MECHANISMS OF HUMAN DISEASE
AND
PHARMACOLOGY & THERAPEUTICS

CASE-BASED SMALL GROUP DISCUSSION

SESSION 14
MHD I

Pulmonary/Hematology

November 26, 2018

STUDENT COPY
At the start of the session, please remember to have the student who developed a clinical question during
the previous small group session share their search strategy; resources and references used to answer the
question; and a summary of the answer to their question.
Please provide them feedback re their search strategy and selected resources.
This should take no more than 5-10 minutes.

Case 1
CHIEF COMPLAINT: "I'm short of breath; I can't stop coughing for the past 2-3 days".

HISTORY: Mr. O'Connor is a 62-year-old who presents to the emergency department with progressive
shortness of breath for the past several days. His problem began four days prior when he developed a
“cold” consisting of a sore throat, rhinorrhea and myalgias. He is an auto mechanic and his job forces
him to work in the cold and damp air. He then developed a cough and trouble breathing. Initially, the
cough was dry but within 24 hours of onset, it produced abundant yellow-green sputum. He states, "I
cough up a cup of this stuff every day." His wife states that he "hacks and spits up" every morning
when he gets up from bed.

The shortness of breath has worsened so that he can hardly speak now in full sentences. He also has
pain in the left side of his chest when he coughs. He becomes tired after walking up a flight of stairs or
during a coughing spell. He denies hemoptysis, night sweats, chills, and paroxysmal nocturnal
dyspnea. However, he does complain of swelling of his ankles: "I've had this for more than a year."
He has been treated for similar episodes of coughing and shortness of breath during the past two
years.

When asked about his past medical history Mr. O'Connor states that he has been treated for high blood
pressure and pneumonias. Once he was hospitalized because "I was drinking too much and my
pancreas acted up."

He currently is not taking any medications except for acetaminophen for occasional knee pain. He has
an old inhaler at home which he doesn’t use.

Mr. O'Connor smokes 1-2 packs of cigarettes per day and has done so for the past 35 years. He rarely
drinks alcohol (only on special occasions) since his pancreas “acted up”.

PHYSICAL EXAMINATION: The patient appears much older than his stated age of 62 years. He is a
stocky man who appears fatigued and anxious. He speaks with difficulty, quickly becoming breathless.
There is cyanosis of his lips and fingertips which intensifies during coughing spells. Blood pressure is
146/82 mm Hg. Apical heart rate is 96/minute and regular. Respiratory rate is 28/minute. Temperature
is 100.2° F. Pulse oximetry on room air 84%. Height 5’7”, weight 237 lbs.

Examination of the head and neck reveals the use of accessory muscles during respiration. Jugular
veins are dilated to 5 cm with a prominent "a" wave.

Examination of the chest reveals use of accessory respiratory muscles. The anterior-posterior diameter
of the chest is increased. Respiratory rate is increased; the expiratory phase is prolonged. Tactile
fremitus is decreased and the lung fields are diffusely hyperresonant with percussion. Percussion also
reveals decreased excursion of the diaphragm bilaterally. Breath sounds are diminished bilaterally.
Coarse crackles, rhonchi and expiratory wheezes are heard bilaterally. Most of these sounds clear with
coughing.
Examination of the cardiovascular system reveals distant heart sounds: $S_2$ is split and louder than $S_1$. The $P_2$ component seems louder than $A_2$ and is heard best at the base of the heart. An $S_4$ is heard best along the left lower sternal border. A murmur is not detected.

The abdomen is round but soft. Bowel sounds are normoactive. The liver edge is slightly tender and palpable 2 cm beneath the right costal margin in the mid-clavicular line. Hepatojugular reflux is appreciated.

There is pitting edema of his ankles.

There is no clubbing of his nails.

Mr. O'Connor is hospitalized.

**Educational Objectives**

1. Define all unknown terms:

2. Develop a broad differential diagnosis for dyspnea by organ system

3. Develop a broad differential diagnosis for cough.
4. Develop a limited or more specific differential diagnosis for this patient based upon the data given in the history and physical examination. In other words, what diseases have a higher probability of causing these clinical problems in this patient, especially when both dyspnea and cough are present? Why?

5. Explain the pathogenesis of the following clinical findings: cyanosis, tachypnea, fever, distended jugular veins, use of accessory muscles of respiration, increased A-P chest diameter and hyperresonant percussion, wheezing, loud S₂, P₂, S₄.

