Respiratory

Asthma

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Asthma Versus COPD

- Reactive
- Younger onset
- Reversible
- Wheeze
- Inflammation

- Triggers
  - Exercise
  - Cold air
  - Infection
  - Environmental allergies
  - GERD
  - Medications (i.e. beta-blockers)

Factors in Classification

- Frequency of exacerbations requiring oral steroids
- Rescue use
- Interference with activity
- Nighttime awakenings
- FEV (peak flow)
  - Target 80% of predicted or better

Rule of 2 in Asthma

- ≤ 2 times/week – use of albuterol
- ≤ 2 nighttime awakenings/mo
- > 2 refills per year on rescue
- ER visits/hospitalizations

Asthma Control Test - Questions

- In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?
- During the past 4 weeks, how often have you had shortness of breath?
- During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?
- During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?
- How would you rate your asthma control during the past 4 weeks?

ACT - Scoring

- 1-5, 5 = none of the time or not at all
- <15 – likely very poor control
- 15-19 – could likely use some improvement
- 20+ - decent control

Asthma Action Plan

- Delineates green, yellow and red zones for asthma care based upon peak flow readings
- Peak flow meter (kazoo looking device for home use) can aid in recognizing exacerbation in patients diagnosed with asthma
- The asthma action plan also designates specific actions to take when the patients peak flow reading is in each respective zone (i.e. call your doctor now, change medications, begin steroid therapy, etc.)

Asthma Action Plan

For: _____ Doctor: _____ Date: _____

Doctor's Phone Number _____ Hospital/Emergency Department Phone Number _____

GREEN ZONE — Doing Well

- No cough, wheeze, chest tightness, or shortness of breath during the day or night
- Can do usual activities

And, if a peak flow meter is used,

Peak flow: more than _____
(80 percent or more of my best peak flow)

My best peak flow is: _____

Take these long-term control medicines each day (include an anti-inflammatory).

Medicine	How much to take	When to take it
Before exercise	❒ _____	❒ 2 or ❒ 4 puffs _____	5 minutes before exercise

YELLOW ZONE — Asthma Is Getting Worse

- Cough, wheeze, chest tightness, or shortness of breath, or
- Waking at night due to asthma, or
- Can do some, but not all, usual activities

-Or-

Peak flow: _____ to _____
(50 to 79 percent of my best peak flow)

First

Add: quick-relief medicine—and keep taking your GREEN ZONE medicine.

_____ (short-acting beta$_2$-agonist)

❒ 2 or ❒ 4 puffs, every 20 minutes for up to 1 hour
❒ Nebulizer, once

Second

If your symptoms (and peak flow, if used) return to GREEN ZONE after 1 hour of above treatment:
❒ Continue monitoring to be sure you stay in the green zone.

-Or-

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:

❒ Take: _____ (short-acting beta$_2$-agonist) ❒ 2 or ❒ 4 puffs or ❒ Nebulizer

❒ Add: _____ (oral steroid) mg per day For _____(3–10) days

❒ Call the doctor ❒ before/ ❒ within _____ hours after taking the oral steroid.

RED ZONE — Medical Alert!

- Very short of breath, or
- Quick-relief medicines have not helped, or
- Cannot do usual activities, or
- Symptoms are same or get worse after 24 hours in Yellow Zone

-Or-

Peak flow: less than _____
(50 percent of my best peak flow)

Take this medicine:

❒ _____ (short-acting beta$_2$-agonist) ❒ 4 or ❒ 6 puffs or ❒ Nebulizer

❒ _____ (oral steroid) mg

Then call your doctor NOW. Go to the hospital or call an ambulance if:
- You are still in the red zone after 15 minutes AND
- You have not reached your doctor.

DANGER SIGNS

- **Trouble walking and talking due to shortness of breath**
- **Lips or fingernails are blue**

- **Take ❒ 4 or ❒ 6 puffs of your quick-relief medicine AND**
- **Go to the hospital or call for an ambulance _____ (phone) NOW!**

See the reverse side for things you can do to avoid your asthma triggers.

