Group on Immunization Education
Society of Teachers of Family Medici**ne**

# CLINICAL SCENARIO SERIES ON IMMUNIZATION

## Pneumococcal Pneumonia

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**Clinical Scenario – Chronic Liver Disease**

Learning Objectives

1. Explain the severity of disease due to pneumococcus.
2. Discuss missed opportunities for vaccination at hospital discharge and office visits.
3. Understand vaccination guidelines
4. Discuss ways to raise rates by institutional protocols

Scenario - Part One

Markus, a 48 year-old male, arrives at the Emergency Department complaining of dyspnea, fever, and cough.

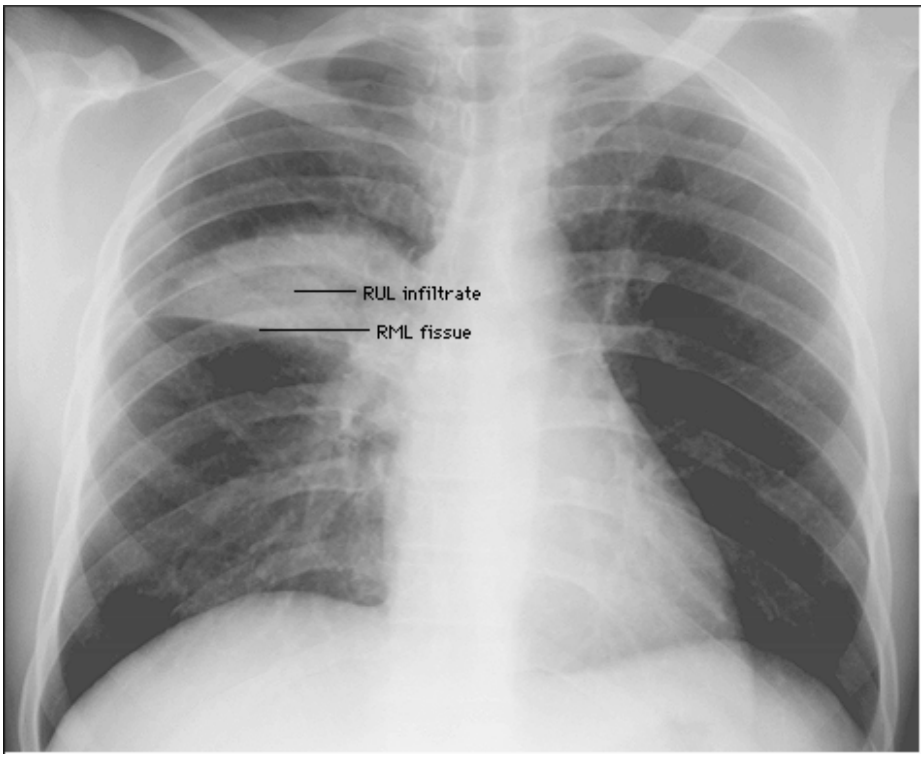
His symptoms started 8 days ago with fever, cough, myalgia, headache and sore throat. Given the symptom complex and the presence of an influenza outbreak in the community, his primary care physician diagnosed influenza and started an antiviral agent. After initial improvement, he had a worsening of symptoms starting thee days ago with productive cough, pleuritic chest pain, fever, chills and malaise. Last night he developed dyspnea and decided to come to the Emergency Department today.

Past medical history is significant for idiopathic cardiomyopathy. He was hospitalized three months ago for congestive heart failure at which time a cardiac catherization revealed normal coronary arteries and an ejection fraction of 30%. A recent echocardiogram revealed an ejection fraction of 36%. Medications include carvedilol, lisinopril, aspirin, furesomide, and potassium chloride. He has no known drug allergies. Vaccination record reveals Td 8 years ago.

Vital signs today disclosed a temperature of 40°C, blood pressure of 110/60, and respirations of 30 per minute. Weight is 81 kg and is stable.

Physical examination reveals labored respirations, rales in the right mid-lung field, and a normal cardiac exam. No pedal edema or jugular venous distension is noted.

