

Approach to Respiratory Distress

1. GENERAL APPROACH TO SHORTNESS OF BREATH

Initial Approach:

- AIRWAY:
 - Ensure upper airway **patent** → patient speaking (patent) vs gurgle/stridor (not patent)
 - If ↓GCS → ↓tone of upper airway soft tissue → assume possible obstruction
 - Management:
 - Look for causes:
 - Blood/vomit in mouth → Suction
 - Swelling from trauma/allergy → Medication
 - ↓GCS
 - If unable to clear obstruction → prepare for Intubation
- BREATHING:
 - Ensure oxygenating (sats ≥92%) & ventilation
 - Look → Resp Distress (tripoding, tracheal tug, intercostal/supraclavicular indrawing)
 - Listen → presence/absence of breath sounds
 - Management:
 - Give O2 → via nasal cannula vs non-rebreather mask
 - If not responding → positive airway pressure (CPAP/BiPAP) vs intubation/mechanical ventilation
- CIRCULATION:
 - Management:
 - 2 large bore IVs (18G+) with IVFs if hypotensive
- Investigations:
 - ECG
 - CXR (portable if unstable)
 - Bedside US

Differential Dx → focus on deadly

- 4 categories
 - UPPER AIRWAY:
 - Foreign body, Swelling, Blood, Vomit
 - LUNGS
 - Pneumonia, Pneumothorax (PTX), PE, Asthma/COPD
 - HEART
 - ACS, Pulmonary edema, Pericardial effusion, Tamponade
 - METABOLIC (Acidosis)
 - Sepsis, DKA, Drugs

Physical Exam:

- UPPER AIRWAY
 - Signs of resp distress with stridor
 - Look for blood/vomit in oral cavity
- LUNGS
 - Signs of resp distress without stridor
 - Pneumonia → crackles, bronchial breath sounds
 - PTX → ↓breath sounds
 - Asthma/COPD → wheezes, ↓breath sounds
- HEART:
 - Pulmonary edema → pink/frothy sputum, crackles
 - Pericardial effusion → muffled heart sounds
 - Tamponade → hypotension
- ACIDOSIS:
 - Tachypnea without symptoms of resp distress (normal O2 sat)

2. APPROACH TO ANAPHYLAXIS

Terminology:

- Allergic reaction = body reacting to previously sensitized allergen
- Can occur in different body systems & range from mild to severe (anaphylaxis)
- **Anaphylaxis** = multi-system involvement (medical emergency)

Pathophysiology:

- Previous sensitized allergen = production of IgE antibodies → bind mast cells/basophils → degranulation & release of mediators (histamine, leukotrienes, prostaglandins) → symptoms
 - Tx based on **inhibiting mediators**
- **Multi-system** involvement by above mediators
 - LUNGS → bronchoconstriction & mucous secretion
 - CVS → vasodilation
 - GI → diarrhea & cramping
 - SKIN → swelling (urticarial = superficial; angioedema = deep)

Assessment & Treatment:

- AIRWAY → can have ++**swelling**
 - Assess oropharynx for swelling of lips, tongue, mucous membranes
 - Assess for difficulty swallowing/throat tightness & listen for stridor (mainly inspiratory)
 - Tx = early **Epinephrine** (0.3-0.5cc 1:1000 solution IM q5-10min) & monitor airway closely
 - If no ↓swelling/worsening → definitive airway (intubation)
 - Safety Note → never give 1:1000 Epi **IV**!!
- BREATHING → **wheezing** from bronchoconstriction
 - Assess for respiratory distress (in-drawing, tracheal tug, abdominal breathing, tripodding)
 - Tx = **bronchodilators** (Ventolin & Epinephrine) + O2 if hypoxic
- CIRCULATION → ↓**BP** & **syncope** from vasodilation & ↓contractility (potential for arrhythmias)
 - Put on cardiac monitor, get ECG
 - Tx = **IVF** (1-2L)
 - If still hypotensive → vasopressor = Epinephrine (0.5-1cc 1:10000 IV infusion over 10-15min) or Dopamine
- Target Mediators:
 - Anti-histamines = main target
 - **H1-blockers** (Diphenhydramine 50mg IV/PO/IM q4h)
 - **H2-blockers** (Ranitidine 150mg PO/50mg IV q8h)
 - Note: if anaphylaxis → give Epi early, before antihistamines
- 2nd phase reaction phenomenon
 - Recurrence of symptoms **6-72h** post initial reaction without re-exposure to allergens
 - Can be the same reaction, worse, or less severe
 - Hypothesized that steroids may ↓2nd reaction (controversial)
 - If given → **Prednisone** 50mg PO daily x 5d