Courtesy of nhlbi.nih.gov

Inhaled Corticosteroids (ICS)

- Mechanism of Action; By stimulating glucocorticoid receptors in the respiratory tract, this likely suppresses inflammation and improves breathing
- Budesonide (Pulmicort – comes in nebulizer), beclomethasone (Qvar), fluticasone (Flovent), mometasone (Asmanex)
- Take time to work (not meant for acute relief as monotherapy)
- Increased risk of thrush (rinsing mouth following use is important)
- Long term risks (osteoporosis, HPA suppression, elevations in blood sugar) are not as big of a deal with inhaled corticosteroids compared to systemic corticosteroids

Short Acting Beta Agonists (SABA)

- Mechanism of Action: Binds and agonizes beta-2 receptors to relax smooth muscle and open up the airway, allowing for less labored, easier breathing
- Albuterol (ProAir, Ventolin, Proventil, AccuNeb), Levalbuterol (Xopenex)
- Acute relief of respiratory distress
- Adverse effects – shakiness, tremor, tachycardia, anxiety
- Potential impact of reducing serum potassium, but rarely clinically significant with inhaled medications
- Monitoring use of SABA in asthma is very important to assessing severity/staging of asthma

Long Acting Beta Agonists (LABA)

- Mechanism of Action: Binds and agonizes beta-2 receptors to relax and open up the airway, allowing for less labored, easier breathing
- Formoterol (Foradil, Perforomist-nebulizer), salmeterol (Serevent), aformoterol (Brovana)
- Never use alone in asthma due to black box warning for increased risk of death
- Often added on to inhaled corticosteroid for patients who need more control
- Similar adverse effect profile to short acting beta agonists (same mechanism, just longer duration of action)
- Formoterol has a quicker onset than other long acting beta agonists and is specifically mentioned for as needed use in combination with budesonide

Common ICS/LABA Combinations

- Common long acting beta-agonists and inhaled corticosteroids
  - Fluticasone/salmeterol (Advair, AirDuo) – low dose 100/50 BID, moderate dose 250/50, high dose 500/50 (Diskus)
  - Budesonide/formoterol (Symbicort) – low dose 80/4.5 1-2 puffs BID, moderate dose 160/4.5 BID
  - Mometasone/formoterol (Dulera) – low dose 100/5 1 puff BID, moderate 100/5 2 puffs BID, high 200/5 2 puffs BID
  - Fluticasone/vilanterol (Breo Ellipta) – low/moderate 100/25 QD, high 200/25 QD

Steps in Asthma Treatment

- Intermittent – GINA guidelines recommend PRN steroid/beta agonist
- Mild Persistent – Low dose inhaled corticosteroid (chronic) + PRN steroid/beta agonist
- Moderate Persistent – Medium dose inhaled corticosteroid or LABA/low dose CS combination+ PRN steroid/beta agonist
- Severe Persistent – High Dose ICS + LABA and/or montelukast + PRN steroid/beta agonist

Acute Exacerbation

- Systemic Steroids for exacerbation
  - Usual adult dose range 40-60 mg/day (prednisone)
  - Prednisolone 0.5-1mg/kg/day for pediatrics
  - Usually no more than 10-14 days is necessary for acute exacerbation resolution (ideal to minimize length of steroid if possible to prevent risk of systemic effects)

Nebulizers

- Pediatrics/elderly
- Albuterol, levalbuterol
- LABA (formoterol, aformoterol)
- Budesonide
- Ipratropium
  - Ipratropium - combination with albuterol (Duoneb)
  - Revefenacin (LAMA)

Nurse Monitoring - Asthma

- Respiratory rate
- Heart rate (tachycardia common in distress or with albuterol)
- Blood pressure
- Oxygen saturation (SpO_2) — goal usually ≥94%
- Work of breathing (accessory muscles, ability to speak)
- Peak expiratory flow (PEFR) if available — compare with patient's personal best
- Inhaler/device technique and education

COPD

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COPD Characteristics

- COPD characteristics in comparison to asthma
  - Irreversible lung disorder
  - Usually not impacted by triggers
  - Older patients
  - Sputum common
  - Chronic smoking or other environmental long term cause almost always present

GOLD Staging

- 1 – mild (FEV1 >80% of predicted)
- 2 – moderate (FEV1 50-80)
- 3 – severe (FEV1 30-50)
- 4 – very severe (FEV1 <30)

ABE - Classification

- A – 0-1 moderate exacerbations with mMRC 0-1 and/or CAT <10
  - Single bronchodilator with no preference on LABA or LAMA stated
- B – 0-1 moderate exacerbations with mMRC 2 or higher and/or CAT 10 or more
  - LABA + LAMA
- E – Patients with 2 or more moderate exacerbations or 1 or more exacerbation leading to hospitalization
  - LABA + LAMA
- mMRC and CAT are assessments used to assess symptoms and the impact on the patients QOL

CAT and mMRC

- CAT (COPD Assessment Test)
  - Symptom assessment test that incorporates cough, phlegm, energy, sleep, and other factors
  - Scored from 0-40 with 40 being the worst
    - <10 less symptoms
    - 10 or greater more symptoms (category B)
- Modified Medical Research Council Questionnaire (mMRC)
  - 0-4 scoring based upon dyspnea symptoms with 4 being severe dyspnea that prevents leaving the house or when doing simple activities such as getting dressed
    - 0-1 – Less symptoms
    - 2-4 – More symptoms (places patient in category B)

