  - 7-14 day course improves FEV1 in exacerbations
  - Hyperglycemia is common side effect
Treatment for COPD

- Positive-pressure ventilation
  - Indicated for respiratory fatigue, acidosis, hypoxia, hypercapnia
  - Can decrease intubation rates and possibly improves survival
  - Patient needs to be awake, cooperative, and able to handle secretions
Case #3

- 35 yo previously healthy F c/o one week of headache, sore throat and muscle aches, fevers, now with productive cough and increasing fatigue.
- On physical exam she is febrile and has decreased breath sounds over the RLL.
- What is your differential and work-up?
Pneumonia

- Clinical features:
  - Typically: Cough, dyspnea, sputum production, fever, pleuritic chest pain
  - Pneumococcal: sudden onset of fever, rigors, productive cough, tachypnea
  - Atypical pneumonia: Coryza, low grade fevers, non-productive cough

- On exam:
  - Tachypnea, tachycardia, fever
  - Inspiratory rales = Alveolar fluid
  - Bronchial breath sounds = Consolidation
  - Dullness/decreased BS = Pleural effusion
  - Rhonchi = Bronchial congestion
Pathophysiology

- Usually inhaled/aspirated pathogens
  - Risk: Stroke, seizure, intoxication
- Hematogenous spread: Staph. aureus
- Infection within alveoli with intense inflammatory response
  - Filling alveoli with bacteria, WBC, exudate
Which patient groups get which types?

- Pneumococcus
- Staph aureus
- Klebsiella
- Pseudomonas
- Haemophilus
- Atypical
  - Chlamydia
  - Mycoplasma
  - Legionella
Special populations

- **Diabetics**
- **HIV**
  - Pneumonia more common and has higher morbidity than non-HIV population
  - Pneumococcus = Most common bacteria
  - CD4>800: Bacterial more common
  - CD4 250-500: TB, cryptococcus, histoplasma
  - CD4< 200: PCP, CMV

- **Elderly/Nursing home**
  - Predictors for morbidity: Tachycardia, tachypnea, temp>100.4, somnolence, confusion, crackles, leukocytosis
  - Pathogens: Pneumococcus, gram negatives, Haemophilus, influenza
  - May just present with confusion, weakness
Pneumonia

- Chest X-ray
- Measure O2 sat, CBC, electrolytes
- Blood cultures for admitted patients (before antibiotics)
Treatment

- Pneumococcal most common, but atypicals becoming more prevalent
- Outpatient
  - Doxycycline
  - Newer macrolide (Azithromycin)
  - Fluroquinolone (Levofloxacin)
- Also consider MRSA for severe infections
Treatment

- **Inpatient**
  - Early antibiotics lowers mortality
  - 3rd gen cephalosporin (Ceftriaxone) or PCN w/ beta-lactamase inhibitor (Unasyn/Zosyn) **plus** macrolide (Azithromycin)
  - Fluroquinolone alone (Levofloxacin)
  - Add pseudomonal coverage (Cefepime) as needed i.e. CF patient
Admission or not?

- 75% CAP do not require admission, can be discharged with follow up
- Admission: Elderly, HIV pts, tachypnea, oxygen requirement
- ICU: Markedly tachypneic, high oxygen requirement, evidence of shock
Case #4

- 65 yo M with hx of CAD s/p CABG with increasing dyspnea on exertion, orthopnea, increasing swelling in feet and ankles, now today with acute shortness of breath and respiratory distress. No chest pain, no fevers; ROS otherwise negative
- Pt in moderate respiratory distress on exam with diffuse crackles in all lung fields
- What is your differential diagnosis and approach to this patient?
Congestive Heart Failure

- Can present with acute pulmonary edema and with respiratory distress
- Due to decreasing CO and rising SVR
- Sympathetic nervous system and renin-angiotensin-aldosterone system are activated
- Result: Volume overload, pulmonary edema, resp distress
Causes of acute decompensation in CHF

- Non-compliance
  - Medications: diuretics
  - Diet: excessive salt
- Cardiac
  - Arrhythmia
  - ACS
  - Uncontrolled HTN
- Other
  - Volume overload due to renal failure
  - PE
  - Exacerbation of other co-morbidity (ex. COPD)
What are some signs and symptoms of CHF?
Signs & Symptoms of CHF

- **Symptoms**
  - Respiratory distress
  - Cool / diaphoretic skin
  - Weight gain
  - Peripheral edema
  - Orthopnea
  - Paroxysmal nocturnal dyspnea
  - Abdominal pain

- **Signs**
  - Elevated JVD
  - S3
  - Hypertension
  - Rales
  - +/- peripheral edema
  - +/- RUQ tenderness (congested liver)
  - Tachypnea
Evaluation of CHF

- **CXR (portable)**
  - Cardiomegaly
  - Vascular congestion
  - Pulmonary edema

- **Labs**
  - CBC, electrolytes, cardiac enzymes, BNP

- **EKG**

- **Search for cause of decompensation**
What is the BNP and why do we care?

- Natriuretic peptide released by RA when heart is stretched i.e. volume overload
- Level correlates with CHF severity, rate of re-hospitalization, and risk of death
  - BNP > 480 = 40% risk of re-hospitalization or death within 6 months
- Helps to distinguish between other causes of SOB i.e. COPD
Differential Diagnosis

- Pulmonary:
  - Asthma/COPD exacerbation
  - Pulmonary embolus
  - Pneumothorax
  - Pleural effusion
  - Pneumonia

- Cardiac:
  - ACS, arrhythmia
  - Acute valvular insufficiency
  - Pericardial tamponade

- Fluid retentive states:
  - Liver failure, portal vein thrombosis
  - Renal failure
  - Nephrotic syndrome
  - Hypoproteinemia

- High output states:
  - Sepsis
  - Anemia
  - Thyroid dysfunction
Treatment

- Control airway and maintain ventilation
- Supplemental oxygen
- Cardiac monitoring
- Pulse oximetry
- Establish IV access
- +/- ABG
- Frequent vital signs
Which medications are used to treat CHF?
Treatment of CHF

- Preload reduction
- Vasodilators
- Inotropic support if needed
Treatment of CHF

- Reduce preload and afterload:
  - Nitroglycerin by sublingual or IV route
- Volume reduction
  - Lasix- Diuresis starts in 15-20 minutes
    - If no prior use: 40 mg IV
    - Outpatient use: Double last 24 hour usage
    - If no effect by 30 minutes, repeat a doubled dose
- Clinical endpoint- Rapidly lower filling pressures to prevent need for endotracheal intubation
- Place foley catheter and monitor UOP
NIPPV

- Noninvasive Positive Pressure Ventilation
  - Controversial but worth a try in severe respiratory distress
  - Temporizes while medical therapy is working
  - BiPAP may decrease need for intubation
  - Patient cooperation is required