MECHANISMS OF HUMAN DISEASE
AND
PHARMACOLOGY & THERAPEUTICS

CASE-BASED SMALL GROUP DISCUSSION

SESSION 5 - Cardiovascular
MHD I

September 28, 2018

STUDENT COPY

Helpful Resources

McPhee, SJ, Hammer GD. Pathophysiology of Disease: An Introduction to Clinical Medicine, 6th edition. Cardiovascular Disorders: Vascular Disease, Atherosclerosis p. 296-300 (available as e-book though Loyola Health Science Library)


**Case 1**

**CHIEF COMPLAINT:** “Chest pain” on and off for the past six months.

**HISTORY:** Mr. Solomon is a 58 year-old insurance broker who presents to a physician’s office because of an episode of “chest pain” that he experienced 1 week prior during a golf game. Although he minimizes the severity of the pain and attributes it to being “out of shape,” his wife insisted that he see a physician because he has had similar episodes during the past six months.

Mr. Solomon describes the pain as being a discomfort or heaviness. He rates the pain intensity as 8/10 at its worst. It is localized to “my breast bone” and does not radiate. While golfing last week, the pain subsided following a brief rest and he returned to his game. Previous episodes of the heavy feeling tended to occur following large meals and on one occasion, while dancing at a wedding. None of the episodes lasted more than “several minutes.”

Although Mr. Solomon does not experience nausea or vomiting during golf, he notes many episodes in the past of feeling a burning sensation in his chest. He describes the sensation as being “like acid behind my breast bone.” This feeling occurs most often late at night when he lays down. Usually he has had a large meal or drank alcohol. The sensation does not radiate.

When asked about how he feels about these episodes, he admits to being concerned about his health and longevity, considering his father died at age 52 of “heart problems.” He says, “Business is poor, my kid is always in trouble. Who’s going to take care of things?”

When asked about his past medical history Mr. Solomon recalls no previous illnesses (aside from chickenpox and some ear aches as a child), surgeries or hospitalizations. He hasn’t seen a doctor in “years”.

Mr. Solomon smokes ½ to 1 pack of cigarettes per day since the age of 25. He drinks 2-3 cocktails per night to “settle my nerves.”

**PHYSICAL EXAMINATION:** Mr. Solomon appears anxious. He is wearing clean casual shirt/pants. Vital signs: BP(obtained with a large cuff) right arm 162/94; left arm 160/92. Weight 200lbs; Height 5’7”. Respiratory rate is 16/minute. Pulse 86 beats/minute and regular. Temperature, 98.4°F. He was pain free at the time of the examination.

**HEENT:** prominent bilateral diagonal earlobe creases
Fundoscopic examination: normal; there are no changes of hypertensive retinopathy.
Cardiovascular system: regular, apical heart rate of 88/minute. S1 is heard best at the apex; a loud S2 is heard best in the right second intercostal space and left parasternal border. An S4 is heard at the apex. There is no rub. There are no murmurs. There are no carotid bruits.
Lungs: clear to percussion and auscultation.
Abdominal examination: negative for abnormalities. An indirect hernia is noted in the right inguinal region.
There is no chest wall or rib pain to palpation.
There is no rash or vesicles on the chest wall.
Vascular: Radial and dorsalis pedis pulses are symmetrical; no peripheral edema.
EDUCATIONAL OBJECTIVES

1. Define all unknown terms:

2. Cite the primary clinical problem (not the diagnosis)

3. Develop a broad list of disease processes which could be a cause of this patient's clinical problem. Organize by organ systems.

4. In general, what factors (data) would you take into consideration when determining a differential diagnosis or specific diagnosis in a patient?

5. Based on the history and physical examination findings, develop a differential diagnosis of the clinical problem for this patient. Discuss why you are including some diagnoses and not others (ie provide pertinent "negatives" and "positives" to support your diagnoses)
The physician formulates a differential diagnosis and sends Mr. Solomon to the office laboratory for blood work. An EKG and chest X-ray are ordered.

**LABORATORY DATA**

**Complete Blood Count (Hemogram)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Reference Range</th>
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</thead>
<tbody>
<tr>
<td>RBC</td>
<td>5.1</td>
<td>[4.5 - 6.0] M/ML</td>
</tr>
<tr>
<td>WBC</td>
<td>5.6</td>
<td>[4.0 - 10.0] X 10/MM</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>15.2</td>
<td>[14.0 - 17.0] gm/dl</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>45</td>
<td>[40.0 - 54.0] %</td>
</tr>
<tr>
<td>Platelet</td>
<td>320</td>
<td>[150 - 400] K/ML</td>
</tr>
</tbody>
</table>

**Basic Metabolic Panel**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>110</td>
<td>[70 - 100] mg/dl</td>
</tr>
<tr>
<td>Blood Urea Nitrogen</td>
<td>11</td>
<td>[7 - 22] mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.9</td>
<td>[0.6 - 1.4] mg/dl</td>
</tr>
<tr>
<td>Calcium</td>
<td>9.3</td>
<td>[8.5 - 10.5] mg/dl</td>
</tr>
<tr>
<td>Sodium</td>
<td>143</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>104</td>
<td>[98 - 108] mmol/L</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>24</td>
<td>[20 - 32] mmol/L</td>
</tr>
</tbody>
</table>

