Academic Half Day: Pneumonia

Facilitator Guide

Agenda
1:00-1:05 Large Group Theory Burst on PNA
1:05-1:45 Case 1
1:45-1:50 Break
1:50-2:20 Case 2 & 3
2:20 – 2:30 Questions for Expert

Case 1

Mr. Jones is a 67 yo man with HTN and HLD who presents to the ED with a 4 day history of cough with productive sputum, subjective fevers, and chills. He endorses shortness of breath and has been eating and drinking less over the last few days. He denies chest pain. He has been taking acetaminophen and ibuprofen intermittently for fever. He drinks 1 beer with dinner 4-5 nights/week. He is not a smoker and does not use IV drugs.

Medications: HCTZ 25 mg daily, Metoprolol tartrate 25mg BID, Rosuvastatin 10mg QHS
Allergies: none

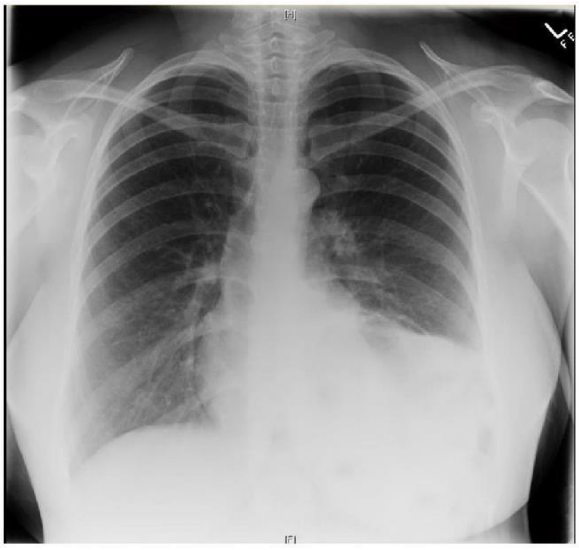
Physical Exam:
T 101°F, HR 105, BP 130/90, RR 29, SpO2 93% on RA
GEN: Appears fatigued but in NAD
HEENT: PERRL, EOMI. No rhinorrhea. Dry mucous membranes.
CV: Tachycardic. Normal S1/S2. No murmurs, rubs or gallops.
CHEST: Bibasilar crackles left > right with reduced breath sounds over LLL. Egophany is present in the LLL.
ABD: Soft, NT, ND, +BS
Ext: warm, pulses 2+, no edema.
Neuro: A&Ox2. Mentation is different from baseline per family.

Stop here and go over the pertinent aspects of the history and physical examination before continuing to labs and imaging.

Labs:
70%Seg \ 12.7 /
15%Band 12 ----- 102
10%Lymph / 35 \

138 | 105 | 30 /
---------- 100
3.8 | 23 | 1.1 \

CXR is shown to the right.



1. What is your working diagnosis? Why?
PNA. The key is that this is a CLINICAL DIAGNOSIS! Per the IDSA guidelines, the definition entails two parts: symptoms suggestive of PNA (cough, pleuritic chest pain, fever) PLUS infiltrate on imaging +/- microbiologic data (however, a pathogen is only identified in 30-40% of cases).

Imaging: CXR or Ultrasound.

> Ultrasound can be done at the bedside and does not have ionizing radiation. It has a good sensitivity (94-95%) and specificity (90-96%) when compared to CT. However, it requires a trained operator.

2. What if suspicion is high and the CXR has no infiltrate? Would you still treat for PNA?
Several studies (including one retrospective study by Dr Panos & Dr Rouan) showed a CXR sensitivity of 77% (admission CXR sensitivity of 80% in the UC article) & specificity of 91% (LR +8.5). In critically ill patients with all the symptoms of PNA and a clear CXR it's possible that CXR findings lag by 48hrs. One suggested theory includes dehydrated patients (elevated BUN, sCr) with early signs of PNA may not have an infiltrate yet. As such, the infiltrate may "fluff out" after 48hrs after IVF resuscitation (this retrospective study involved 105 patients). Other theories propose that in early PNA the CXR findings may lack not because of fluid status but because neutrophils have not had sufficient time to extravasate.