Arterial blood gas results reveal hypoxemia but normal carbon dioxide levels and a pH of 7.38. Complete metabolic panel is normal and brain natriuretic peptide levels are stable compared to a month ago. White blood cell count is 16,100 with 85% neutrophils.




http://info.med.yale.edu/intmed/cardio/imaging/cases/pneumonia_rul/index.html
Source: Yale School of Medicine, used with permission.

Questions

1. What is the differential diagnosis?
2. Would you hospitalize him?
3. What testing would you do?
4. What treatment would you prescribe?

Answers

1. This case represents secondary bacterial pneumonia following influenza; the differential diagnosis includes primary bacterial pneumonia and spread of an initial bacterial infection of the upper respiratory tract to the lungs. Common organisms include *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus, and Moraxella catarrhalis*.

2. Given hypoxia and respiratory distress in a person with underlying cardiomyopathy, hospitalization is advised on clinical grounds. A recommended way to evaluate for hospitalization is to use the Pneumonia PORT score (N Engl J Med 1997;336:243-50). As applied to this case, points (in parentheses) occur for age (48), coexisting heart failure (10), respiratory rate of ≥30 (20), temperature ≥40 °C (15), and hypoxia (10); the total is 103. This places him in risk class IV which is 91 to 130 points and which usually requires hospitalization.

3. According to the Infectious Disease Society of American (IDSA) 2007 Guidelines, testing is based on severity and specific risk factors. If the community acquired pneumonia (CAP) is severe (e.g., ICU admission), blood cultures and expectorated sputum Gram staining and culture and urinary antigen tests for *Legionella pneumophia* and *Streptococcus pneumoniae* are recommended. If the CAP is not severe and no other risk factors (e.g., asplenia, alcohol abuse, severe liver disease, severe obstructive lung disease, failure of outpatient antibiotic therapy) are present, testing is optional.

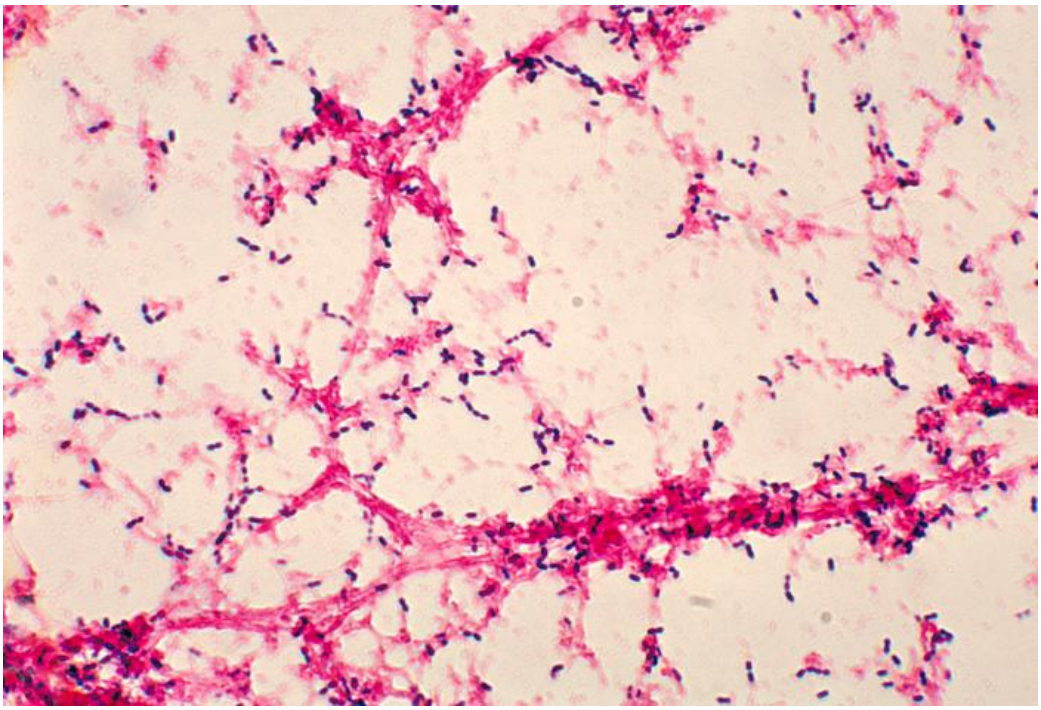
   The pneumococcal urinary antigen test may be used to supplement blood and sputum cultures in adults. This assay is an immunochromatographic membrane test to detect the pneumococcal cell-wall polysaccharide. The test has sensitivity of 50%-880% (70%-90% if bacteremia) and a specificity of about 90% in adults (lower in children).