6. What is your diagnosis? Why?

7. Describe the pathologic changes in the lung that you would expect to find in this patient.
**LABORATORY TESTS:**

**Complete Blood Count (Hemogram) with Differential**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC</td>
<td>6.50</td>
<td>[4.5 - 6.0] M/ML</td>
</tr>
<tr>
<td>WBC</td>
<td>11.4</td>
<td>[4.0 - 10.0] X 10/MM</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>19.8</td>
<td>[14.0 - 17.0] gm/dl</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>61.0</td>
<td>[40.0 - 54.0] %</td>
</tr>
<tr>
<td>MCV</td>
<td>89.3</td>
<td>[85 - 95] fl</td>
</tr>
<tr>
<td>MCH</td>
<td>29.9</td>
<td>[28.0 - 32.0] pg</td>
</tr>
<tr>
<td>MCHC</td>
<td>33.5</td>
<td>[32.0 - 36.0] gm/dl</td>
</tr>
<tr>
<td>RDW</td>
<td>13.0</td>
<td>[11.0 - 15.0] %</td>
</tr>
<tr>
<td>Platelet Count</td>
<td>412</td>
<td>[150 - 400] K/ML</td>
</tr>
</tbody>
</table>

**Complete Metabolic Panel**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>130</td>
<td>[136 - 146] mmol/L</td>
</tr>
<tr>
<td>Potassium</td>
<td>3.9</td>
<td>[3.5 - 5.3] mmol/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>90</td>
<td>[98 - 108] mmol/L</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>33</td>
<td>[20 - 32] mmol/L</td>
</tr>
<tr>
<td>BUN</td>
<td>17</td>
<td>[7 - 22] mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>1.2</td>
<td>[0.7 - 1.4] mg/dl</td>
</tr>
<tr>
<td>Glucose</td>
<td>108</td>
<td>[70 - 100] mg/dl</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.6</td>
<td>[3.6 - 5.0] gm/dl</td>
</tr>
<tr>
<td>Protein, Total</td>
<td>6.5</td>
<td>[6.5 - 8.3] gm/dl</td>
</tr>
<tr>
<td>Calcium</td>
<td>9.2</td>
<td>[8.9 - 10.3] mg/dl</td>
</tr>
<tr>
<td>Alkaline Phosphatase</td>
<td>88</td>
<td>[30 - 110] IU/L</td>
</tr>
<tr>
<td>AST</td>
<td>84</td>
<td>[5 - 40] IU/L</td>
</tr>
<tr>
<td>Bilirubin, Total</td>
<td>0.6</td>
<td>[0.2 - 1.4] mg/dl</td>
</tr>
</tbody>
</table>

**Blood Gases, Arterial**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Reference Range</th>
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</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.38</td>
<td>[7.36 - 7.46]</td>
</tr>
<tr>
<td>pCO2</td>
<td>58</td>
<td>[32 - 46] mm Hg</td>
</tr>
<tr>
<td>pO2</td>
<td>44</td>
<td>[74 - 108] mm Hg</td>
</tr>
<tr>
<td>HCO3</td>
<td>31</td>
<td>[21 - 29] mmol/L</td>
</tr>
</tbody>
</table>

**EXAM: CHEST AP**

**HISTORY:** PATIENT WITH PROGRESSIVE SHORTNESS OF BREATH AND COUGH

**FINDINGS:**

THE CARDIAC SILHOUETTE IS NOT ENLARGED.

THE LUNGS ARE HYPERINFLATED, AND THE DIAPHRAGM IS FLATTENED. THERE IS NO FOCAL CONSOLIDATION, PLEURAL EFFUSION OR PNEUMOTHORAX.

PA AND LATERAL RADIOGRAPHS ARE RECOMMENDED FOR COMPLETE EVALUATION WHEN CLINICALLY APPROPRIATE.

8. Correlate and explain the laboratory data. How does the data support your diagnosis?
9. Determine the rate, rhythm and axis of the patient's electrocardiogram. Describe any abnormalities and correlate with the clinical problem. EKGs are at the end of this case.


11. Describe the rationale for treating Mr O'Connor with each of the following:
   - Oxygen
   - Albuterol (what is the route of delivery, what is the mechanism of action?)
   - Ipratropium (what is the route of delivery, what is the mechanism of action?)
   - Prednisone

12. What else would you recommend as part of the therapeutic plan?
13. Mr O’Connor clinically improves and is discharged from the hospital. On followup he is at his clinical baseline and pulmonary function tests are ordered. Explain the significance of the spirometry and correlate with your diagnosis and clinical findings.

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>Predicted</th>
<th>Percent of predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1</td>
<td>0.5L</td>
<td>2.9L</td>
<td>17%</td>
</tr>
<tr>
<td>FVC</td>
<td>1.7L</td>
<td>3.9L</td>
<td>43%</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. **Unknown** – question will be provided during small group session
Case I - EKG A

Technician VICKY ZUNO
Test id: 768-05
EKG-B represents essentially the same tracing as A but all leads are at half-standard to eliminate potential interpretation difficulties due to the wave amplitude in A.