Clinical Pearl: Remember a true PNA on CXR will lag behind clinical resolution so if you get a CXR that shows a possible consolidation that then is clear the next day, this was unlikely PNA! Think possible aspiration pneumonitis, atypical pulmonary edema, atelectasis.

3. What type of pneumonia does Mr. Jones have?
Community-acquired pneumonia (CAP). Remember that the point of classification of pneumonia is to help guide your antibiotic choices.

4. Where should further assessment and treatment of Mr. Jones take place (i.e. outpatient, inpatient, Stepdown, ICU)? How did you come to this conclusion? Use your Appendix Tools!
Don't Linger Here. The point is not to belabor the CURB-65 and Port and Severe criteria. The point is to know that the tools exist and can help support their clinical judgements for a patient. Both tools predict the 30-day mortality of patients and can help stratify patients for outpatient vs inpatient treatment (level 1 evidence). The PSI/ PORT score is well validated with a >40,000 patient study. CURB-65, while validated had a much lower study power. Per IDSA & NEJM articles for CAP, mortality sensitivity for PSI/ PORT score >> CURB-65.

CURB-65 is 3 which yields a 14% 30 day mortality rate.
PSI/PORT is 107.

CURB-65:
If CURB-65 is greater than or equal to 2, then inpatient admission is suggested. As a broad generalization, we tend to overestimate mortality risk (over-admit) when left to our own clinical judgment. Of note, CURB-65 requires a BMP for the urea nitrogen value. A CRB-65 score is more

practical for use in the primary care setting without significant compromise in prognostic value. A score of 0 or 1 can be managed safely as an outpatient.

Per the 2019 IDSA Guideline Severe CAP Assessment tool (last item in the appendix), 1 major or 3 minor criteria constitute severe CAP, and admission to the ICU or stepdown unit would be recommended. For triage within the hospital, this tool is preferred over CURB65 or PSI/PORT since it has been validated.

Make them defend an ICU vs Stepdown vs Wards admission. Data shows a worse prognosis when patients are transferred from the general wards to the ICU within 24-48 hours of admission compared to when they are directly admitted to the ICU; however, with bed limitations, we can't admit everyone we are concerned about to the ICU.

5. What additional workup would you obtain for this patient?
They don't have this list because we want them to initially come up with the list themselves.

Ask them to think of a reason for each choice

□ Blood culture □ Sputum culture □ Arterial Blood gas
□ Urine Strep pneumo Ag □ Urine Legionella Ag □ Influenza swab
□ MRSA Nares
□ Other:_____

Table 3. Diagnostic Testing in Patients with Suspected Community-Acquired Pneumonia

Clinical factor	*Blood culture*	*Sputum culture*	Legionella *urine antigen test*	*Pneumococcal urine antigen test*	*Indicated diagnostic test*
Alcohol abuse	✓	✓	✓	✓	
Asplenia	✓			✓	
Cavitary infiltrate	✓	✓			Fungal and TB cultures; consider MRSA
Chronic severe liver disease	✓			✓	
Failure of outpatient antibiotic therapy		✓	✓	✓	
Intensive care unit admission	✓	✓	✓	✓	Endotracheal aspirate or bronchoalveolar lavage
Leukopenia	✓			✓	
Pleural effusion (> 5 cm) on lateral chest radiography	✓	✓	✓	✓	Thoracentesis and pleural fluid cultures (including Gram stain with or without AFB)
Positive *Legionella* urine antigen test		✓			Bronchoscopic or sputum specimen nucleic acid amplification test
Positive pneumococcal urine antigen test	✓	✓			
Severe obstructive or structural lung disease		✓			
Travel within past two weeks or foreign-born			✓		Fungal and/or viral PCR, TB testing

AFB = acid-fast bacillus; MRSA = methicillin-resistant Staphylococcus aureus; *PCR = polymerase chain reaction; TB = tuberculosis.*

Adapted with permission from Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. *2007;44(suppl 2):S40, with additional information from reference 19.*

Key Points: Routine microbiologic testing in outpatients with CAP was not recommended. Studies that evaluated the use of gram stain and culture have not demonstrated better outcomes.

