Pulmonology Test Review

Lise Harper, MD MPH

October 29, 2019

Question 1

- C; Laryngoscopy

Diagnose a patient with vocal cord dysfunction

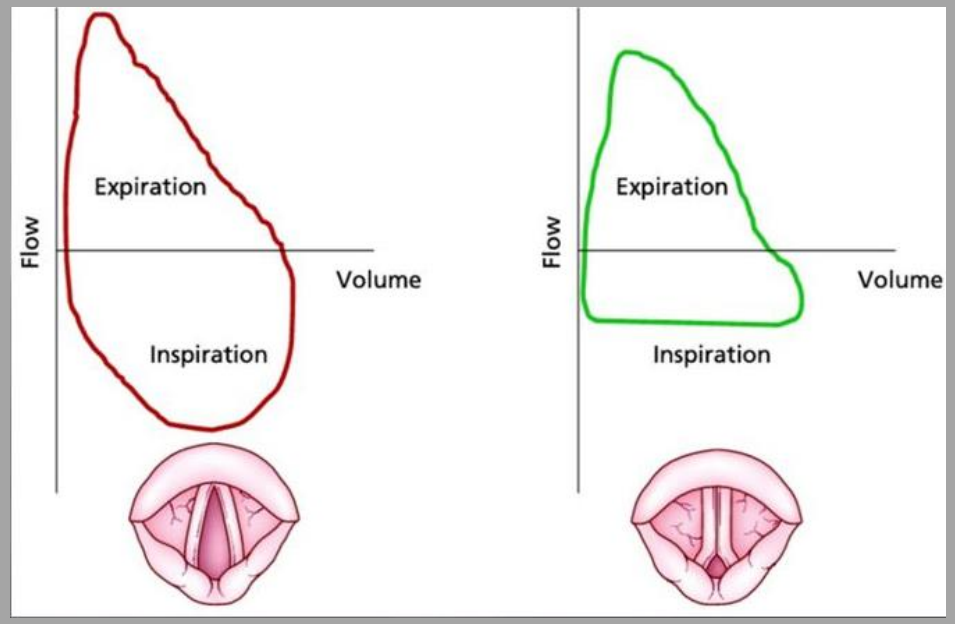
- 32 y/o M with persistent asthma
- Diagnosed with asthma in high school and requires several courses of prednisone yearly
- Recent ED visit for dyspnea, wheezing, dysphonia, and upper chest and throat tightness
- Treated with albuterol, IV methylprednisolone and hospitalization

- Vocal cord dysfunction:
  - Paradoxical adduction of the VCs during inspiration, leading to a functional airway obstruction
  - Dysphonia, midchest tightness, exposure to particular triggers, difficulty breathing in, and symptoms that are only partially responsive to asthma medications

Diagnose a patient with vocal cord dysfunction

- Inducers of VCD
  - Asthma
  - Exercise
  - Postextubation
  - Inhaled irritants
  - Laryngopharyngeal reflux
  - Neurologic injury
  - Psychological disorders and stress

- Vocal cord dysfunction:
  - Diagnose by laryngoscopy; visualization of the abnormal movement
  - Tx with speech therapy using cognitive behavioral techniques and avoidance of irritants



Question 2

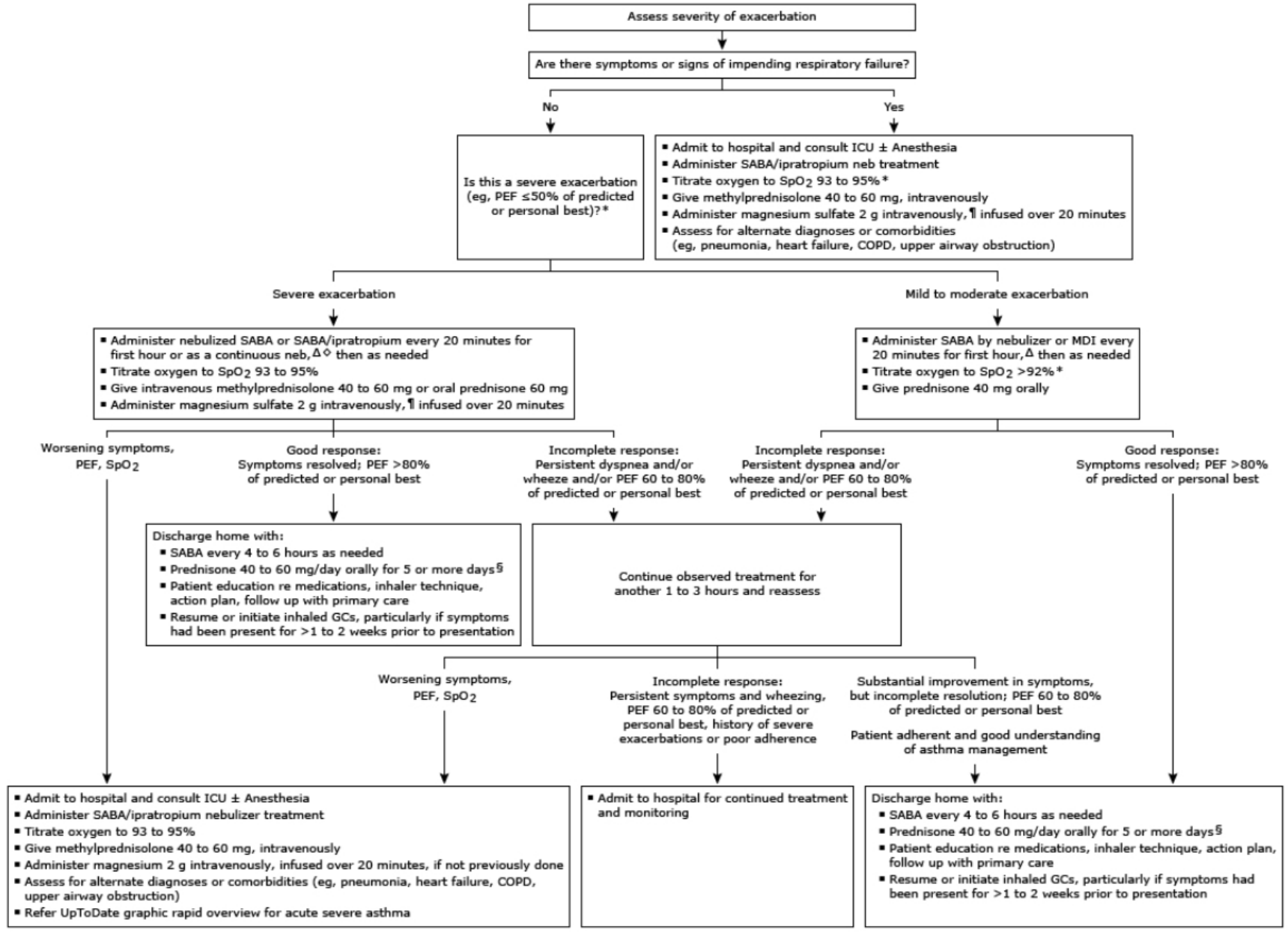
- A; Admit patient to the hospital for inpatient management

Treat an asthma exacerbation in the hospital

- 52 y/o F with hx of asthma presents with worsening wheezing, dyspnea and cough despite using albuterol inhaler QID
- Smokes 2 PPD; ran out of budesonide/formoterol 2 weeks ago
- 2 recent exacerbations; hx of intubation
- HR 140, RR 32/min and O2 sat 89% on RA
- Chest exam with poor air movement and faint wheezing

Severe Asthma Exacerbation Risk Factors and Signs
Risk Factors
History of near-fatal asthma attack or intubation
Emergency department or hospital visit in the last 12 months
Poor asthma medication adherence
Recent treatment with oral glucocorticoid
Psychosocial stressors or psychiatric disease
Signs
Unable to speak in full sentences
Use of accessory muscles of respiration
Respiration rate >30/min, heart rate >120/min
SpO_2 <90% on ambient air
Agitation, confusion, or drowsiness

Management of asthma exacerbations in adults: Emergency department or urgent care