4. Given hypoxia, oxygen is recommended.

   IDSA recommends either an advanced macrolide (azithromycin or clarithromycin) plus a betalactam (cefotaxime, ceftriaxone, ampicillin-sulbactam, or, for selected patients ertapenum) OR a respiratory fluoroquinolone (e.g, moxifloxacin, gemifloxacin, or levofloxacin).

Scenario – Part 2

The next day, he is febrile and coughing but not dyspneic on oxygen. The laboratory reported gram positive cocci grew in blood cultures.



Questions

5. What is the diagnosis?
6. What antibiotics are appropriate?
7. Could this case have been prevented? If so, when?

Answers

5. This case represents secondary bacterial pneumonia following influenza; the organism is *Streptococcus pneumoniae* which is a gram-positive diplococcus.

6. Susceptibility testing should guide antibiotic choice when results are available. Cefotaxime, ceftraixone or a respiratory fluorquinolone are the preferred parenteral agents for bacteremic pneumococcal pneumonia for strains with reduced susceptibility to penicillin (other agents guided by in vitro susceptibility testing may be used).

7. A cardiac condition is an indication for both inactivated influenza vaccine and pneumococcal polysaccharide vaccine (PPV), as shown by the Recommended Adult Immunization Schedule. http://www.cdc.gov/nip/recs/adult-schedule.pdf

**Sidebar**
A study of 1633 patients discharged with pneumonia found that 61% to 62% had been discharged from a hospital within the previous 4 years and that 87% had high-risk medical conditions recognized during the previous admission. (Fedson DS, Harward MP, Reid RA, Kaiser DL. Hospital-based pneumococcal immunization. Epidemiologic rationale from the Shenandoah study. JAMA 1990;264(9):1117-22.). Previous hospital care is a risk factor for subsequent pneumonia (Fedson DS, Baldwin JA. Previous hospital care as a risk factor for pneumonia. Implications for immunization with pneumococcal vaccine. JAMA 1982;248(16):1989-95.)