<table>
<thead>
<tr>
<th>Vent. rate</th>
<th>83 BPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR interval</td>
<td>184 ms</td>
</tr>
<tr>
<td>QRS duration</td>
<td>104 ms</td>
</tr>
<tr>
<td>QT/QTc</td>
<td>540/599 ms</td>
</tr>
<tr>
<td>P-R-T axes</td>
<td>47 118 -59</td>
</tr>
</tbody>
</table>

Case 1 – EKG B

Technician: VICKY ZUNO
Test id: 786.05
Case 2
CC: “I cannot catch my breath at all today”

HPI: A 22 year-old woman presents to the Emergency Department with progressive dyspnea, cough, wheezing and chest tightness. This is her third ED visit in the past 6 months for similar symptoms. She has an albuterol inhaler and uses it as needed, usually at least once daily. For the last 3 days she has been using her inhaler frequently without much relief.

The patient grew up and lives in Chicago and has had this disease process since childhood.

She recently started a new job and is concerned that she will be “fired” if she does not show up today.

PE: Anxious appearing, using accessory muscles, unable to complete full sentences.

P 102, Temp 98.4°F, Respiratory rate 30, Blood pressure 110/50. Oxygen saturation is 89% on room air.

On lung exam there are diffuse expiratory wheezes and poor air entry throughout the lung fields.

Her peak flow is 150 L/min

Educational Objectives

1. What is the most likely diagnosis? Explain her symptoms of cough, wheezing dyspnea, and chest tightness.

2. The medical student rotating in the ED is asked to check for “pulsus paradoxus”. Explain what the student will assess and why.

3. Define “peak flow”. How it is assessed and how it is used in the management of this patient’s condition? What is this patient’s predicted peak flow?
4. Outline an initial plan of care.

The patient presents to the ED 2 months later with the same symptoms. She has not started the new medications that have been prescribed, has not followed up with her primary care physician, and has not made changes with respect to environmental triggers.

Several staff express frustration over the patient’s “noncompliance”.

5. Discuss potential reasons for poor outcomes in this patient.

6. The graphic below indicates the prevalence of this disease process in the neighborhoods of Chicago. What factor(s) may account for the differences?
Question 7 Unknown – question will be provided during the small group session.
Case 3
A 67-year old previously healthy man presents with gradual onset of fatigue over the last several weeks. Two days ago he noted the appearance of small red-purple dots on his skin. His gums have had some oozing of blood.

PMHx
Cholecystectomy at age 52
Right ankle fracture sustained while playing hockey age 23

Medications
Ibuprofen 600mg PRN headache and ankle pain – takes infrequently

Physical examination reveals a well-developed man in no acute distress.
Supine BP 110/72, pulse 110, Temperature 98.5°F
His skin and mucous membranes are pale. There are numerous petechiae on his legs and arms. Abdominal exam is normal as are heart (aside from tachycardia) and lung exams.

Initial Laboratory Data

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC</td>
<td>2.2</td>
<td>[4.0-10.0] k/ul</td>
</tr>
<tr>
<td>RBC</td>
<td>1.49</td>
<td>[3.60-5.50] m/ul</td>
</tr>
<tr>
<td>Hgb</td>
<td>6.5</td>
<td>[12.0-16.0] gm/dl</td>
</tr>
<tr>
<td>Hct</td>
<td>17.9</td>
<td>[34.0-51.0] %</td>
</tr>
<tr>
<td>MCV</td>
<td>86</td>
<td>[85-95] fl</td>
</tr>
<tr>
<td>MCH</td>
<td>28.3</td>
<td>[28.0-32.0] pg</td>
</tr>
<tr>
<td>MCHC</td>
<td>33.3</td>
<td>[32.0-36.0] gm/dl</td>
</tr>
<tr>
<td>RDW</td>
<td>15.1</td>
<td>[11.0-15.0] %</td>
</tr>
<tr>
<td>Plt Count</td>
<td>4</td>
<td>[150-400] k/ul</td>
</tr>
</tbody>
</table>

Learning Objectives
1. What is the main clinical problem?

2. Develop a differential diagnosis for the main clinical problem.

3. Is there additional data that should be elicited from the patient via history and/or on physical exam?
4. A peripheral blood smear is reviewed. Why?

The peripheral blood smear reveals 22% of cells have the morphology depicted in the image.

5. What is your diagnosis based on the information provided? What are confirmatory tests/procedures to be performed?

Additional diagnostic tests
Prothrombin time 15.6 [10-11.6 sec]
Partial thromboplastin time 43.4 [22.9 – 34.3 sec]

6. Correlate the additional data with the clinical scenario.
Cases 4,5 Unknowns – Data will be provided during the small group session

REMINDER: One student has been assigned to develop a clinical question which has arisen during today’s case discussions. The student should have input from their colleagues and facilitator.