Per IDSA guidelines, the clearest indication for extensive diagnostic testing including is in the ICU. Pre-treatment culture of respiratory secretions and blood cultures are recommended in 1. Intubated patients, 2. Patients currently or previously being treated for MRSA or *P. aeruginosa,* or 3. Were hospitalized and received parenteral antibiotics in the last 90 days. (See IDSA 2019 guidelines e47 for rationale).

It is not wrong to collect them in other situations (ie – as per table above. It is just not recommended by IDSA). Why? Because as before, think about why you are obtaining a culture or test and how it will impact your management. In addition, blood cultures have low positive return, are unlikely to change management in most scenarios, and run the risk of false positive results. Sputum cultures should only be obtained if it is an adequate pre-treatment specimen.

2014 NEJM review article disagreed with IDSA (and AAFP accordingly). They recommend that any patient admitted to the hospital obtain a sputum culture, blood cultures, pneumococcal and legionella urinary antigens, and PCR assay for M. pneumonia and C. pneumonia. The argument is that pathogen-directed therapy greatly fosters antibiotic stewardship, reduces cost and risk of complicating infections (eg – C. dificile colitis).

Urine antigens can be detected starting on the 1st day of illness and for up to 3 days after antibiotic administration. LR+ for pneumococcal urine antigen test 14.6-20; LR+ for Legionella urine antigen +82

6. When should we be using procalcitonin? Would you get it for Mr Jones?
Procalcitonin is a peptide precursor hormone of calcitonin. It is secreted by C cells of the thyroid, neuroendocrine cells of the lung and intestine. It is released in multiple tissues in response to bacterial infections via direct stimulation from cytokines (IL-6, TNF-A, IL1 B). Whereas in viral illness, procalcitonin production is blocked by interferon gamma. According to a Cochrane review meta-analysis, IDSA HAP/VAP guidelines, 2016 AAFP & 2014 NEJM CAP recommendations, procalcitonin can be used to support clinical decision-making for the discontinuation of antibiotics. Furthermore, 14 randomized controlled trials in European settings have found a reduction in antibiotic prescribing in low-acuity settings and shorter duration of therapy in higher-acuity settings (ie – ED's & ICUs) without compromising morbidity/mortality outcomes. Note that data on this biomarker is emerging. There is support for and against its use as a biomarker in a variety of clinical settings. Procalcitonin is available at Lenox Hill Hospital.

Info from a paper published last year (6/25/2019) in the Journal of Clinical Infectious Diseases (https://doi.org/10.1093/cid/ciz545): A meta-analysis of 23 studies of 2,408 patients with CAP was performed and showed that the sensitivity of procalcitonin was 0.55 and the specificity was 0.76. The conclusion was that "a procalcitonin level is unlikely to provide reliable evidence either to mandate administration of antibiotics or to enable withholding of treatment in patients with CAP".

7. What are the most common pathogens causing Community Acquired Pneumonia?

What are the most common pathogens implicated in CAP: Strep pneumococcus (most common - all the rest about 5-10%)

Table 1. Common Etiologies of Community-Acquired Pneumonia

Etiology	*Frequency (median percentage)*	*Etiology*	*Frequency (median percentage)*	*Etiology*	*Frequency (median percentage)*
Outpatients		**Inpatients not admitted to ICU**		**Inpatients admitted to ICU**	
Mycoplasma pneumoniae	16	*S. pneumoniae*	25	*S. pneumoniae*	17
Respiratory viruses	15	Respiratory viruses	10	*Legionella* species	10
Streptococcal pneumoniae	14	*M. pneumoniae*	6	Gram-negative bacilli	5
Chlamydophila pneumoniae	12	*H. influenzae*	5	*Staphylococcus aureus*	5
Legionella species	2	*C. pneumoniae*	3	Respiratory viruses	4
Haemophilus influenzae	1	*Legionella* species	3	*H. influenzae*	3
Unknown	44	Unknown	37	Unknown	41

ICU = intensive care unit.