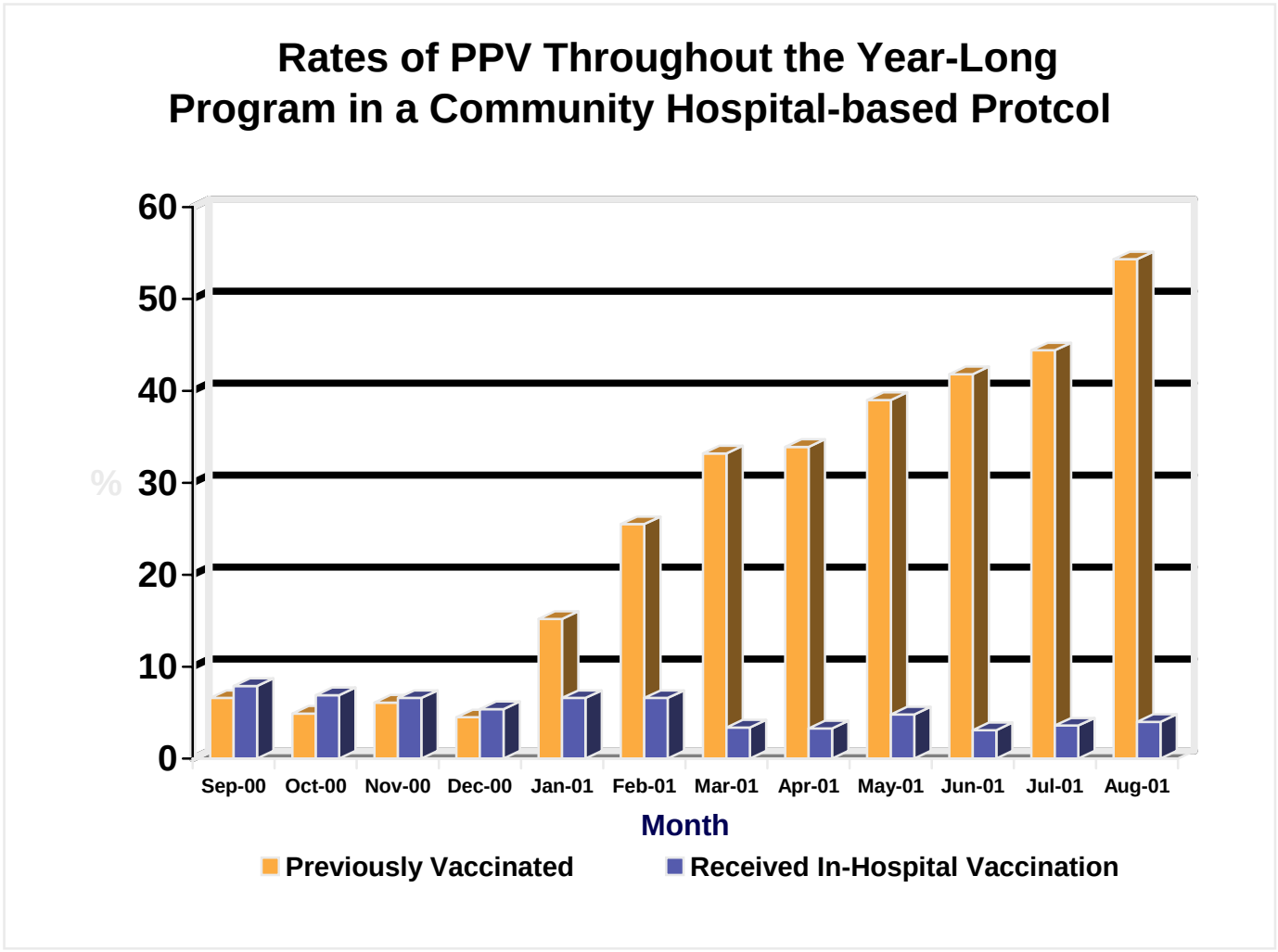
At hospital discharge, he could have received pneumococcal polysaccharide vaccination and, if in season, influenza vaccination. Outpatient visits, as needed for hospital follow-up, were additional missed opportunities for vaccination.

Institutional protocols based on standing orders can substantially increase immunization rates of hospitalized patients. Standing orders for immunizations are allowed by the Centers for Medicare & Medicaid Services. Institutional protocols can be pre-preprinted admission orders in long-term care facilities, nursing-based protocols, pharmacy based protocols, and/or computer-enabled protocols.

Prior to standing orders, a nursing-based protocol led to substantially higher cumulative vaccination rates in a community hospital that had high readmission

rates even though a small percentage of patients was vaccinated each month (see Figure below; *Infection Control and Hospital Epidemiology 2003; 24: 526-531)*. Nursing staff screened newly admitted patients for eligibility based on age, diagnosis or medications and place an order form for PPV on the charts of eligible patients. Following the physician's order, the nursing staff administered the PPV and recorded it. Admission vaccination screening and computer-based record keeping were initiated to identify unvaccinated eligible patients and track vaccination status.

**Figure 1**



A pharmacy-based standing order protocol (SOP) resulted in substantially higher immunization rates; see Figure 2 below (*Am J Health-Syst Pharm* 2003; 60:1471-6 and "Designing and implementing a hospital-based vaccine standing orders program. *Am Journal Health-Syst Pharm* 2007 64:1096-1102.
The implementation steps follow:

1. The patient risk assessment form was combined with the actual vaccination form.
2. A preprinted documentation sticker was developed to simplify the procedure for the nurse.
3. A "vaccine kit" containing the vaccine, documentation sticker, CDC Vaccine Information Statement and a wallet card for the patient were sent from the pharmacy.
4. Daily, a student pharmacist or technician screened new admissions to assess patient eligibility, checked computer for previous PPV doses, and generated orders for patients who meet defined criteria.
5. The nurse verified vaccination status, educated the patient, administered the vaccine, and documented vaccine administration.

**Figure 2**

**Pneumococcal Vaccination Rate in UPMC Presbyterian, comparing experimental and control groups from a pilot to a full standing order program (SOP)**.