General Medication Flow

- SABA/Short Acting Anticholinergic
  - Or Combo
- Long Acting Anticholinergic (LAMA)
- Long Acting Beta Agonist (LABA)
- Inhaled corticosteroids (ICS)
- Roflumilast
- Azithromycin
- Theophylline

Guidelines and Inhaled Corticosteroids

- GOLD Guidelines STRONGLY favor inhaled corticosteroids in these situations
  - Blood eosinophils over 300 cells/microliter
  - Concomitant asthma
  - COPD exacerbations causing hospitalization(s)
  - 2 or more moderate COPD exacerbations per year
- GOLD Guidelines favor risk/benefit discussion and possible inhaled corticosteroid use in the following situations
  - 1 moderate COPD exacerbation per year
  - Blood eosinophils 100-300 cells/microliter

Long Acting Antimuscarinics AKA Anticholinergics (LAMA)

- Mechanism of Action: Blockade of muscarinic receptors leads to reduced activity of acetylcholine in respiratory smooth muscle which leads to relaxation; anticholinergic activity can also help dry up secretions
- Tiotropium (Spiriva), aclidinium (Tudorza), umeclidinium (Incruse), glycopyrrolate (Seebri)
- Aclidinium – twice daily down side
- Tiotropium and aclidinium are dry powders
- Dry mouth is common adverse effect
- Usually don’t worry about systemic anticholinergic effects

Adverse Effects Beta Agonists, Anticholinergics

- Beta Agonists (i.e. albuterol, salmeterol)
  - Tachycardia
  - Tremor
- Anticholinergic (i.e. ipratropium, tiotropium)
  - Dry mouth

Inhaled Corticosteroids

- Reduces Exacerbations
- Not used as monotherapy in COPD
- Systemic Corticosteroids
  - Avoid long term if possible
  - OP, GERD, HPA suppression, Diabetes

Roflumilast

- Reduces exacerbations
- $$
- SE risks
  - Weight loss, GI
  - Psychiatric concerns
- 3A4 Interactions
  - Inducers – treatment failure (rifampin, St. John’s wort, carbamazepine, etc.)

Other Alternatives

- Theophylline
  - Drug levels (10-20)
  - Drug interactions (CYP1A2)
    - Quinolones, macrolides
    - Sympathomimetics
  - Systemic effects – Ramps you up; insomnia, tremor, tachycardia, GI upset
- Azithromycin
  - Frequent exacerbations – prophylaxis
  - Watch QTc prolongation risk

Classic Medication Causes of Respiratory Issues

- Amiodarone
- Nitrofurantoin
- Beta-blockers
  - Can blunt response to medications (beta-agonists)

Other Considerations

- Oxygen
- Vaccination
- Smoking
- Alpha-1 antitrypsin deficiency (AATD) screening

Combination Inhalers

- Albuterol and ipratropium (Combivent Respimat; Duoneb)
- Budesonide and formoterol (Symbicort)
- Fluticasone and salmeterol (Advair)
- Fluticasone and vilanterol (Breo Ellipta)
- Formoterol and mometasone (Dulera)
- Tiotropium and olodaterol (Stiolto Respimat)
- Umeclidinium and vilanterol (Anoro Ellipta)
- Glycopyrrolate and formoterol (Bevespi Aerosphere)
- Indacaterol and glycopyrrolate (Utibron Neohaler)
- Fluticasone and umeclidinium and vilanterol (Trelegy Ellipta)
- Budesonide and glycopyrrolate and formoterol (Breztri)

Acute Exacerbation Management

- Acute COPD Exacerbations
- Oxygen
  - Target saturations around 90%
- Short acting bronchodilators
  - Short acting beta agonists
  - Ipratropium
- Short term systemic corticosteroids
- Antibiotics and antivirals as indicated
  - For use of antibiotics, patient should have symptoms of
    - Increased dyspnea
    - Increased sputum volume
    - Increased sputum purulence

Nurse Monitoring - COPD

- Respiratory rate
- Heart rate
- Blood pressure
- Oxygen saturation (often acceptable goal 88–92% in COPD)
- Work of breathing (accessory muscles, pursed-lip breathing)
- Temperature (watch for infection)
- Level of consciousness (CO_2 retention can cause drowsiness)

Respiratory Failure

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Respiratory Failure

- Failure of gas exchange in the lungs
  - Goals of the lungs
    - Bring in O_2
    - Eliminate CO_2
- Low oxygen is most common form of respiratory failure
  - $PaO_2 < 60$ mm Hg
  - Normal or low PCO_2
  - Pneumonia, pulmonary edema
- Hypercapnic
  - Elevated $PCO_2 > 50$ mm Hg
    - Asthma, COPD, drug overdose

Management

- Get O2 levels up if low oxygen saturations
  - Respiratory failure
    - Most common reason for intubation
    - Target >60 mm Hg PaO2
      - Oxygen saturations >90%
- Elevated CO2 usually not primary concern
  - Exception might be substantial acidosis
    - pH<7.2

Medication Management

- Treat identifiable cause
  - Pneumonia – antibiotics
  - Pulmonary Edema - Diuretics
  - COPD – Anticholinergics/beta agonists/steroids
  - Asthma – beta agonists, steroids, etc.