Information from references 1 through 3.

Typicals: H. influenza, Moraxella

Atypicals: M. pneumoniae, C. pneumonia, Legionella (serogroup 1 = 80-95% of Legionella PNA)

**Note: Legionella is #2 in ICU. This impacts antibiotic coverage recommendations!

Viruses: influenza, parainfluenza, RSV, adenovirus

Note: Increasing resistance of Strep pneumo to macrolides is changing how we prescribe antibiotics for CAP with a shift away from macrolide monotherapy in the outpatient setting (page e54 2019 IDSA guidelines)

8. What antibiotic regimen would you choose to treat Mr. Jones?

Beta-lactam + Macrolide:

Ceftriaxone 1g (or 2g) IV q24h (or Unasyn-ampicillin/sulbactam 1.5-3g IV q6h or Zosyn-piperacillin/tazobactam IV 3.375mg IV q6h based on CrCl – adjust dose if CrCl is <40mL/min to 2.25mg q6h or q8h) + Azithromycin 500mg IV qday

OR

Respiratory FQN:

Levofloxacin 750mg PO or IV qday or Moxifloxacin 400mg PO or IV qday

Strictly speaking, Mr. Jones does not have severe pneumonia based on the IDSA criteria. However, his platelets are borderline (platelets <100 would meet a minor criteria for severe pneumonia and Mr. Jones platelet count is 102). If we were managing him for severe CAP, the guideline based recommendations would be slightly different (would add a beta lactam to the fluoroquinolone if using that option, see page e55 for more details).

Table 4. Initial Treatment Strategies for Inpatients with Community-acquired Pneumonia by Level of Severity and Risk for Drug Resistance

	Standard Regimen	Prior Respiratory Isolation of MRSA	Prior Respiratory Isolation of *Pseudomonas aeruginosa*	Recent Hospitalization and Parenteral Antibiotics and Locally Validated Risk Factors for MRSA	Recent Hospitalization and Parenteral Antibiotics and Locally Validated Risk Factors for *P. aeruginosa*
Nonsevere inpatient pneumonia*	β-Lactam + macrolide† or respiratory fluroquinolone‡	Add MRSA coverage§ and obtain cultures/nasal PCR to allow deescalation or confirmation of need for continued therapy	Add coverage for *P. aeruginosa*‖ and obtain cultures to allow deescalation or confirmation of need for continued therapy	Obtain cultures but withhold MRSA coverage unless culture results are positive. If rapid nasal PCR is available, withhold additional empiric therapy against MRSA if rapid testing is negative or add coverage if PCR is positive and obtain cultures	Obtain cultures but initiate coverage for *P. aeruginosa* only if culture results are positive
Severe inpatient pneumonia*	β-Lactam + macrolide† or β-lactam + fluroquinolone‡	Add MRSA coverage§ and obtain cultures/nasal PCR to allow deescalation or confirmation of need for continued therapy	Add coverage for *P. aeruginosa*‖ and obtain cultures to allow deescalation or confirmation of need for continued therapy	Add MRSA coverage§ and obtain nasal PCR and cultures to allow deescalation or confirmation of need for continued therapy	Add coverage for *P. aeruginosa*‖ and obtain cultures to allow deescalation or confirmation of need for continued therapy