**Lipid Profile**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHOLESTEROL</td>
<td>280</td>
<td>&lt;200 MG/DL</td>
</tr>
<tr>
<td>TRIGLYCERIDE</td>
<td>285</td>
<td>&lt;150 MG/DL</td>
</tr>
<tr>
<td>HDL CHOLESTEROL</td>
<td>33</td>
<td>&gt;39 MG/DL</td>
</tr>
<tr>
<td>LDL CHOLESTEROL</td>
<td>190</td>
<td>&lt;100 MG/DL</td>
</tr>
</tbody>
</table>

Comment:

**TRIGLYCERIDE REFERENCE RANGE APPLIES TO FASTING SAMPLE**

**LDL INTERPRETATION MG/DL – BASED ON CURRENT GUIDELINES**

OPTIMAL LESS THAN 100 MG/DL
NEAR OPTIMAL 100-129 MG/DL
BORDERLINE 130-159 MG/DL
HIGH 160-189 MG/DL  
VERY HIGH GREATER THAN 189 MG/DL  

NON-HDL CHOLESTEROL  247 <160 MG/DL

EXAM:  PA AND LATERAL CHEST

COMPARISON : None

FINDINGS:

PA AND LATERAL CHEST EXAMS ARE NEGATIVE FOR CONSOLIDATION OR EDEMA.  
CARDIAC SILHOUETTE SIZE NORMAL.  NEGATIVE EFFUSION.  MEDIASTINAL AND HILAR  
CONTOURS WITHIN NORMAL LIMITS.  NEGATIVE PNEUMOTHORAX.

IMPRESSION:

NORMAL 2 VIEWS OF THE CHEST.

6. Review the laboratory data. Interpret the EKG (the EKG is at the end of the small group). Correlate the results with your differential diagnosis.

7. What is your diagnosis: Why?

8. What are the risk factors for this disease in this patient?
Mr Solomon’s physician is now deciding whether to recommend an exercise stress test vs coronary angiography to Mr Solomon.

9. Describe briefly what an “treadmill exercise stress test” entails and what information can be obtained from it with respect to Mr Solomon. Briefly describe “coronary angiography”.

Mr. Solomon elects to undergo a treadmill exercise test after lengthy discussion with his physician regarding both procedures.

DIAGNOSTIC THINKING IN THE CASE OF MR. SOLOMON (QUESTIONS 10-11)

10. According to the NHANES survey, the prevalence of coronary artery disease among men age 40-59 is 6.0%. With a positive exercise stress test defined as a >/= 1mm horizontal or down-sloping ST depression, this test has a mean sensitivity of 60% and mean specificity is 90%.

   a. Define sensitivity, specificity, prevalence, pre-test probability, post-test probability, positive predictive value, and negative predictive value. Illustrate these concepts in a 2x2 grid.

   b. In most clinical scenarios, a test is neither 100% sensitive nor 100% specific. There is always a trade-off. Comment on when you might want to choose a highly sensitive test and when you might want to choose a highly specific test.
c. Given the high specificity and low sensitivity of the exercise stress test, how would these values help you interpret a positive test result?

After 8 minutes of exercise via the Bruce Protocol on the treadmill Mr. Solomon developed “chest pressure”, 7/10 in intensity, and EKG changes consisting of ST depressions in the inferolateral leads of 2mm.

Five minutes after the test was stopped Mr. Solomon’s chest pain subsided and the EKG changes resolved.

11a. This patient has a positive stress test. As noted above, given the high specificity of the test, you may feel reassured that this positive test is highly suggestive of underlying coronary artery disease. However, it is very important to note that the prevalence (pre-test probability) of a disease greatly affects the interpretation of a test result. To illustrate this point and based on the provided parameters, complete a 2x2 table. Use this table to calculate the post-test probability (negative and positive predictive value). {Hint: start with the prevalence (ie T disease positive is 6 and T disease negative is 94) based on the given prevalence of 6%}.

<table>
<thead>
<tr>
<th></th>
<th>Disease +</th>
<th>Disease -</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Result +</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Result -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>94</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

11b. To illustrate the effect of prevalence on PPV and NPV further, repeat the exercise above but using the prevalence of 35%, which is the prevalence of coronary artery disease in men >80 years old.
Mr. Solomon declines further diagnostic testing. He reemphasizes that he has “a lot of things going on” at home and work. He leaves and states “I’ll see my doctor soon”.

**NUTRITION INTEGRATION**

3 WEEKS LATER

Mr. Solomon and his wife return to his physician’s office. He feels the same and has the same symptoms. His blood pressure during this visit is 162/93. Physical exam is unchanged. The Solomon’s want some guidance on the “right foods” to eat to help his “cholesterol”. He does not want to start any “drugs” for his cholesterol at this time.

12. This question addresses issues related saturated fats, trans fats, monounsaturated fats, and polyunsaturated fats.

a. Which are considered the “bad” fats?

b. What are the effects of saturated fats, trans fats, monounsaturated fats, and polyunsaturated fats on a patient’s LDL cholesterol?

c) According to the 2015-2020 Dietary Guidelines Published by the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS), a healthy eating pattern limits which of the above fats? Did the guidelines provided any specific quantitative recommendations?
13. Mrs. Solomon mentions that she saw the “DASH” diet when she was searching the internet. She asks, “Do you think this diet would be good for my husband?” How would you respond?

14. Question will be provided during the small group session

REMINDER - We are resuming the MHD “Asking a Clinical Question” Activity. Please make sure the assigned student, with input from the group and facilitator, formulates a clinical question to search and present during the next small group session.
Vent. rate
PR interval
QRS duration
QT/QTc 432/479 ms
P-R-T axes 77 10 38