Discharge Instructions:

- Rx:
 - Antihistamines (Diphenhydramine + Ranitidine) x 3d
 - ±Prednisone
 - Epi-pen with proper instructions on correct usage
- If allergen known → avoidance
- If allergen unknown → allergy testing

3. APPROACH TO PNEUMONIA

Terminology:

- Pneumonia = inflammation of lung parenchyma
 - Alveolar airspaces filled with exudate & inflammatory cells
 - Causes → infection, chemical exposure

Classification:

- Important to classify as organisms involved depend on **patient & setting**
 - Bacterial → Gram +ve, Gram -ve, anaerobes
 - Viral
 - Fungal
- Based on PATIENT:
 - Healthy
 - Unhealthy (co-morbidities) = ↑susceptibility to infections/specific organisms
 - Immunocompromized → DM, HIV, antirejection meds, steroids
 - Existing lung problems → COPD, asthma
 - Aspiration risk → seizures, strokes
- Based on SETTING:
 - Community-acquired → patient lives independently in own home
 - Hospital-acquired → infection from hospital setting (>48h from admission)
 - Health-care acquired → patient from LTC, nursing home

Causes (based on classification):

- **Community Acquired = CAP:**
 - HEALTHY Patient
 - Bacterial:
 - Typical (classic Sx) → S.pneumoniae (most common), M.catarrhalis, H.influenza
 - Atypical (non-classic Sx) → mycoplasma, chlamydia
 - Viral → influenza, RSV
 - UNHEALTHY Patient
 - Potential for “healthy” patient organisms (above) plus:
 - HIV = PCP, TB
 - Asplenic = encapsulated organisms (ie. Strep)
 - On chemotherapy = ↑general susceptibility to infection
 - Existing lung problems = ↑general susceptibility to infection, ↑resistance d/t multiple courses of abx for previous infection
 - Aspiration risk = anaerobes (Klebsiella, Fusobacterium)
- **Hospital/Health-Care Acquired (Nosocomial) = HAP:**
 - Bacterial (most common):
 - Can get community organisms (ie. S.pneumoniae, H.influenza)
 - More worrisome = Pseudomonas, Klebsiella, E.Coli, Staph/MRSA
 - Viral (influenza) can occur but more rare

Presentation of Pneumonia:

- TYPICAL:
 - Hx: Fever, cough, ↑sputum production, confused
 - Px: ↑HR, ↑RR, resp distress, confused
 - Resp exam: adventitia (crackles, wheeze, rales, rhonchi), ↓breath sounds, dullness to percussion
 - If pleural effusion → friction rub
- ATYPICAL (more common with extremes of age):
 - Hx: confusion, dyspnea, shock
 - +/- fever, cough, ↑sputum

Diagnosis:

- Labs:

- ↑WBC (↑Neut), ↑plat (acute phase reaction)
- ↓Na, ↓HCO₃, ↑BUN/Cr
- VBG/ABG for those in resp failure
- Imaging → **ESSENTIAL** for diagnosis
 - CXR → portable (if too sick) vs PA & Lat

Treatment:

- GENERAL:
 - Airway → if not protecting/significant resp distress = Intubate
 - Breathing → if hypoxic = give O₂
 - Circulation → if hypotensive/tachycardic = IVF (RL or NS)
- SPECIFIC → **Antibiotics** (choice dependent on local, prevalence, and resistance organisms)
 - CAP:
 - HEALTHY:
 - PO = Macrolide vs doxycycline
 - IV = Fluoroquinolone; Ceftriaxone + macrolide
 - UNHEALTHY (co-morbid):
 - Immunosuppressed or COPD → IV fluoroquinolone; ceftriaxone + macrolide
 - HIV = worried about PCP → Septra
 - Aspiration = worried about anaerobes → Clindamycin
 - HAP → need broader & stronger
 - IV Ceftriaxone, Fluoroquinolone +/- Vanco (if MRSA)
 - Viral → usually in context of pandemic
 - Refer to local guidelines for use of antivirals
- Risk Stratification = send home vs admit vs ICU → 2 tools
 - CURB 65 → determines overall risk of death at 30d (each = 1pt)
 - Confusion
 - Urea > 7mol/L
 - RR > 30bpm
 - BP (SBP < 90 or DBP < 60)
 - Age ≥65
 - Scoring
 - 0-1 → outpatient treatment
 - 2-3 → consider short hospitalization vs close outpatient F/U
 - 4-5 → hospitalization +/- ICU
 - 5 = ~60% death at 30d
 - Pneumonia Severity Index (PORT score)
 - Components
 - Demographics → age, gender, residence (ie. nursing home)
 - Co-morbidities → cancer, liver disease, CHF, CVD
 - Px → altered MS, ↑HR, ↑RR, ↓BP, ↑or↓Temp
 - Labs & Imaging

4. APPROACH TO PNEUMOTHORAX

Terminology:

- Pneumothorax (PTX) = air in pleural cavity (potential space between parietal and visceral pleura)
- Effects:
 - 1st → Can impair oxygenation + ventilation
 - 2nd → if 1-way valve leaking air into pleural space → can shift mediastinum to contralateral side → ↓venous return to heart → ↓BP → cardiac arrest

Causes:

- SPONTANEOUS:
 - Occurs when blebs or bullae rupture in lungs
 - 1° → in patient with NO underlying lung disease

- Usually affects thin & tall patients
 - ↑risk in smokers & genetic factors (ie. marfan's syndrome)
 - 2° → in patient WITH underlying lung disease
 - Most common = COPD, asthma
 - Can also occur with infections → TB, PCP
- TRAUMATIC:
 - Puncture of pleura leading to air into space
 - Iatrogenic → biopsy, thorocentesis, intercostal nerve blocks
 - Trauma/Penetrating injury → open wound to pleura, rib fractures puncturing pleura
 - More likely to lead to TENSION pneumothorax (d/t ↑ likelihood of 1-way valve)

Presentations:

- SPONTANEOUS:
 - Hx → CP in affected side = severe, sudden onset, stabbing/sharp, radiation to shoulder, pleuritic
 - Px → SOB, ↑RR, ↓O2 sat, ↓Breath sounds (BS) affected side
- TRAUMATIC:
 - Hx → trauma, recent procedures
 - Px → as above + evidence of open wounds
- TENSION:
 - Px → ++resp distress, contralateral tracheal deviation, ↑JVP, ↓BP, ↓BS on affected side

Investigations = Diagnostic Imaging → CXR, US, CT

- Important → tension PTX is a **clinical** diagnosis (no time for imaging)
- CXR:
 - Can visualize the outline of pleura d/t detachment
 - Expiratory film → ↑sensitivity of picking up PTX (especially if small)
 - Supine patients → no air rising to apex of lungs (any air will rise to most superior aspect = chest wall) → will instead get deep sulcus sign (air collecting in inferior sulci at angle where diaphragm joins chest wall)
 - Limitations:
 - Difficult to detect small PTX & in supine patients
- US:
 - High sensitivity and specificity for Dx of PTX
- CT:
 - High sensitivity and specificity
 - Will also indicate if any underlying lung/chest pathology is present
 - Limitation = requires stable patient

Treatment:

- Goals:
 - 1st = **release air** accumulated within pleural space in order to maintain ventilation
 - 2nd = **stop** further accumulation of air into pleural space
- SPONTANEOUS & IATROGENIC PTX:
 - Small** (<3cm from apex):
 - If hemodynamically stable → conservative tx (observe in ED for few hours then D/C with frequent f/u)
 - Large:**
 - Need to release air as patient likely symptomatic
 - Requires Chest tube → 5th ICS in Anterior Axillary Line
- TENSION PTX (**unstable** patients):
 - 1st = Needle decompression with large bore IV needle (14/16G) → 2nd ICS in midclavicular line (MCL)
 - Should hear gush of air → will allow enough time to insert chest tube
 - Hemodynamic status should improve post decompression
 - 2nd = chest tube (directions as above)
 - TRAUMATIC Tension PTX:
 - Often has air leak from outside (open wound) or inside (tear in tracheobronchial tree)
 - Open PTX** = sucking chest wound

- **Initial Tx** = 3-way occlusive dressing over wound → dressing pulled to chest wall on inspiration (stopping air entry to pleural space from wound) & allows air to exit through open side of dressing on expiration = 1-way valve effect
- **Ultimate Tx** = chest tube + definitive repair in OR
- Persistent air leak from tracheobronchial tree
 - Initial Tx = chest tube (5th ICS AAL)
 - However will continue to have persistent PTX
 - Ultimate Tx = definitive repair in OR

5. APPROACH TO ACUTE CORONARY SYNDROMES (ACS)

Cause → blockage of coronary arteries

- Can lead to permanent damage (cell death) to myocardium = MYOCARDIAL INFARCTION
 - If ST elevation on ECG = **STEMI**
 - If no ST elevation on ECG = **NSTEMI**
- Can lead to ↓ blood supply to myocardium (no cell death) = MYOCARDIAL ISCHEMIA

Presentations:

- **Hx** = most important aspect of evaluation
 - RF for ACS = **RF for CAD**
 - Smoking, DM, HTN, FHx of CAD (at young ages), ↑cholesterol
 - RFs ↑chance of ACS but NOT required to Dx ACS
 - **CP** → onset (timing & what pt doing), quality, location, severity, duration (new or recurrent), frequency (similar previous episodes), radiation (jaw, shoulder, arm, back), ↑/↓ factors (pleuritic, positional, affect of exercise/rest)
 - **Associated Sx** → SOB, diaphoresis, N/V, presyncope
 - Hx worrisome for ACS (TYPICAL Sx):
 - Retrosternal chest pressure
 - Radiation pain to both arms/shoulders
 - Exertional pain better with rest
 - Not pleuritic or positional
 - Association with nausea, diaphoresis
 - Patient states similarity of pain to previous MI
 - ATYPICAL Sx:
 - CP → mild discomfort, isolated in shoulder/arm/jaw/epigastric, isolated SOB or diaphoresis, pain sharp/pleuritic/reproducible on palpation, no association with exercise & no improvement with rest
 - Have low threshold for investigation due to atypical presentations
 - More likely in → **elderly, women, DM**
- **Px:**
 - Large range of presentations → from sick to well
 - Sick → cardiac arrest, unstable vitals (↓/↑BP, ↓/↑HR, ↑RR)
 - Cardiac → listen for S1/S2, presence of EHS/murmurs, ↑JVP
 - Resp → listen for crackles, presence of breath sounds

Investigations:

- **ECG** = cornerstone Dx for ACS
 - Approach = rate, rhythm, axis
 - In potential ACS patient → look for ST elevation & ST depression +/- T inversion
 - **ST elevation** → indicates acute infarct
 - Causes of non-ACS ST elevations:
 - Benign early repolarization, LBBB, LVH, LV aneurysm, pericarditis
 - Acute infarct follows **2 rules**
 - TERRITORIAL → each coronary artery + branches supply specific areas to heart
 - If 1 branch blocked → territory supplied by this artery = no O2 delivery
 - Look at 12 lead ECG in territories:

- **Inferior** = Leads 2, 3, aVF
 - Supplied mainly by RCA
 - **Lateral** = Leads 1, aVL, V5, V6
 - Supplied by branches of LAD + Left circumflex
 - **Anterior** = Leads V1, V2, V3, V4
 - Supplied mainly by LAD
 - Want to determine if ST elevations belong to same territories
 - RECIPROCAL Changes
 - If ST elevations occur in 1 territory → get ST depression in opposite territory & vice-versa
 - Inferior = opposite to Lateral
 - Anterior = opposite to Posterior (requires 15 lead ECG with posterior leads = V7, V8, V9)
 - **ST depression +/- T inversion**
 - ST depression = denotes ischemia → not territorial or reciprocal
 - If no ST depression then look for T-wave inversion
- Non-ECG modalities:
 - Imaging → to exclude other Dx of CP
 - CXR:
 - Look for PTX, pneumonia, aortic dissection
 - Bedside US:
 - Look for pericardial effusions,
 - CT:
 - Look for PE, aortic dissection
 - BW:
 - Routine:
 - CBC → Hg (Sx may be present with anemia)
 - Lytes & creatinine → idea of baseline function, may direct future Tx choices
 - Specific = **cardiac enzymes** → ↑ if myocardial death

Cardiac markers

Marker	Initial Elevation	Peak Elevation	Return to Baseline
Myoglobin	1-4 h	6-7 h	18-24 h
CK-MB	4-12 h	10-24 h	48-72 h
Cardiac Trop I	3-12 h	10-24 h	3-10 d
Cardiac Trop T	3-12 h	12-48 h	5-14 d

- **Trop I** = most sensitive
 - However can take hours to appear abnormal on BW
 - Most institutions choose to draw levels at **6-8h post event**
- Delayed -ve Trop **CAN** r/o MI but cannot r/o angina
- Early -ve Trop **CANNOT** r/o MI as may be too early

Treatment:

- **STEMI** → 5 overall principles
 - O₂ → To achieve O₂ sat >92%
 - Antiplatelet → ASA, Clopidogrel, Ticagrelor, Glycoprotein 2B/3A inhibitor
 - Antithrombin → Unfractionated Heparin, LMWH, fondaparinux
 - Open vessel (main Tx) → PCI, CABG
 - Symptom treatment → morphine, nitrates
- **NSTEMI**
 - Risk stratify with **TIMI Score** → with non Dx ECG for ACS or normal 1st set of cardiac enzymes
 - Looks at multiple RFs for death, MI, and ischemia needing revascularization in next 14d
 - Includes (each 1 point):
 - Age ≥65
 - ≥3 CAD RFs (as above in Hx)
 - Known CAD
 - ASA use in past 7d
 - Severe angina (>2 episodes in past 24h)

- ST segment changes (>0.5mm)
- Positive cardiac markers
 - ↑score = more aggressive Tx
- Tx = same as STEMI (with ↓incidence of requirement to open vessel)

6. APPROACH TO PULMONARY EMBOLUS (PE)

Terminology:

- PE = **Clot** in pulmonary arterial tree → in main, segmental, or sub-segmental arteries
- Why is PE bad:
 - RESP problems → V/Q mismatch (areas of lung with ventilation with no perfusion) → **hypoxemia**
 - CARDIAC problems → ↑pulmonary vascular resistance (PVR) → RV strain +/- failure → **CV collapse**
- Often originate from deep vein thrombosis (**DVT**) with migration to lungs
 - Below knee → from anterior/posterior tibial and/or peroneal veins
 - Behind knee → popliteal veins
 - Above knee → superficial/deep/common femoral veins, external iliac veins

Causes → Virchow's Triad

- STASIS → any conditions attributing to immobilization of patient
 - Surgeries, leg casts, long flights/train rides, intubation
- HYPERCOAGULABILITY
 - Congenital → protein C/S deficiency, Factor 5 Leiden, etc.
 - Acquired → HRT, OCP
 - Illness → SLE, malignancy, pregnancy, IBD
- ENDOTHELIAL INJURY
 - Central venous catheters, surgery

Presentation:

- Hx:
 - **CP** → pleuritic, associated with cough +/- hemoptysis
 - **SOB** → poor exercise tolerance, anxiety-like sx d/t tachycardia
 - Can be asymptomatic
 - If severe = CV collapse → ranging from syncope to cardiac arrest
- Px:
 - VITALS → ↑HR, ↑RR (most common), ↓BP, ↑temp, ↓O2 sat
 - CARDIAC → +/- EHS (S3/S4)
 - RESP → Rales
 - PERIPHERIES → signs of DVT in lower limbs (swelling, erythema, warmth)