Definition of abbreviations: ATS = American Thoracic Society; CAP = community-acquired pneumonia; HAP = hospital-acquired pneumonia; IDSA = Infectious Diseases Society of America; MRSA = methicillin-resistant *Staphylococcus aureus*; VAP = ventilator-associated pneumonia.
*As defined by 2007 ATS/IDSA CAP severity criteria guidelines (see Table 1).
†Ampicillin + sulbactam 1.5–3 g every 6 hours, cefotaxime 1–2 g every 8 hours, ceftriaxone 1–2 g daily, or ceftaroline 600 mg every 12 hours AND azithromycin 500 mg daily or clarithromycin 500 mg twice daily.
‡Levofloxacin 750 mg daily or moxifloxacin 400 mg daily.
§Per the 2016 ATS/IDSA HAP/VAP guidelines: vancomycin (15 mg/kg every 12 h, adjust based on levels) or linezolid (600 mg every 12 h).
‖Per the 2016 ATS/IDSA HAP/VAP guidelines: piperacillin-tazobactam (4.5 g every 6 h), cefepime (2 g every 8 h), ceftazidime (2 g every 8 h), imipenem (500 mg every 6 h), meropenem (1 g every 8 h), or aztreonam (2 g every 8 h). Does not include coverage for extended-spectrum β-lactamase-producing Enterobacteriaceae, which should be considered only on the basis of patient or local microbiological data.

(see guidelines page e51 for a bigger version of this chart)

Table 3. Initial Treatment Strategies for Outpatients with Community-acquired Pneumonia

	Standard Regimen
No comorbidities or risk factors for MRSA or *Pseudomonas aeruginosa**	Amoxicillin or doxycycline or macrolide (if local pneumococcal resistance is <25%)†
With comorbidities‡	Combination therapy with amoxicillin/clavulanate or cephalosporin AND macrolide or doxycycline§ OR monotherapy with respiratory fluoroquinolone‖

Definition of abbreviations: ER = extended release; MRSA = methicillin-resistant *Staphylococcus aureus*.
*Risk factors include prior respiratory isolation of MRSA or *P. aeruginosa* or recent hospitalization AND receipt of parenteral antibiotics (in the last 90 d).
†Amoxicillin 1 g three times daily, doxycycline 100 mg twice daily, azithromycin 500 mg on first day then 250 mg daily, clarithromycin 500 mg twice daily, or clarithromycin ER 1,000 mg daily.
‡Comorbidities include chronic heart, lung, liver, or renal disease; diabetes mellitus; alcoholism; malignancy; or asplenia.
§Amoxicillin/clavulanate 500 mg/125 mg three times daily, amoxicillin/clavulanate 875 mg/125 mg twice daily, 2,000 mg/125 mg twice daily, cefpodoxime 200 mg twice daily, or cefuroxime 500 mg twice daily; AND azithromycin 500 mg on first day then 250 mg daily, clarithromycin 500 mg twice daily, clarithromycin ER 1,000 mg daily, or doxycycline 100 mg twice daily.
‖Levofloxacin 750 mg daily, moxifloxacin 400 mg daily, or gemifloxacin 320 mg daily.

9. **What if Mr. Jones' CURB-65 is 1 – where should he be treated?** OUTPATIENT
a. With which antibiotics would you treat Mr. Jones in this setting? Amoxicillin or doxycycline or macrolide (only if local pneumococcal resistance to macrolides is <25%, NYC resistance rate is 40% per most recent NYC antibiogram (2017-2018).
NYC Antibiogram: https://www1.nyc.gov/site/doh/providers/resources/antibiogram.page

b. What antibiotics do we use to treat Mr. Jones if he had lung, heart, renal or liver diseases, DM, alcoholism, asplenia, immunosuppressing drugs or states, or antibiotic use in past 3 months?
These patients are even more likely to have drug resistant strep pneumoniae which is not covered by a macrolide alone. As such, treatment recommendation is with a Respiratory FQN OR a beta lactam plus macrolide (OR plus doxycycline).

10. When do we switch Mr. Jones from IV to PO antibiotics in the hospital?
Discuss personal experience with group. General guideline is to switch when clinically improving in 2-3 days, able to tolerate PO. Systemic review from JAMA 2016 delineated guideline with PO tolerance, HR <100 and SBP > 90, SpO2 >90% or baseline O2, RR <25, Temperature < 100.9 F, and returned to cognitive baseline. Simply – SIRS negative and at baseline cognition. *All criteria should be met for at least 24 hours before switching to oral antibiotics.