Intubation/Sedative Agents

- Propofol (Diprivan)
  - Mechanism of Action: Binds multiple receptors in the CNS to interrupt neural transmission, including $GABA_A$, glycine, nicotinic, and M_1 muscarinic receptors
  - Rapid on and off set (very rapid onset as it easily crosses the blood brain barrier)
  - Dissolved in lipid emulsion containing egg lecithin and soybean oil (patients with egg or soy hypersensitivity should use cautiously)
  - ADE: Dose-dependent respiratory depression and hypotension due to vasodilation can occur
    - Also, hypertriglyceridemia, acute pancreatitis, and myoclonus
    - Continuous infusion helps reduce variable blood pressures
  - Rare: Propofol infusion syndrome (PRIS) – worsening metabolic acidosis, hypertriglyceridemia, hypotension, arrhythmia, AKI, hyperkalemia, rhabdomyolysis, and liver dysfunction
    - More likely with higher dose and a longer duration of use

Intubation/Sedative Agents

- Dexmedetomidine (Precedex)
  - Mechanism of Action: Selective α_2-receptor agonist with sedative, analgesic sparing and sympatholytic properties
  - Patients more easily arousable, with less respiratory depression
  - ADE: hypotension and bradycardia (think clonidine)
  - May reduce the risk of delirium
  - Onset of action is much slower than propofol

Intubation/Sedative Agents

- Benzodiazepines
  - Mechanism of Action: Activate $GABA_A$ receptors in the brain
  - Elderly are more sensitive due to decreased clearance with age
  - Agents: Midazolam, Lorazepam, Diazepam
  - Midazolam and Diazepam have active metabolites and are much more impacted by CYP enzyme interactions compared to lorazepam
  - IV Lorazepam contains propylene glycol, may be associated with dose-related toxicity, monitor serum osmole gap
  - Prolonged use of benzos may result in longer time to awakening time
  - ADEs: cardiopulmonary instability and/or cardiovascular instability and tolerance can develop with long-term use

Intubation - Medications

- Lidocaine
  - Helps suppress gag reflex (pre-medication)
  - Possibly helps prevent increases in HR, Intracranial pressure, MAP
- Fentanyl
  - Blunt sympathetic response to physical act of intubation
- Neuromuscular Blocking agents
  - Cause complete muscle relaxation (paralysis) – allows for easier insertion of breathing tube
  - Patient cannot breathe on their own
  - Next Slide

Neuromuscular Blocking Agents

- Depolarizing Agent
  - Mechanism of Action: bind and activate acetylcholine receptor which causes depolarization of skeletal muscle and ultimately relaxation
  - Succinylcholine (Anectine)
    - Short acting agent
    - Risk of malignant hyperthermia
    - Does not have a reversal agent
    - Can increase potassium (avoid in patients with hyperkalemia)
    - Doesn’t accumulate with renal/liver dysfunction

Neuromuscular Blocking Agents

- Non-depolarizing:
  - Mechanism of Action: bind and block activation of the nicotinic acetylcholine receptor at the neuromuscular junction
  - Aminosteroidal compounds: pancuronium (Pavulon), pipecuronium (Arduan), Vecuronium (Norcuron), and rocuronium (Zemuron)
    - Pancuronium: long acting, vagolytic, and ↑ $t_{1/2}$ in renal or hepatic dysfunction
    - Pipecuronium: long acting
    - Vecuronium: intermediate acting, not vagolytic, dose adjustment required in renal or hepatic dysfunction, less likely to cause drop in BP
    - Rocuronium: intermediate acting, quickest onset of non-depolarizing agents

Supportive Care

- DVT Prophylaxis (anticoagulants)
- Stress ulcer prophylaxis (PPIs)
- Management of issues causing respiratory failure
- If used, monitor for VAP (infection)
- Minimizing sedation as much as possible

Nurse Monitoring

- Airway patency and ability to ventilate with bag-valve mask
- Oxygen saturation
- Heart rate and rhythm
- Blood pressure
- Level of consciousness
- Respiratory effort and rate
- Signs of difficult airway (anatomy, secretions, trauma)