Question 3

- B; Magnesium sulfate, intravenously

Treat a patient for an acute asthma exacerbation with magnesium sulfate

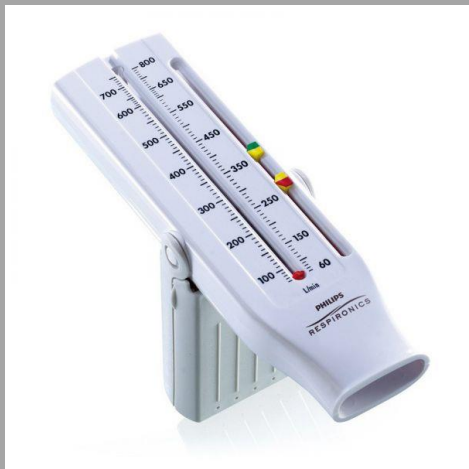
- 24 y/o F being treated in the ED for an acute asthma exacerbation
- s/p continuous albuterol and ipratropium nebs and IV methylprednisolone
- HR 121, RR 28/min, O2 sat 95% on 4 L/min
- Peak flow is < 40% of her baseline
- Sitting upright, using accessory muscles and speaking in 4 word sentences
- Diffuse wheezing on exam

- IV magnesium sulfate
  - Relaxes bronchial smooth muscle tissue
  - 2014 systematic review:
    - IV infusion of 1.2 g or 2 g of mag sulfate IV over 15 to 30 min reduced hospital admissions and improves lung function
- Other key points:
  - SAMA/SABA combo > SABA alone: has been shown to reduce hospitalizations and improve lung function in mod-severe exacerbation

Treat a patient for an acute asthma exacerbation with magnesium sulfate

- Other answers
  - IV ketamine: theoretical bronchodilatory effect, but 2 RCTs failed to demonstrate added bronchodilator effects compared to conventional management
  - Monteleukast and theophylline may be effective long term options in outpatient setting

- Peak flow measurement
  - Determine personal best; PF diary
  - Normal range: 80-100% of personal best
  - Used to determine severity and response to treatment in acute setting
  - PEF <200 L/min = severe obstruction
  - Severe if ≤ 50% predicted
  - > 50 but < 70% = moderate



Question 4

- C; Surgical wedge resection

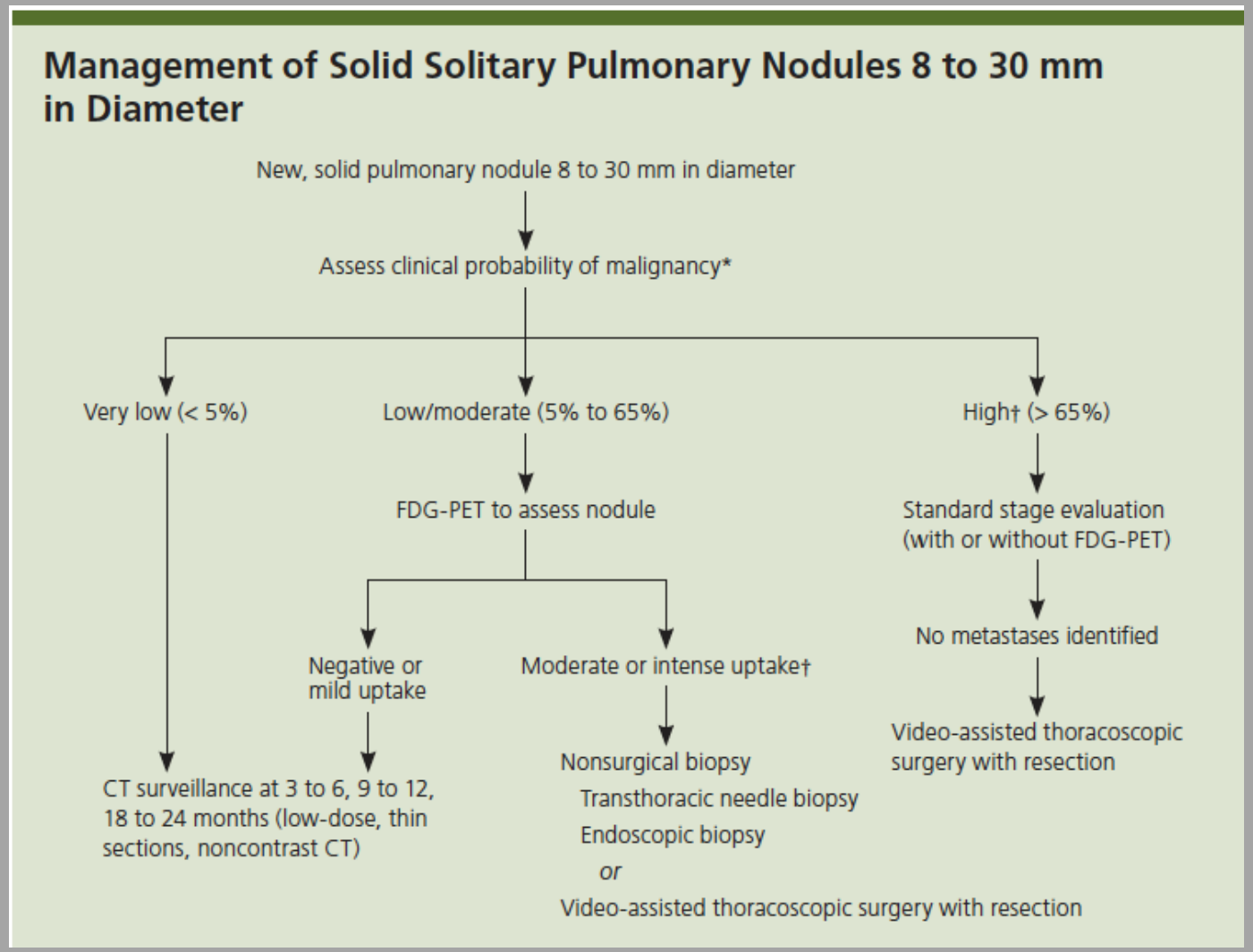
Evaluate a solitary pulmonary nodule in a patient at high risk for malignancy

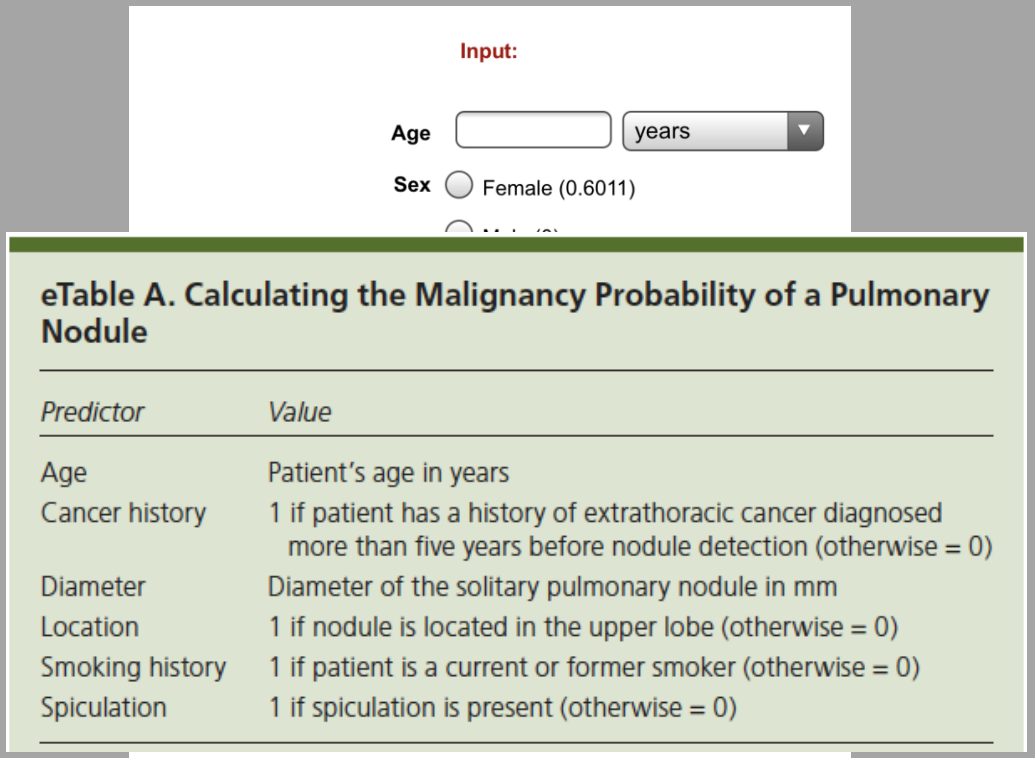
- 72 y/o F with 30-PY smoking hx, quit 5 years ago
- Hx of COPD and breast CA
- Screening low dose CT shows a peripheral 9-mm solid pulmonary nodule LUL; no LAD
- PET/CT showed FDG activity