11. For how many days should Mr. Jones' be treated? EXPERT OPINION
Grade 1b evidence - treat at least 5 days, a 7-10 day course is recommended, barring a problem with antibiotic dosing or change in clinical status. Discuss personal experience.

IDSA/ATS guidelines state that patients with CAP should be treated for a minimum of five days. Thus, the recommended duration for patients with good clinical response within the first two to three days of therapy is five to seven days total. A meta-analysis of 15 randomized controlled trials of almost 2800 patients with mild to moderate CAP, which found comparable clinical outcomes with less than seven days compared with more than seven days of antimicrobial therapy; however, only two of these trials were specifically about hospitalized patients. Keep in mind this is for MILD to MODERATE CAP. 2014 NEJM review recommends 5-7 days of treatment for outpatients or inpatients with prompt clinical response.

There have been multiple articles posted in Annals that have demonstrated that many patients with pneumonia receive overtreatment with antibiotic therapy. Reference: https://annals.org/aim/article-abstract/2737823/excess-antibiotic-treatment-duration-adverse-events-patients-hospitalized-pneumonia-multihospital

12. If Mr. Jones were diagnosed with severe CAP, would corticosteroids be indicated?
For patients with severe community-acquired pneumonia, corticosteroids are not recommended. Unless in the case of refractory septic shock as outlined in the Surviving Sepsis campaign.

Case 2

A 56-year-old man presents to a homeless clinic with an acute cough and a temperature of 102° F (38.9° C). His heart rate is 104 beats per minute; his breath sounds are not decreased, but he has crackles; and he has no history of asthma.

1. **How likely is it that he has pneumonia? Should we get a CXR? Use the Heckerling Clinical Decision Rule in your Appendix.**

Discussion points: Use of likelihood ratio, patient social situation, and their clinical gumption to make medical decisions. No right or wrong answer.

Heckerling rule assumes outpatient pretest probability as 5% and ED as 15%. Using the Heckerling rule, the patient has four out of five key predictors for pneumonia. In the primary care setting, his posttest probability of pneumonia would be 27 percent, and you would order chest radiography to confirm the diagnosis before prescribing antibiotics. **However**, his social situation needs to be taken into account. Homeless patients do not always readily seek care, and the pretest probability for pneumonia may be closer to that in the emergency department setting (15 percent) than that in a typical primary care office (5 percent). You determine that this patient now has a posttest probability of 56 percent. What if he has no transportation to CXR, cannot afford CXR? Because of the relatively high risk of pneumonia and the difficulty of obtaining a radiograph for the uninsured patient, you could probably just prescribe antibiotics.

Case 3

You are the cardiac telemetry night resident. Mr. Smith is a 67 y/o male with HTN, DM-2, and COPD on 4L O2 at rest and exertion who presented four days ago with typical chest pain. Otherwise a full ROS was negative on admission. Initial EKG and cardiac enzymes were negative, but a NM stress test was positive. Mr. Smith underwent a LHC and received a DES to the LAD the day after admission. Other than a transient period in the cath lab, he is cared for on the cardiac telemetry unit. Through hospital day 3 and into 4 he develops progressively worsening symptoms of fevers, chills, productive cough, nausea, loss of appetite, and vomiting. He endorses mild left hemithorax discomfort associated with his cough on deep inspiration. Of note, he was treated for left foot cellulitis 1 month ago with IV ceftriaxone then PO amoxicillin-clavulanic acid with complete resolution.

The nurse has called you to say the patient feels worse and would like something for chest pain. You go to see him.

Pause here to ask the learners what they're thinking as they go to see the patient. Are they building a differential diagnosis based on what they know? Are they thinking about what additional information they will want to obtain when they reach the bedside?

Exam:
VS: 101F, BP 100/60, P 105, RR 32, SpO2 92% on 4 L
GEN: Appears fatigued, but NAD
HEENT: PERRL, EOMI. No rhinorrhea. MM dry.