Investigations:

- Goal = to r/o alternative Dx & rule in PE
- **CXR** → Look for pneumonia, pleural effusion, pneumothorax, CHF
 - **PE CXR findings (rare):**
 - **Hampton's Hump** = wedge shaped hyperdensity representing area of pulmonary infarct
 - Majority of patients with PE = **normal CXR**
- **ECG:**
 - Look for STEMI, pericarditis
 - **PE ECG findings:**
 - Most common = **sinus tachycardia** (~40% pts)
 - Flipped T in V1-V4 (~30% pts)
 - RBBB (~20% pts)
 - S1Q3T3 pattern (~20% pts) = prominent S in Lead 1, Q in lead 3, inverted T in lead 3
- **BW:**
 - CBC, lytes, BUN, Cr → for baseline values
 - Troponin
 - **D-Dimer** = fibrin degradation product (can ↑ in PE)

- See below
- CONFIRMATORY TESTING for Dx
 - **VQ scan** → looks at:
 - Ventilation → inhalation of air with radionucleotide and entry to air spaces in lungs
 - Perfusion → injection of IV radionucleotide to look at blood flow in lungs
 - In **PE** → part of lung affected will have **ventilation without perfusion**
 - Best used in patients with normal lungs
 - Not as sensitive or specific as CT scan
 - **CT with contrast** → imaging of choice to Dx PE
 - Will detect filling defects
 - Indicate regions of pulmonary infarction
 - **Doppler US** → used in patients with suspicion of **DVT**
 - Can also indicate alternative Dx → ie. Cellulitis, Baker's cyst

Approach to PE:

- **Risk stratification** → Very Low vs Low vs High
 - VERY LOW risk → **PERC Rule**
 - 8 criteria
 - Age > 50
 - HR > 100
 - O2 sat <94%
 - Prior DVT/PE
 - Recent trauma or surgery
 - Hemoptysis
 - Exogenous estrogen use
 - DVT Sx
 - If patient has none of above with low clinical suspicion of PE → no further w/u indicated
 - Total w/u may include only → CXR, ECG, basic BW (NO D-dimer)
 - LOW risk → **D-Dimer**
 - Scored via **Well's Score** → based on clinical presentation with point scoring
 - Components:
 - DVT Sx (3)
 - HR >100 (1.5)
 - Recent immobilization >3d or surgery in past 30d (1.5)
 - Previous VTE (1.5)
 - Hemoptysis (1)
 - Malignancy (1)
 - Scoring:
 - **≤4 = low risk**
 - D-Dimer -ve = no further w/u indicated
 - D-Dimer +ve = further w/u with **imaging** required (follow high-risk)
 - **>4 = high risk** (see below)
 - HIGH risk → **Imaging** (cannot r/o with negative D-Dimer)
 - VQ scan
 - **CT** → high sensitivity
 - Doppler US → to r/o DVT
- **Treatment:**
 - Initial = ABCs
 - Ensure airway patent
 - Ventilation & oxygenation adequate → supplemental O2
 - Not hypotensive → IVF +/- vasopressors
 - If hemodynamically stable → **anticoagulation** (heparin, LMWH bridging to warfarin, oral anticoagulants)
 - If massive PE causing CV compromise (unstable) → **thrombolytics**

7. APPROACH TO ASTHMA

Terminology:

- Asthma = Chronic inflammation of airways → leading to airway edema and bronchoconstriction → airflow obstruction → ↓ventilation (↑CO₂) + ↓oxygenation (↓O₂) → respiratory arrest
- **Triggers** of asthma exacerbations:
 - Allergens
 - Smoking
 - URTI

RF for severe exacerbations:

- Previous asthma exacerbations requiring ICU admission/intubation
- Multiple hospital admissions
- Poor baseline lung function

Presentation:

- Hx:
 - **SOB** + chest tightness → worse on exertion
 - Audible **wheezes**
 - ↑use of puffers
- Px:
 - General APPEARANCE → position, LOC, colour, VS (varies based on degree of exacerbation)
 - **Mild** exacerbation:
 - Can lay down comfortably, normal LOC, normal colour (pink), ↑RR/HR, normal O₂ sat
 - **Moderate** exacerbation:
 - Will sit upright, normal LOC, normal colour (pink), ↑↑RR/HR, ↓O₂sat
 - **Severe** exacerbation:
 - “Tripod” positioning leaning forward, confused +/- ↓LOC, cyanotic (blue) + diaphoretic, ↑↑↑HR or ↓HR, ↓BP, ↓↓O₂ sat
 - RESP:
 - **Mild:**
 - Full sentences, no in-drawing, bilateral AE but ↓, + wheezes
 - **Moderate:**
 - 3-4 word dyspnea, +/- in-drawing (intercostal, supraclavicular), tracheal tug, loud wheezes, ↓AE
 - **Severe:**
 - Single word dyspnea, ↑in-drawing/tracheal tugging, +/- abdo breathing, quiet on auscultation with ↓↓AE & no wheezing

Investigations:

- CXR → to r/o pneumonia, PTX, pneumomediastinum
 - Not necessary if Dx clear on Hx (ie. known allergen, URTI trigger, etc)
- BW → not indicated in patients with routine exacerbations
- ECG → if suspicious for MI/ACS
- **FEV1** → bedside test to measure forced expiratory volume in 1 sec (requires **alert** patient)
 - Compare measured value to expected value (as %) → for risk stratification
 - **Mild** exacerbation → 50-70% expected FEV1
 - **Moderate** exacerbation → 25-50% expected FEV1
 - **Severe** exacerbation → <25% expected FEV1
 - Use in conjunction with clinical information to determine severity of exacerbation

Treatment:

- GENERAL = ABCs:
 - Avoid hypoxia → give supplemental O₂ to maintain sats >92%
 - Avoid hypotension → give IVF
- RAPID ACTING B2-AGONISTS = **mainstay** of asthma tx

- Action = bronchodilation
- **Salbutamol** (Ventolin) = main choice → various delivery methods (Neb, MDI, IV)
 - **MDI** for Mild-Moderate exacerbation
 - 4-6puffs q20-40min
 - **Neb** for Severe exacerbation (as unable to coordinate breathing efficiently enough for MDI)
 - 3 Neb doses back to back (1Neb = 4-6 MDI puffs)
 - Adverse Effects:
 - ↑HR, ↓K
- **ANTICHOLINERGICS:**
 - Action = bronchodilation
 - **Ipratropium** (Atrovent) → various delivery methods (Neb, MDI)
 - MDI for Mild-Mod
 - Neb for Severe
 - Given **with** Ventolin in 1st 3 rounds of Tx → dosing as above
- **EPINEPHRINE** → given if exacerbation triggered by **allergic** reaction
 - Action = bronchodilator, vasopressor
- **STEROIDS:**
 - Action = ↓airway inflammation & edema
 - Can be given IV/PO → IV only for those who can't tolerate PO intake
 - IV = Hydrocortisone 100-200mg
 - PO = Prednisone/Prednisolone 50mg OR Dexamethasone 16mg
- **ANTIBIOTICS:**
 - Only for those with documented **pneumonia** on CXR
- **SPECIFIC for Severe Exacerbations:**
 - **Magnesium** 2g IV over 30min → smooth muscle relaxant (bronchodilation)
 - **BiPAP** → no large RCTs to support use; depends on local centre preferences
 - Intubation + mechanical ventilation:
 - Indications = ↓LOC, ++ exhaustion, cardiac or respiratory arrest
 - Intubated asthmatic = **very difficult** patient (d/t many reasons including inducing bronchospasm, difficult to maintain resp requirements, etc)

Discharge:

- Requirements:
 - In no resp distress
 - FEV1 >75% predicted (at least **2h** after last tx with bronchodilator)
- Medications:
 - **Salbutamol** puffer + aerochamber → 1-2puffs q4h
 - **Steroids** → Prednisone/Prednisolone 50mg daily x 4d OR Dexamethasone 16mg x 1d (if given in ED)

8. APPROACH TO COPD

Terminology:

- COPD = chronic inflammation of tracheobronchial tree → leading to airflow obstruction → resp failure → death

Causes:

- Smoking (majority), alpha1-antitrypsin deficiency
- Natural **progression** → lung function ↓ after each acute exacerbation of COPD (AECOPD)
- **Triggers:**
 - Lung problems → pneumonia, PE, PTX
 - Medication → ran out of puffers
 - Social → continuation of smoking

Evaluation:

- Hx:
 - **CURRENT** attack:
 - Onset, current Sx (SOB, cough, exercise intolerance), associated Sx (PND, orthopnea, CP)

- **Triggers:**
 - Pneumonia → fever, chills, sputum changes (colour, amount)
 - PE → immobilization, previous VTE, etc.
 - PTX → abrupt onset SOB
 - Run out of puffers, ↑smoking
- BASELINE Function:
 - Able to walk around the block, walk up stairs, O₂ dependent (rest vs exertion)
 - Puffer use → name & frequency of use
- PREVIOUS Attacks:
 - Frequency of exacerbations → last exacerbation, previous steroid use, usual course of illness (# of days, requiring hospitalization/ICU, needing intubation)
- Px = Similar to approach with CC of SOB
 - VITALS → ↓O₂ sat, ↑HR, ↑temp (if infection = trigger)
 - GENERAL → Signs resp distress = tripod positioning, cyanosis, tracheal tugging, intercostal in-drawing, abdominal breathing
 - CARDIAC → HS/EHS, murmurs, cardiac apex, JVP
 - RESP → AE & symmetry, presence of crackles/rales, pleural rubs
 - PERIPHERIES → signs of DVT in legs (if PE = trigger), peripheral edema (if CHF = trigger)

Investigations:

- BW:
 - CBC → for signs of infection (↑WBC), hemoconcentration (↑H_g)
 - Lytes, BUN, Cr → for electrolyte abnormalities & renal insufficiency
 - VBG +/- ABG → look for CO₂ retention (↑pCO₂), compare to baseline value if available for severity of current illness
 - Others:
 - If concerned of cardiac insult → Trop, CK, ECG
- ECG:
 - ↑HR during acute exacerbation → typically Multifocal Atrial Tachycardia (MAT)
 - Also look for cardiac cause mimicking AECOPD (ie. STEMI)
- Imaging:
 - **CXR** → most common
 - Typical COPD CXR → **hyperinflation** with flattened diaphragm
 - Identify triggers → pneumonia, PE, PTX
 - CT → used if suspicion of PE as trigger
 - Bedside US → used to evaluate for PTX

Treatment:

- Initiated once other caused of SOB excluded
- O₂:
 - Prevent hypoxia → titrate to O₂ sats of 90% (via NP or venturi mask)
- BRONCHODILATORS:
 - **Salbutamol** (main tx) → via Nebs/MDI
 - Given back-to-back x 3 initially
 - AE = ↑HR, ↓K
 - **Ipratropium** → added for additional bronchodilation
 - Given as single initial dose
- STEROIDS:
 - Methylprednisone IV OR Prednisone PO
 - Important to begin **early** as can take hours for effect
- ANTIBIOTICS:
 - Indication:
 - **Pneumonia** on CXR, or
 - Sx consistent with **infection** = fever, ↑sputum production, change in sputum colour
 - Either Doxycycline, Fluoroquinolone, or Cephalosporin
- BiPAP → for mod-severe exacerbation
 - Can only be used in awake patients

- Use **early** in treatment plan
- Useful in preventing intubation in those with severe exacerbations
- INTUBATION:
 - Indications:
 - Severe exacerbation without access to BiPAP
 - Failing BiPAP/↓O2 sat despite on BiPAP
 - Worsening acidosis (↑CO2)

Disposition:

- D/C **home** if:
 - Normal O2 sat at rest **AND** on exertion
 - Meds = 10-14d PO **steroids** +/- abx if indicated
- **Admission** if:
 - ↓O2 sat with exertion/ambulation
 - Requiring continuous BiPAP → admit to ICU

Summarized by Alex Mungham, Dr. Stella Yiu