Evaluation of the incidental solid pulmonary nodule in adults

Nodule size (mm)	Low (<5%) cancer risk	High (>65%) or moderate (5 to 65%) cancer risk
Solitary		
<6	No routine follow-up	Optional CT at 12 months
6 to 8	CT at 6 to 12 months, then consider CT at 18 to 24 months	CT at 6 to 12 months, then CT at 18 to 24 months
>8	CT at 3 months, then at 9 and 24 months	FDG PET/CT, biopsy or resection

Evaluate a solitary pulmonary nodule in a patient at high risk for malignancy



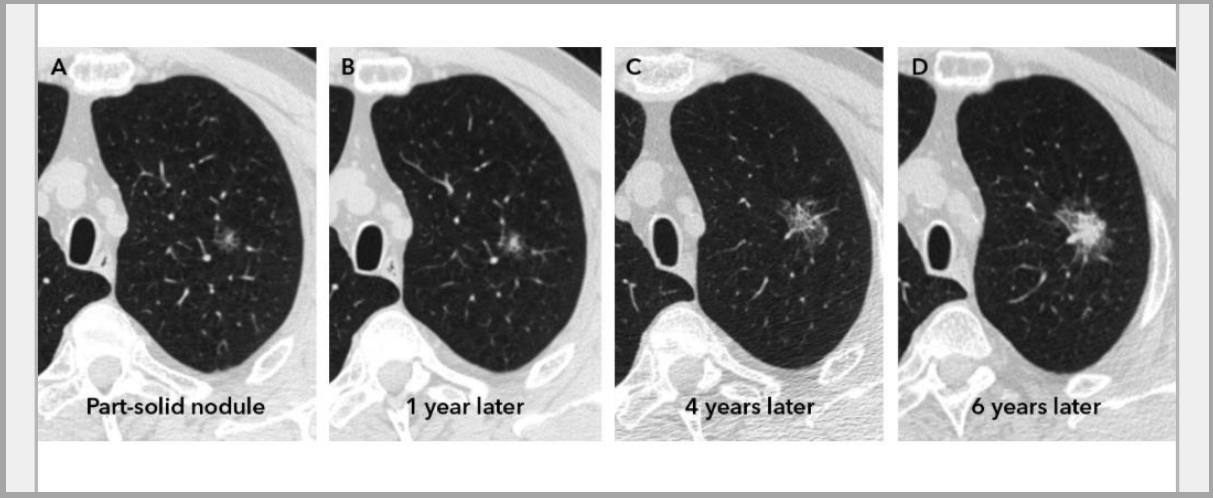


Question 5

- A; Chest CT scans every 2 years for 5 years

Evaluate a subsolid solitary pulmonary nodule

- 72 y/o M found to have an 8 mm ground glass nodule in the RUL
- He undergoes f/u CT at 12 months and also 2 years
- The nodule is unchanged



- Subsolid nodule
  - Pure ground glass
  - Part-solid
- Adenocarcinoma in situ
  - Slower rate of growth
  - Observed growth rates: 400-800 days

Pure ground glass	<6 mm	No follow-up
	≥6 mm	CT at 6-12 months to confirm persistence, then CT every 2 years until 5 years
Part solid nodule	<6 mm	No follow-up
	≥6 mm	CT at 3-6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years

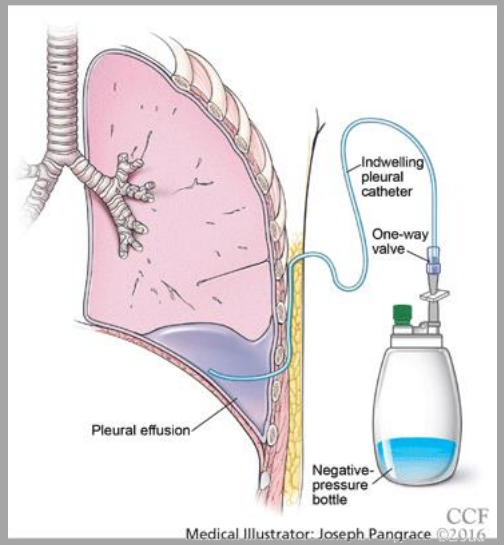
Question 6

- A; Indwelling pleural catheter placement

Manage a malignant pleural effusion

- 58 y/o F with hx of breast cancer
- 6 months of progressive dyspnea and cough
- Left-sided pleural effusion; cytology positive for adenocarcinoma
- Treated for metastatic breast CA
- Requires repeat thoracentesis for drainage of pleural fluid

- Consider prognosis, degree of lung re-expansion and patient performance status
- Indwelling pleural catheters with intermittent drainage provide symptom relief and 50% to 70% of patients achieve spontaneous pleurodesis after 2-6 weeks
- Recent trial:
  - Non-inferior to talc pleurodesis and assoc. with ↓ LOS and ↓ SOB



Manage a malignant pleural effusion

- Other answers:
  - Pleurectomy – rarely performed as invasive, long recovery and no more effective than less invasive options
  - Repeat therapeutic thoracentesis – appropriate if < 3 month prognosis and slower reaccumulation of fluid
  - Chemical pleurodesis – obliteration of the pleural space with talc; very effective, success rate of 60% to 90%, but assoc. with increased pain and ↑ LOS

- Side effects:
  - Bleeding, catheter blockage, catheter fracture
  - Infection along tract or w/in pleural space; often can be treated with antibiotics and catheter does not need to be removed

- Another point about testing for malignant pleural effusion:
  - Sensitivity of pleural fluid is 60%
  - Increases by 15% if a 2nd sample is obtained
  - If cytology is negative and malignancy is still suspected, thoracoscopy is next step
    - Biopsy of the pleural surface: > 90% sensitivity