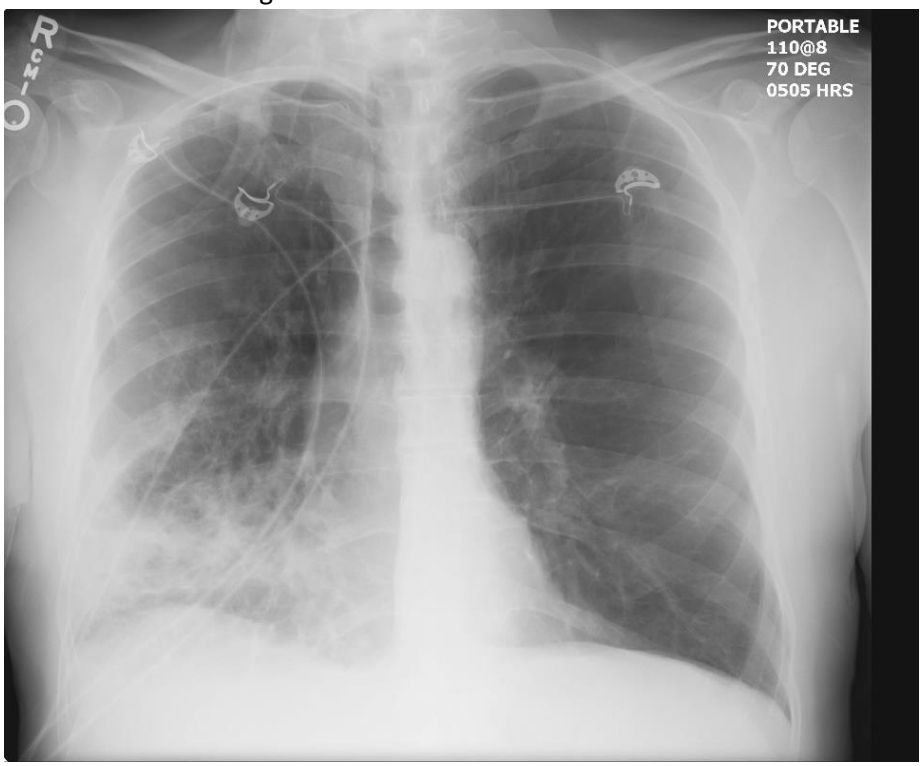
CV: Tachycardic. Normal S1/S2. No m/r/g.
CHEST: Bibasilar crackles, R > L.
Abd: Soft, NT, ND, +BS
Ext: warm, pulses 2+, no edema.
Neuro: A&Ox3, complete neurological exam normal, no meningismus

70% Segs
15%Bands
10% Lymph

141 | 101 | 32 /
---------- 215
4.0 | 15 | 1.1 \

ABG: 7.38 / 26 / 90

You note that a CXR ordered on long call has resulted. You look at the film:



1. What is your working differential diagnosis? Pertinent +/- in history and physical? What are you thinking about ordering?

Just because it is pneumonia half day, doesn't mean we forget the rest. Make them churn out a respectable differential and defend it. Things are rarely straightforward in medicine. Let alone night float cross coverage.

- What if he's been vomiting up the aspirin, brilinta, statin and no one noticed? What if that chest pain isn't pneumonia, but ACS? If ACS: What would they do about it?
- What if he has a PE? His Wells Score is moderate at 3.
- Probably HAP, but does the existence of one rule out the others?

Talk about their night float workup and need to discuss with senior resident: EKG, troponin. Make sure they look at the CXR themselves, not just radiology read. CT PE protocol (while PE is a so-so guess, you might get a good look at the LLL consolidation. Downside: more contrast in a patient that just had a LHC)? D-Dimer?

To move forward: assume EKG and trop were ok. D-dimer elevated (but this happens in pna too). Any CT imaging of the chest confirmed LLL consolidation that is consistent with a lobar pneumonia.