Question 7

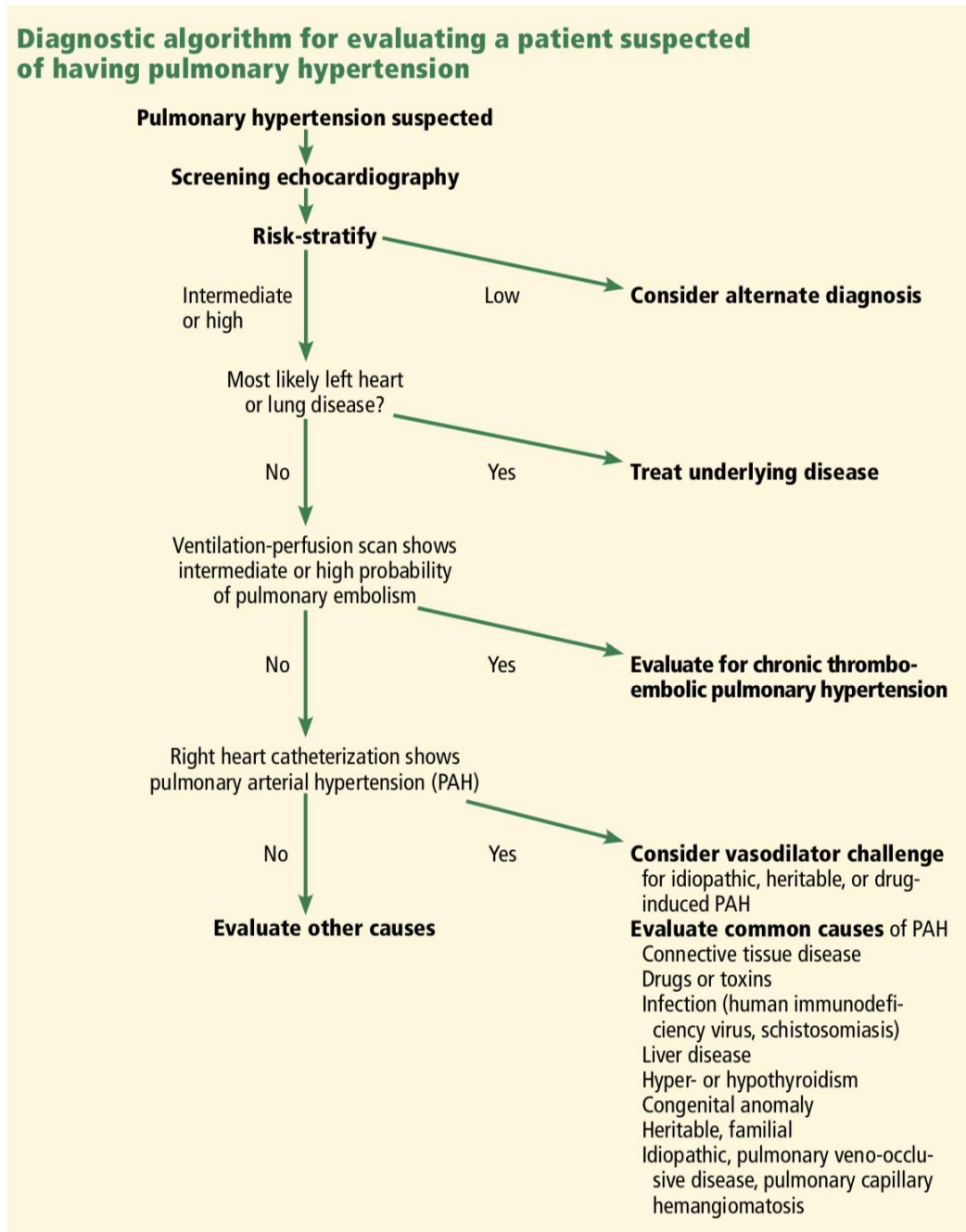
- C; Transthoracic echocardiogram

Evaluate suspected pulmonary artery hypertension with transthoracic echocardiography

- 35 y/o F with 4 months of exertional dyspnea and 1 week of chest pressure
- Widened split S_2 with a prominent pulmonic component and neck vein distension
- Normal lung exam, labs and EKG
- CXR clear with prominent hilae

- Transthoracic echocardiogram is the initial test if suspicion for pulmonary hypertension
  - Estimates pulmonary artery pressure, right and left heart function
  - May underestimate true pulmonary artery pressures, so if pretest probability is high, may require RHC if ECHO unrevealing

- PH defined as resting mean PAP of 25 mm Hg or greater on RHC



- Evaluation of left-heart disease
  - More than 75% of cases of PH are directly related to LV dysfunction or MV or AV disease
- Evaluation of lung disease
  - COPD, ILD, OSA
- Evaluation for chronic thromboembolic disease
  - Important to identify, as it is the only curable etiology of PH
  - Up to 9% of patients who survive acute PE exhibit features of chronic proximal thrombosis and remodeling of the distal pulmonary arteries

Question 8

- D; Supplemental oxygen

Treat pulmonary hypertension secondary to chronic hypoxemia

- 62 y/o F with exertional dyspnea x 6 months
- Former smoker with severe COPD
- On LAMA/LABA, inhaled corticosteroid
- O2 sat 89%, diminished breath sounds and prominent pulmonic sound
- ABG: 7.41/43/55
- CXR: hyperinflation, ECHO: RVSP 58 mm Hg
- PSG with AHI of 2 and a mean O2 sat of 87%

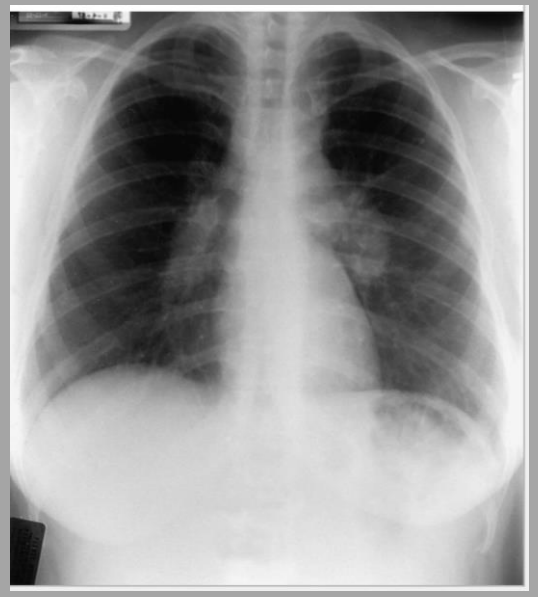
- Pulmonary hypertension in the setting of advanced COPD, Group 3
- Maximum inhaler therapy for her COPD
- Oxygen indicated if:
  - Hypoxemia during daytime rest
  - In the setting of cor pulmonale or secondary polycythemia
  - Hypoxemia during sleep
- Other answers:
  - BiPAP: indicated in the setting of hypercapnia with COPD
  - Prednisone: for acute exacerbation of COPD
  - Vasodilator: not indicated for PH Group 2

Question 9

- D; Observation

Manage an asymptomatic patient with stage I pulmonary sarcoidosis

- 24 y/o F seen in follow-up
- CXR with incidental findings of bilateral hilar adenopathy
- Normal vital signs and asymptomatic



- Pulmonary sarcoidosis:
  - Stage I: hilar LAD with normal lung parenchyma
  - Stage II: hilar LAD with abnormal lung parenchyma
  - Stage III: no LAD with abnormal lung parenchyma
  - Stage IV: parenchymal changes with fibrosis and architectural distortion
- Majority of patients with stage I pulmonary sarcoidosis have spontaneous resolution of the hilar LAD

Manage an asymptomatic patient with stage I pulmonary sarcoidosis

- Sarcoidosis:
  - Granulomatous disease that can affect multiple organ systems
  - > 90% have lung involvement
  - Patients are often asymptomatic and incidental CXR findings
  - Diagnose with bronchoscopic biopsy, except:

Asymptomatic bilateral hilar lymphadenopathy	No evidence of fevers, malaise, or night sweats to suggest a malignancy
Löfgren syndrome	Bilateral hilar lymphadenopathy, migratory polyarthralgia, erythema nodosum, and fever
Heerfordt syndrome	Anterior uveitis, parotiditis, fever (uveoparotid fever), and facial nerve palsy

- Organ involvement:
  - Skin
  - Lymph node
  - Eye
  - Liver

Number and percentage of patients with specified organ involvement

Organ involvement	Number*	Percent
Lungs	699	95
Skin ¶	117	15.9
Lymph node	112	15.2
Eye	87	11.8
Liver	85	11.5
Erythema nodosum	61	8.3
Spleen	49	6.7
Neurologic	34	4.6
Parotid/salivary	29	3.9
Bone marrow	29	3.9
Calcium	27	3.7
ENT	22	3
Cardiac	17	2.3
Renal	5	0.7
Bone/joint	4	0.5
Muscle	3	0.4

ENT: ear, nose, and throat.
* Total n = 736.
¶ Excluding erythema nodosum.

Manage an asymptomatic patient with stage I pulmonary sarcoidosis

- Treat with glucocorticoids
  - Decision to treat should be based on symptoms and organ involvement

I	Hilar lymphadenopathy with normal lung parenchyma	>90% will have spontaneous resolution without treatment
II	Hilar lymphadenopathy with abnormal lung parenchyma	Approximately 50% rate of spontaneous improvement without treatment
III	No lymphadenopathy with abnormal lung parenchyma	Approximately 20% rate of spontaneous improvement without treatment
IV	Parenchymal changes with fibrosis and architectural distortion	

Question 10

- B; Epinephrine

Treat a patient who has anaphylaxis with epinephrine

- 18 y/o F with lip swelling after attending a picnic
- Hx of allergies to peanut/tree nut with lip swelling
- BP 110/64 mm Hg, HR 109, RR 19, O2 sat 100% on RA
- On exam, bilateral lip swelling, upper > lower lip, no tongue swelling or stridor, lungs CTA
- Urticaria present on hands and trunk

- Presentation
  - Flushing, urticaria and angioedema – 85%
  - Wheeze, stridor and respiratory distress – 70%
  - Hypotension and tachycardia – 45%

Treat a patient who has anaphylaxis with epinephrine

Promptly and simultaneously, give:
IM epinephrine (1 mg/mL preparation): Give epinephrine 0.3 to 0.5 mg intramuscularly, preferably in the mid-outer thigh. Can repeat every 5 to 15 minutes (or more frequently), as needed. If epinephrine is injected promptly IM, most patients respond to one, two, or at most, three doses. If symptoms are not responding to epinephrine injections, prepare IV epinephrine for infusion.
Place patient in recumbent position, if tolerated, and elevate lower extremities.
Oxygen: Give 8 to 10 L/minute via facemask or up to 100% oxygen, as needed.
Normal saline rapid bolus: Treat hypotension with rapid infusion of 1 to 2 liters IV. Repeat, as needed. Massive fluid shifts with severe loss of intravascular volume can occur.
Albuterol (salbutamol): For bronchospasm resistant to IM epinephrine, give 2.5 to 5 mg in 3 mL saline via nebulizer. Repeat, as needed.

Adjunctive therapies:
H1 antihistamine*: Consider giving diphenhydramine 25 to 50 mg IV (for relief of urticaria and itching only).
H2 antihistamine*: Consider giving ranitidine 50 mg IV.
Glucocorticoid*: Consider giving methylprednisolone 125 mg IV.
Monitoring: Continuous noninvasive hemodynamic monitoring and pulse oximetry monitoring should be performed. Urine output should be monitored in patients receiving IV fluid resuscitation for severe hypotension or shock.

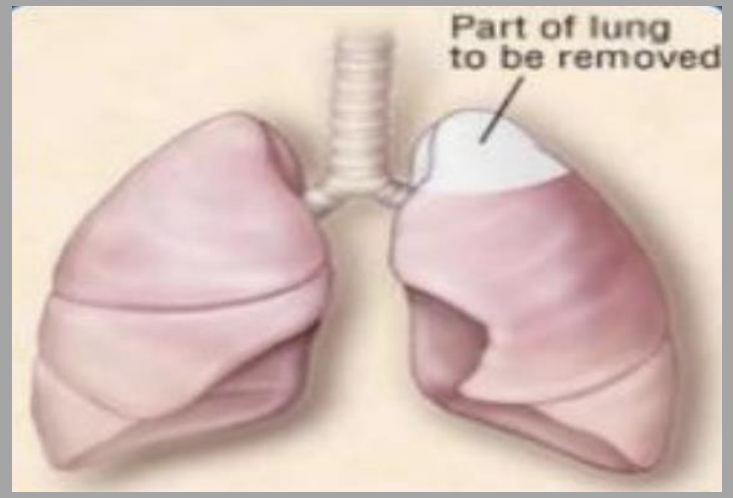
Question 11

- B; Evaluate for lung volume reduction surgery

Evaluate a patient with upper-lobe emphysema and significant exercise limitations for lung volume reduction surgery

- 58 y/o M with severe COPD and chronic exertional dyspnea
- Meds: LABA/anticholinergic, inhaled corticosteroid and SABA
- Uses supplemental O2
- Severe airflow obstruction on spirometry
- CT chest with heterogenous emphysema and without nodules
- ECHO shows DD, no pulmonary HTN

- LVRS
  - Improves the mechanical efficiency of respiratory muscles
  - Increases the elastic recoil of the lungs to improve expiratory flow
  - Reduce exacerbations



Evaluate a patient with upper-lobe emphysema and significant exercise limitations for lung volume reduction surgery

- National Emphysema Treatment Trial (NETT)
  - Carefully selected patients with upper-lobe predominant emphysema and significant exercise limitation despite participation in a pulmonary rehabilitation program had improved quality of life and survival with lung volume reduction surgery

- Candidates for LVRS:
  - Age < 75 y/o
  - Severe dyspnea despite optimal medical therapy and pulmonary rehab
  - > 6 months of smoking cessation
  - FEV1 < 45% predicted
  - DLCO not < 20% predicted
  - Lung volume measurements showing air trapping; increased RV/TLC ratio
  - CT with hyperinflation and heterogenous distribution of emphysema; predominately upper lobe emphysema
  - 6-minute walk > 140 meters

Question 12

- B; CT pulmonary angiography

Diagnose pulmonary embolism as a potential trigger for acute COPD exacerbations

- 66 y/o M with hx of COPD presenting with 1 week of increasing dyspnea on exertion, wheezing and non-productive cough
- Started on treatment with antibiotics and steroids
- Increase in albuterol use and nocturnal awakenings
- No URI symptoms
- Labs: normal CBC, BMP, BNP and ABG
- EKG: sinus tachycardia
- CXR: hyperinflation but no infiltrates

- COPD exacerbation triggers:
  - Respiratory infections - 70%
  - Environmental pollution
  - Other medical conditions:
    - Myocardial ischemia
    - Heart failure
    - Aspiration
    - Pulmonary embolism

- PE and COPD exacerbation
  - Meta-analysis of 5 studies, 550 patients having a COPD exacerbation
  - Prevalence of PE 20%
  - Limitation: unable to determine if the PE was the cause, result or a bystander

Question 13

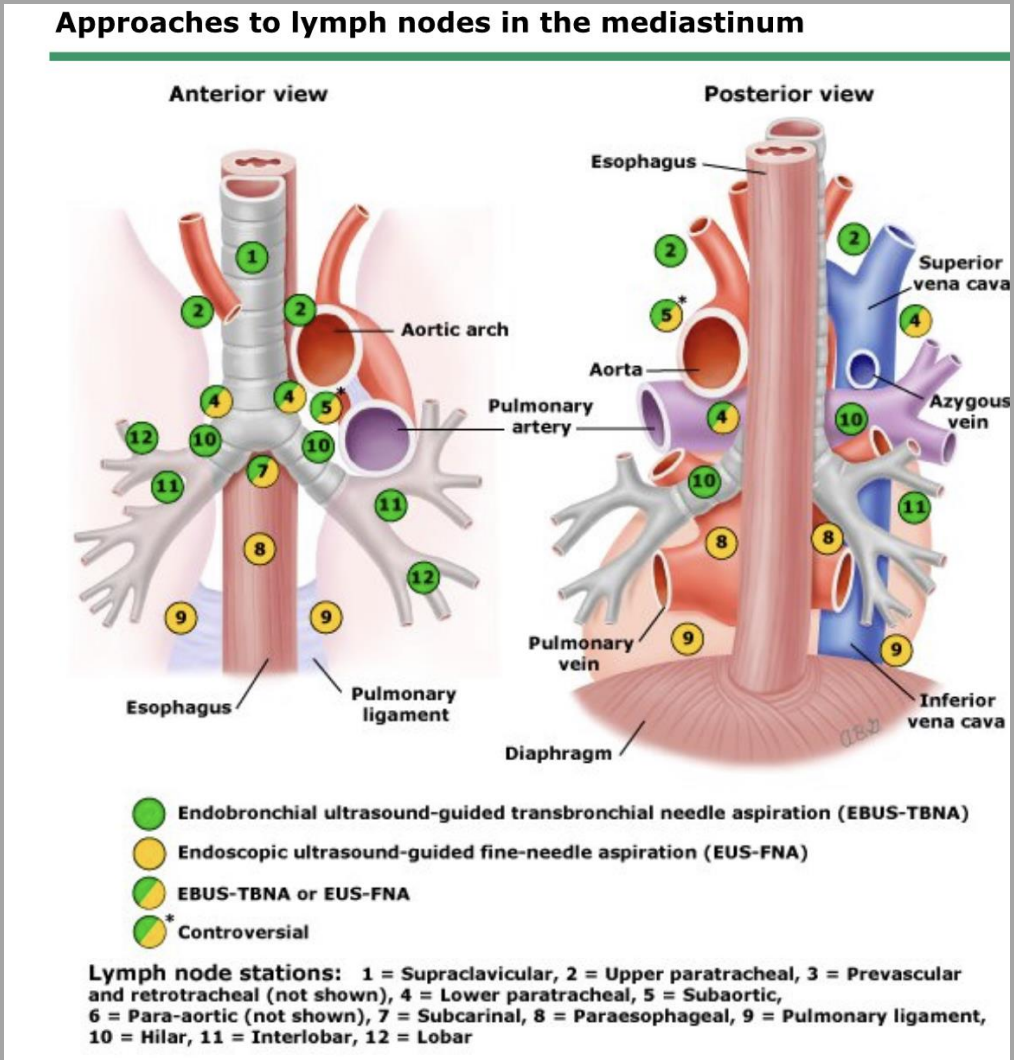
- B; Endobronchial ultrasound and mediastinal lymph node biopsy