2. What is his acid base status?

Anion Gap Metabolic Acidosis with Concomitant Respiratory Alkalosis.
Normal pH.
Valid test: 80-38 = 42 = 24 x 26/15
Anion Gap is 25 = 141- (101+15), so definitely has AGMA
Winter's Formula to check compensation: 1.5 x 15 + 8 +/-2 = 28.5-32.5. The patient's pCO2 is lower than expected which indicates a concurrent respiratory alkalosis.
Delta Delta: 13/9 = 1.4 = pure AGMA
***Have them teach you what a delta delta signifies (in human-being terms).

3. What microbiologic techniques are recommended to diagnose HAP? VAP?

Per 2016 IDSA guidelines, treatment for both HAP & VAP should be tailored according to the results of microbiologic testing. For HAP, non-invasive sampling such as spontaneous expectoration, sputum induction, and NT suction is recommended (weak recommendation, very low-quality evidence). For VAP, non-invasive sampling with semiquantitative cultures such as endotracheal aspiration is recommended. Whereas invasive sampling via bronchoscopy (BAL), mini-BAL (blind bronchial sampling), or protected specimen brush (weak recommendation, low-quality evidence).

Can ask, do you need other lab markers?
Regarding initiation of empiric antibiotics, IDSA guidelines specifically recommended clinical criteria alone >> clinical criteria + either procalcitonin / CRP / CPIS score / BALF sTREM-1 (bronchoalveolar lavage fluid serum soluble triggering receptor expressed on myeloid cells-1 = biomarker in differentiating bacterial infections from other infections).

4. Should we keep him on cardiac telemetry or send him somewhere else?

CURB-65 score and PSI score for a general idea. However, they were not validated for HAP/VAP. Also revisit Severe CAP (scores 2 minor criteria for paO2/FiO2 ratio of 250 & uremia). Although he does not meet clear ICU guidelines, he is a candidate for stepdown.

5. What organisms do you need to cover with empiric coverage?

The key is to think about the risk factors for MRSA, pseudomonas, and MDRO (organisms resistant to two or more standard antibiotics that would usually cover these bugs). The thought is to think about WHICH organisms to cover rather than memorize guidelines.

New HAP/VAP IDSA guidelines have simplified MRSA, pseudomonas, MDRO risk factors.

a. Risk factors for MRSA – IV antibiotics within the past 90 days, hospitalization in a unit where >10-20% of S. aureus isolates are MRSA (all units at UCMC), or where the prevalence of MRSA is unknown. Note, weak recommendation, very low-quality evidence.

b. Risk factors for pseudomonas/MDR GN – IV antibiotics within the past 90 days, structural lung disease (ie – bronchiectasis, cystic fibrosis). Note – much simpler than prior guidelines.
For our patient, organisms to cover include MRSA & pseudomonas given patient is in a unit with >20% staph aureus isolated are MRSA & recent IV antibiotics within 90 days.

6. What empiric antibiotics do you choose for Mr. Jones? What are the common side effects?

Cover MRSA: Vancomycin or Linezolid. Common side effect for vancomycin is red man syndrome. If this occurs, you can slow down the infusion rate. Side effects for linezolid are thrombocytopenia, serotonin syndrome. Daptomycin also covers MRSA but NOT for lung. This is because daptomycin is inactivated by surfactant. In cases where daptomycin is used, keep in mind to check a CK level as this can cause rhabdomyolysis.

Cover Pseudomonas/MDR gram negatives: For patients with MDR risk, pseudomonal risk or at high mortality risk (i.e. pressors or mechanical ventilation due to HAP), IDSA suggests empiric pseudomonas coverage with 2 different antibiotic classes. You can use a penicillin such as piperacillin/tazobactam (zosyn), third generation cephalosporin such as cefepime or ceftazidime, fluoroquinolone such as levofloxacin, aminoglycosides, or carbapenems such as imipenem or meropenem, or aztreonam.

If the patient were without risk factors for MDR or pseudomonas, then IDSA supports empiric coverage with single anti-pseudomonal agent. However, aminoglycosides are excluded from monotherapy.