Evaluate potential lung cancer with the optimal diagnostic procedure

- 63 y/o M with 60-PY smoking hx and cough
- Physical exam and labs, including Na and Ca are normal
- CXR shows a 2-cm nodule RUL
- CT and PET show PET positivity if the lung lesion and in the mediastinal lymph nodes

- Other answers:
  - CT-guided needle biopsy: highly accurate for diagnosis, but increased risk of procedural complications and likely would require a 2nd procedure to stage
  - Sputum cytology: lower sensitivity than EBUS, does not produce sufficient material for molecular studies and would not provide staging
  - Thoracoscopic lung biopsy with LN dissection: more invasive, costly and with increased complication risk

Evaluate potential lung cancer with the optimal diagnostic procedure



- Endobronchial ultrasound-guided transbronchial needle aspiration is the procedure of choice for diagnosing and staging mediastinal and hilar lymphadenopathy in patients with suspected thoracic malignancy
- Initial diagnostic testing should aim at identifying LN involvement or metastatic disease
- EBUS –guided aspiration can access most mediastinal and some hilar LN stations

Question 14

- E; Supervised weight loss program

Manage obesity related asthma with a supervised weight loss program

- 58 y/o M seen in f/u of an asthma exacerbation
- 30-year hx of asthma and 2 prior exacerbations over the past 12 months
- No environmental triggers, allergies, atopy, reflux symptoms, sinus symptoms, snoring or recent respiratory infections
- Recent sleep study negative for OSA
- VS normal, 97% on RA, BMI 36
- Scattered expiratory on exam
- Labs, including IgE level is normal
- CT of the sinuses normal

- Common comorbidities that can improve asthma control if managed:
  - GERD
  - Sinus disease
  - Obstructive sleep apnea
  - Vocal cord dysfunction
  - Obesity
- Incidence of asthma is 1.47 times greater in obese patients
- Weight loss improves asthma control, lung function and quality of life; additionally, reduces asthma medication use

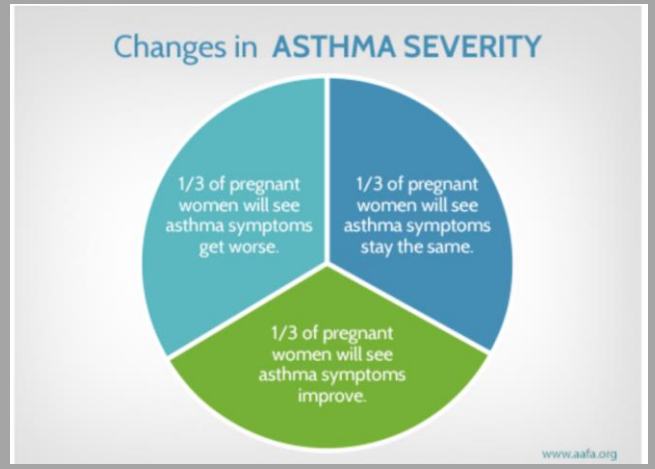
Question 15

- D; Restart previous medications

Treat asthma during pregnancy

- 24 y/o pregnant F with a hx of asthma
- Stopped her asthma medications (albuterol and budesonide) 4 weeks ago due to concern for the the fetus
- 4 weeks of exertional dyspnea and chest tightness 3-4 times per week
- VS normal, O2 sat 97% on RA
- Occasional expiratory wheezing on exam
- Mild airflow obstruction on spirometry

- Risks of untreated asthma > risks of asthma medications
  - Maternal asthma ↑ the risk of perinatal mortality, preterm birth, low-birth-weight infants, and preeclampsia
- Mild persistent asthma with symptoms more than 2 times per week
  - Low-dose inhaled glucocorticoid – budesonide preferred in pregnancy



Classifying Asthma Severity in Children 12 Years and Older and Adults

Classifying severity for patients who are not currently receiving long-term control medication*

Components of severity		*Classification of asthma severity*			
		Intermittent	*Persistent*		
			Mild	*Moderate*	*Severe*
Impairment Normal FEV_1/FVC: 8 to 19 years = 85% 20 to 39 years = 80% 40 to 59 years = 75% 60 to 80 years = 70%	Symptoms	≤ 2 days per week	> 2 days per week but not daily	Dail	
	Nighttime awakenings	≤ 2 times per month	3 to 4 times per month	> 1 bu	
	Short-acting $beta_2$ agonist use for symptom control (not prevention of EIB)	≤ 2 days per week	> 2 days per week but not > 1 time per day	Dail	
	Interference with normal activity	None	Minor limitation	Som	
	Lung function	Normal FEV_1 between exacerbations FEV_1 > 80% predicted FEV_1/FVC normal	$FEV_1 \geq 80\%$ predicted FEV_1/FVC normal	FEV bu pr FEV re	

Stepwise Approach for Managing Asthma in Children 12 Years and Older and Adults

Intermittent asthma

Persistent asthma: daily medication

Consult with asthma subspecialist if step 4 care or higher is required. Consider consultation at step 3.

Step 1
Preferred: Inhaled SABA, as needed

Step 2
Preferred: Low-dose ICS
Alternative*: Cromolyn, LTRA, or theophylline

Step 3
Preferred: Low-dose ICS plus LABA
or
Medium-dose ICS
Alternative*: Low-dose ICS *plus* LTRA, theophylline, or zileuton (Zyflo)

Step 4
Preferred: Medium-dose ICS plus LABA
Alternative*: Medium-dose ICS *plus* LTRA, theophylline, or zileuton

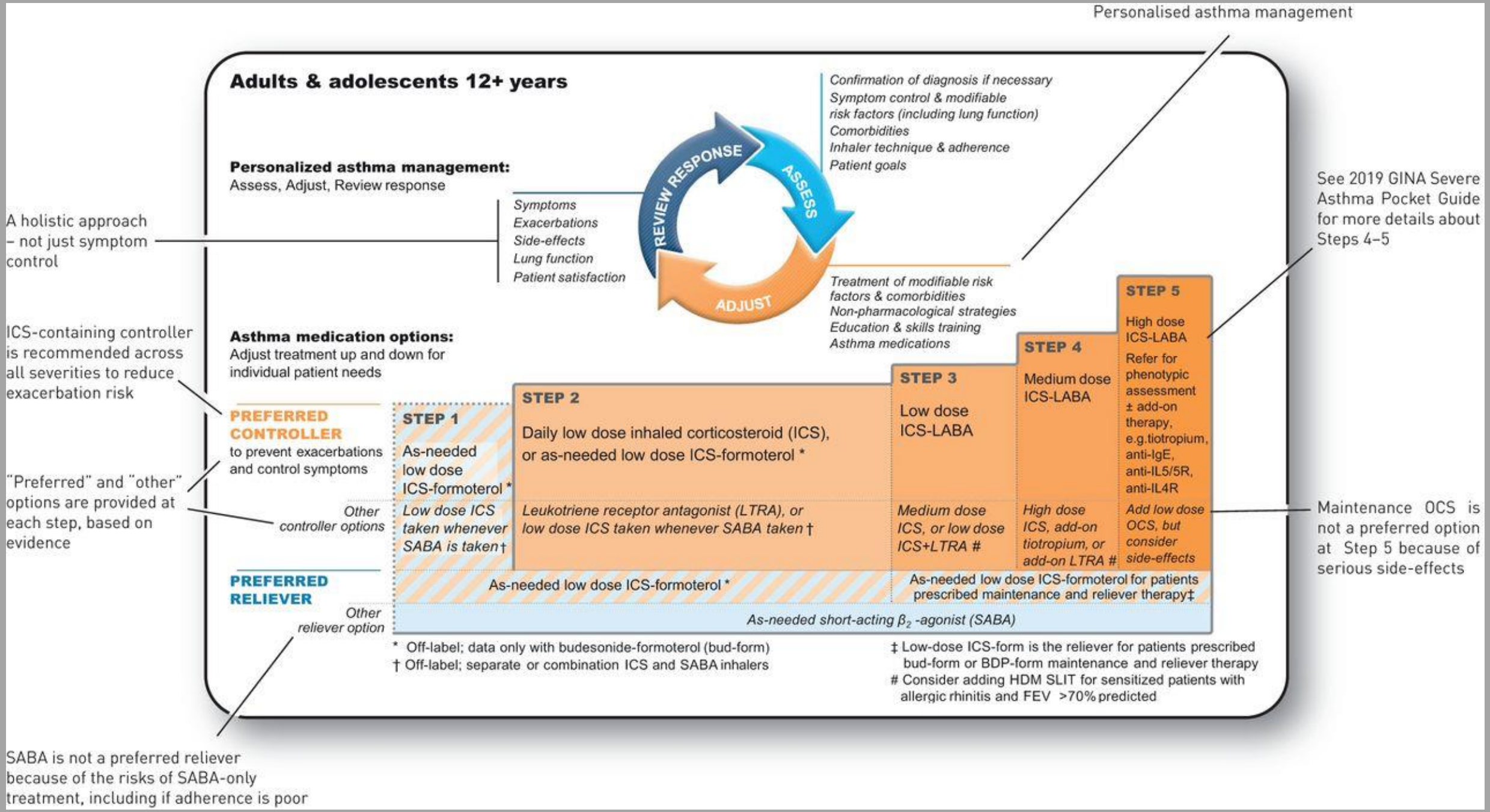
Step 5
Preferred: High-dose ICS plus LABA
Consider omalizumab (Xolair)† for patients who have allergies

Step 6‡
Preferred: High-dose ICS plus LABA plus oral systemic corticosteroid
Consider omalizumab† for patients who have allergies

Assess control
Step up if needed (first, check adherence, inhaler technique, environmental control, and comorbid conditions)
Step down if possible (and asthma is well controlled for at least 3 months)

Each step: Patient education, environmental control, and management of comorbidities
Steps 2 through 4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma.‡

Quick-relief medication for all patients:
Inhaled SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms (up to three treatments at 20-minute intervals, as needed). Short course of oral systemic corticosteroids may be needed.
Use of inhaled SABA for more than two days a week for symptom relief (not prevention of exercise-induced broncospasm) generally indicates inadequate control and the need to step up treatment.


Personalised asthma management
Adults & adolescents 12+ years
Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Patient goals
Personalized asthma management:
Assess, Adjust, Review response
REVIEW RESPONSE
ASSESS
ADJUST
Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction
Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Education & skills training
Asthma medications
A holistic approach – not just symptom control
See 2019 GINA Severe Asthma Pocket Guide for more details about Steps 4–5
Asthma medication options:
Adjust treatment up and down for individual patient needs
ICS-containing controller is recommended across all severities to reduce exacerbation risk
PREFERRED CONTROLLER
to prevent exacerbations and control symptoms
"Preferred" and "other" options are provided at each step, based on evidence
Other controller options
STEP 1
As-needed low dose ICS-formoterol *
STEP 2
Daily low dose inhaled corticosteroid (ICS), or as-needed low dose ICS-formoterol *
STEP 3
Low dose ICS-LABA
STEP 4
Medium dose ICS-LABA
STEP 5
High dose ICS-LABA
Refer for phenotypic assessment ± add-on therapy, e.g.tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R
Low dose ICS taken whenever SABA is taken †
Leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA taken †
Medium dose ICS, or low dose ICS+LTRA #
High dose ICS, add-on tiotropium, or add-on LTRA #
Add low dose OCS, but consider side-effects
Maintenance OCS is not a preferred option at Step 5 because of serious side-effects
PREFERRED RELIEVER
As-needed low dose ICS-formoterol *
As-needed low dose ICS-formoterol for patients prescribed maintenance and reliever therapy‡
Other reliever option
As-needed short-acting β2 -agonist (SABA)
SABA is not a preferred reliever because of the risks of SABA-only treatment, including if adherence is poor
* Off-label; data only with budesonide-formoterol (bud-form)
† Off-label; separate or combination ICS and SABA inhalers
‡ Low-dose ICS-form is the reliever for patients prescribed bud-form or BDP-form maintenance and reliever therapy
# Consider adding HDM SLIT for sensitized patients with allergic rhinitis and FEV >70% predicted

Question 16

- C; Discontinue ibuprofen, begin prednisone

Recognize the role of NSAIDs in poor control of asthma

- 37 y/o M with 1 month of cough and wheezing, increasing nasal congestion and rhinorrhea
- Increase in use rescue inhaler
- Recent traumatic ACL tear
- Hx of sinusitis, but no GERD
- Meds: albuterol, budesonide/formoterol and ibuprofen
- VS normal, 97% on RA
- Conjunctival injection and nasal polyps, wheezing
- IgE 265, WBC 4K with 10% eosinophils

- Aspirin-exacerbated respiratory disease
  - Asthma and rhinosinusitis precipitated by exposure to aspirin or other NSAIDs
  - Onset in adulthood
  - Eosinophilia, inflammatory sinusitis with polyposis
  - Persistent, often severe asthma
- Life-threatening bronchospasm, rhinorrhea, conjunctival injection and flushing
- Treatment: discontinue NSAIDs, use leukotriene-receptor antagonists and usual stepped up asthma care

Question 17

- B; Dexamethasone

Treat high-altitude cerebral edema with dexamethasone

- 31 y/o M on a 3500-meter trek in the French Alps
- Confused and irritable
- He took prophylactic acetazolamide, which he stopped due to nocturia
- HR 128/min, RR 22/min
- Ataxic gait
- Placed on supplemental O2 and started on descent

- High-altitude cerebral edema
  - Hypoxia and hypocapnia alter cerebral blood flow and O2 delivery
  - Vascular leak leads to brain swelling
  - Confusion, irritability, ataxic gait, come, death
  - Treatment: descent, dexamethasone, supplemental O2

Table 2. Lake Louise Criteria for Altitude Illness

Condition	*Criteria**
Acute mountain sickness	Headache and at least one of the following symptoms: fatigue or weakness; dizziness or lightheadedness; gastrointestinal symptoms (nausea or vomiting, anorexia); difficulty sleeping
High-altitude cerebral edema	Change in mental status *or* ataxia in a person with acute mountain sickness, or change in mental status *and* ataxia in a person without acute mountain sickness
High-altitude pulmonary edema	At least two of the following symptoms: dyspnea at rest; cough; weakness or decreased exercise performance; chest tightness or congestion *and* At least two of the following signs: crackles or wheezing in at least one lung field; central cyanosis; tachypnea; tachycardia

*—*Signs and symptoms occurring in the setting of a recent gain in altitude.*

Information from references 12 and 13.

Table 3. Medications for the Prevention and Treatment of Altitude Illness

Medication	*Indication*	*Typical dosage*
Acetazolamide	Prevention and treatment of acute mountain sickness (first-line therapy)*	125 mg twice daily (prophylaxis) 250 mg twice daily (treatment)
Dexamethasone	Prevention of acute mountain sickness†	4 mg every 6 to 12 hours
	Treatment of acute mountain sickness†	4 mg every 6 hours
	Prevention of high-altitude cerebral edema†	4 mg every 6 hours
	Treatment of high-altitude cerebral edema†‡	8 mg, then 4 mg every 6 hours
Nifedipine (Procardia)	Prevention and treatment of high-altitude pulmonary edema†	20 mg every 8 to 12 hours
Salmeterol (Serevent)	Prevention and treatment of high-altitude pulmonary edema†	125 mcg every 12 hours
Sildenafil (Viagra)	Prevention and treatment of high-altitude pulmonary edema†	20 mg every 6 to 8 hours
Tadalafil (Cialis)	Prevention and treatment of high-altitude pulmonary edema†	10 mg every 12 hours

*—*U.S. Food and Drug Administration (FDA)-approved indication.*

†—*Not an FDA-approved indication.*

‡—*Descent is mandatory.*

Information from references 3, 7, and 16 through 29.

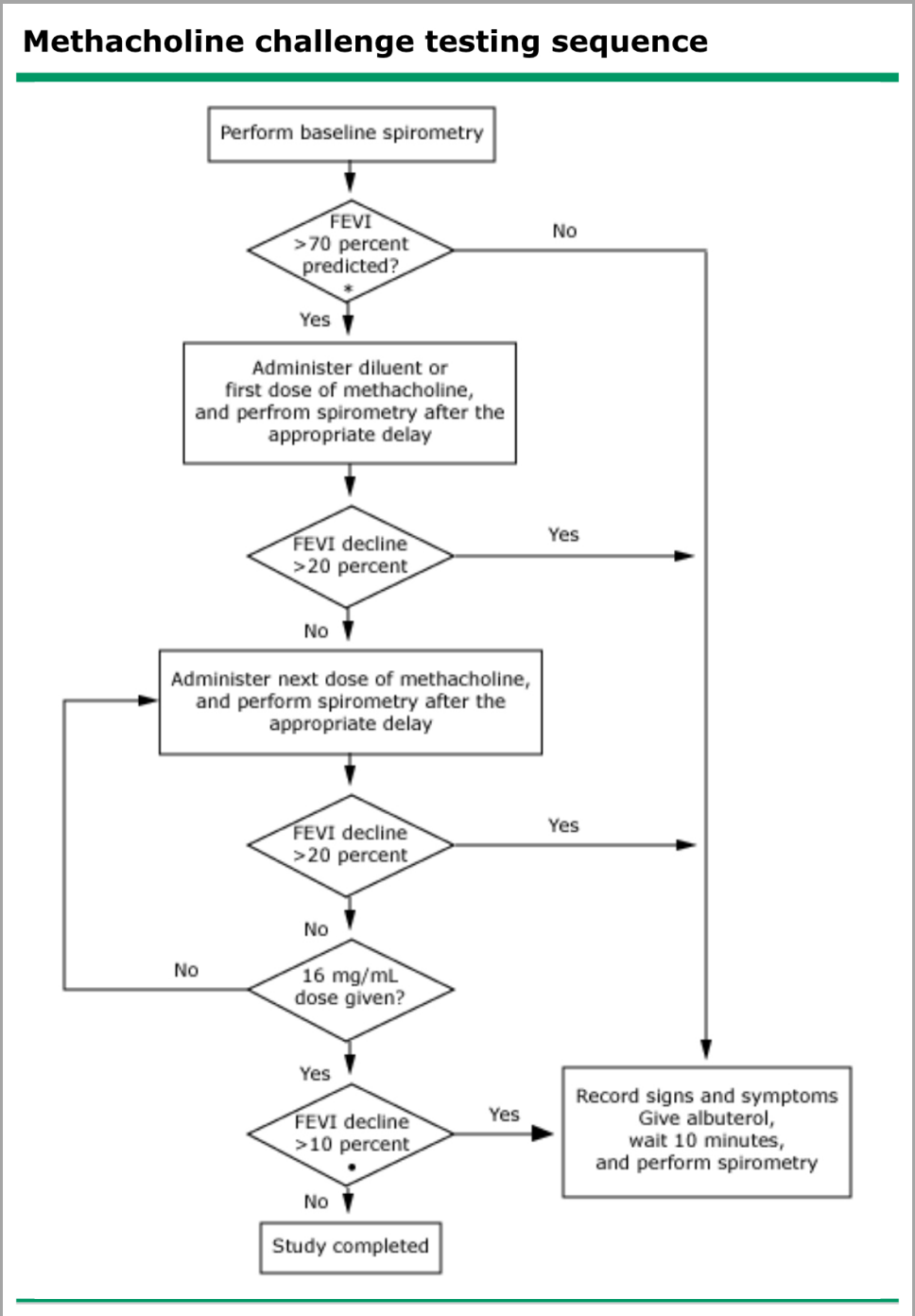
Question 18

- D; Obtain methacholine challenge testing

Diagnose cough-variant asthma

- 62 y/o F with 1 year of cough
- No environmental exposures
- Triggered by temperature changes, exercise, laughter, strong scents
- No sputum, rhinitis, postnasal drip, wheezing, GERD
- Recently treated with intranasal fluticasone and antihistamines without improvement
- VSS, O2 sat 97% on RA
- Labs, CXR and PFTs normal

- Cough-variant asthma
  - Asthma with primary symptom of cough
  - Diagnosis requires documentation of bronchial hyperactivity, as most patients will have normal baseline
  - Often co-exists with GERD or upper airway cough syndrome



- Indications for methacholine challenge test:
  - Diagnosis of asthma
  - Assessment of response to therapy
  - Identification of specific asthma triggers

TABLE 1

Contraindications to methacholine challenge testing: American Thoracic Society guidelines

Absolute contraindications

Severe airflow limitation: forced expiratory volume in 1 second (FEV_1) < 50% of predicted or < 1.0 L
Heart attack or stroke in last 3 months
Uncontrolled hypertension: systolic blood pressure > 200 mm Hg or diastolic pressure > 100 mm Hg
Known aortic aneurysm

Relative contraindications*

Moderate airflow limitation: FEV_1 < 60% of predicted or < 1.5 L
Inability to perform spirometry of acceptable quality
Pregnancy
Nursing mothers
Current use of cholinesterase inhibitor medication (for myasthenia gravis)

Question 19

- A; Complicated parapneumonic effusion

Diagnose a complicated parapneumonic effusion

- 43 y/o M with 1 week of cough, dyspnea, chest pain and night sweats
- T 38.8, BP 134/82 mm Hg, HR 142/min, RR 30/min, O2 sat 88% on RA
- WBC count 29,000
- CXR: large right pleural effusion with compressive atelectasis or consolidation and RUL consolidation
- Broad spectrum antibiotics started
- Thoracentesis: 100 mL serous fluid with pH 7.0, LDH 2310, total protein 5.2, glucose 42, gram stain negative

- Complicated parapneumonic effusion
  - pH < 7.2 and glucose < 60
  - Gram stain typically negative and cultures are usually sterile
  - Thoracostomy tube drainage recommended
- Empyema
  - Frank pus or a positive gram stain
  - Thoracic surgery consult, as usually requires thoracoscopic or open debridement and drainage
- Uncomplicated parapneumonic effusion
  - pH > 7.2 and glucose > 60
  - Usually resolve with antibiotic therapy alone

Diagnose a complicated parapneumonic effusion

- Pleural fluid acidosis (pH < 7.3)
  - Complicated parapneumonic effusions
  - Tuberculous pleuritis
  - Rheumatoid and lupus pleuritis
  - Esophageal rupture
  - Malignancy

- Low pleural fluid glucose (< 60 mg/dL)
  - Increased utilization within the pleural space – bacteria, malignant cells
  - Decreased transport into pleural space – rheumatoid pleurisy, lupus pleuritis

**** Lowest glucose concentrations found in rheumatoid pleurisy and empyema*

Question 20

- A; Continue antibiotic therapy for a total of 7 days

Treat ventilator-associated pneumonia for 7 days

- 67 y/o F with ventilator-associated pneumonia
- Transferred out of the ICU 3 days prior for respiratory failure 2/2 GBS, intubated
- 1 day prior diagnosis of VAP was made and antibiotics started
- Sputum culture grew MSSA and de-escalated to oxacillin; blood cultures negative
- T 37.6, BP and HR within normal limits, RR 15/min and O2 sat 97% on 40% FiO2
- CXR: RML/RLL infiltrates without effusions

- Ventilator-associated pneumonia
  - Pneumonia developing 48 hours after intubation
  - Early onset (< 5 days after hospitalization or intubation) associated with more antimicrobial-sensitive organisms
  - Late onset (> 5 days after hospitalization or intubation) more likely to have MDROs
  - Treat for 7 days as long as there is clinical improvement
  - Consider complications (effusion, empyema, superinfection, antibiotic resistance) if failure to respond