Case Presentation: 59 Year Old African-American Woman with Increasing Dyspnea

Connor Milone, MS3
History of Present Illness

• 59-year-old African-American woman with a history of HFrEF, CKD, hypertension, pre diabetes, and multiple pulmonary nodules presented complaining of increasing lower extremity edema for the last few days.

• She also reported increased shortness of breath when she walks up the stairs. She did not notice any changes shortness of breath when she lies flat. She denies any cough/wheeze, fever/chill, night-time waking/apnea. She denied anosmia or COVID exposure. Denies URI symptoms. Denied chest pain, nausea and vomiting.
Additional History

- ROS positive for shortness of breath and polyuria
- PMH of Nonischemic Nonvalvular Cardiomyopathy, EF <20%, moderate pericardial effusion
- History of ascites and right pleural effusion attributed to CHF in 2019
- PET in 2019 demonstrated nonspecific enlarged mediastinal lymph nodes with mildly increased FDG activity, patient failed to follow up
  - Pleural fluid cytology in 2019 was negative for malignancy
- History of HTN, HLD, CKD Stage 3b
- No prior surgical history
- Patient has never smoked, denies heavy alcohol use
Physical Examination

181/97  80  98.1F  20  92%; Weight 63.7kg, BMI 24.3 kg/m2

Pertinent Findings:

**Gen:** Alert in no acute distress, appears older than stated age, thin, cachectic

**Neck:** Supple, trachea midline, JVD 10 to 11cm

**HEENT:** Oral mucosa moist

**CV:** Regular rate and rhythm, S3 present, no murmur, 2+ lower extremity edema up to her groin in L>R, pitting edema in her abdomen

**Resp:** Dullness to percussion ¾ of way up R posterior chest, Diminished breath sounds on right, L basilar fine crackles to midlung, no wheeze

**GI:** Soft, Nontender, Normal bowel sounds, liver edge 3 cm from the rib cage and smooth, 10cm of shifting dullness

**Lymphatics:** No cervical/axillary lymphadenopathy.
Labs

- WBC: 4.1 thous/mm³
- Hb/Hct: 13.9/43.6
- Plat: 143 thous/mm³
- PT: 14.9 s
- INR: 1.2
- Na 139 mmol/L
- K 4.5 mmol/L
- Cl 98 mmol/L
- HCO₃ 34 mmol/L
- BUN 27 mg/dL
- Cr 1.17 mg/dL
- Pro 8.4 g/dL
- Alb 4.0 g/dL
- Lac 1.0 mmol/L
- Trop <0.012 ng/mL
- NT-proBNP 10,600 pg/mL
- D-Dimer 659 ng/mL
- Procal 0.08 ng/mL
AP Portable Chest Radiograph

**IMPRESSION:** Large right pleural effusion with pulmonary vascular congestion likely secondary congestive heart failure. Probable right perihilar atelectasis.
Thoracentesis

Right-sided thoracentesis yielded 1500 mL of clear yellow pleural effusion

Fluid Analysis Results:
- Pleural Protein 4.8 g/dL
- Pleural LDH 244 IU/L
- Serum LDH 498 IU/L (ULN 618)
- Serum Protein 8.4 g/dL
# Pleural Fluid Evaluation

Transudate vs. Exudate: The Age Old Question

## Light's Criteria

<table>
<thead>
<tr>
<th></th>
<th>Transudate</th>
<th>Exudate</th>
<th>This Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleural: Serum Protein</td>
<td>&lt; 0.5</td>
<td>≥ 0.5</td>
<td>0.57</td>
</tr>
<tr>
<td>Pleural: Serum LDH</td>
<td>&lt; 0.6</td>
<td>≥ 0.6</td>
<td>0.49</td>
</tr>
<tr>
<td>Pleural fluid LDH</td>
<td>&lt; 2/3 ULN</td>
<td>&gt;2/3 ULN</td>
<td>498 (&gt; 412)</td>
</tr>
</tbody>
</table>

**Potential Etiologies**

- Heart failure
- Cirrhosis
- Nephrotic syndrome
- Pulmonary embolism
- Malignancy
- Pneumonia
- Tuberculosis
- Esophageal rupture
- Chylothorax
- Hemothorax
## Additional Fluid Analysis

<table>
<thead>
<tr>
<th>Special Tests</th>
<th>Role</th>
<th>Cutoff</th>
<th>This Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>Equivocal Exudative Effusions</td>
<td>Serum Alb – Pleural Alb &lt;1.2g/dL</td>
<td>4.0 – 2.1 = 1.9</td>
</tr>
<tr>
<td>Culture</td>
<td>Complicated Parapneumonic Effusion vs Empyema</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Cytology</td>
<td>Malignant Effusion</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Amylase</td>
<td>Pancreatitis, Pancreaticopleural fistula, Malignant, Esophageal Rupture</td>
<td>&gt; Serum ULN (~220)</td>
<td>36</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Exudative Effusions (Cholesterol Effusion)</td>
<td>&gt;45 mg/dL (&gt;250 mg/dL)</td>
<td>51</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>Chylothorax</td>
<td>&gt;110 mg/dL</td>
<td>N/A</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>Hemothorax</td>
<td>Pleural Hct / Blood Hct ≥0.5</td>
<td>N/A</td>
</tr>
<tr>
<td>Adenosine Deaminase</td>
<td>TB, Malignant, PE, Empyema</td>
<td>&gt;40 IU/L</td>
<td>N/A</td>
</tr>
<tr>
<td>NT-proBNP</td>
<td>CHF if Exudative</td>
<td>&gt;1500 pg/mL</td>
<td>10,600</td>
</tr>
<tr>
<td>Creatinine</td>
<td>Urinothorax</td>
<td>Pleural Cr / Serum Cr ≥1</td>
<td>N/A</td>
</tr>
<tr>
<td>Tumor Markers: CEA, CA15.3, CA549, HER2/Neu, CYFRA 12.1, CA125, telomerase</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>
Differential Diagnosis

• (1) Heart failure (Transudative Pleural Effusion)
  
  For:
  - CXR revealing prominent pulmonary vasculature
  - Largely elevated proBNP
  - Meets clinical picture (anasarca, progressive dyspnea, reduced ejection fraction)

  Against:
  - Effusion is predominantly unilateral
  - Equivocal pleural fluid analysis for Light’s Criteria

• (2) Malignancy (Exudative Pleural Effusion)
  
  For:
  - CXR revealing large unilateral pleural effusion with right perihilar atelectasis
  - Previous PET in 2019 showed enlarged mediastinal lymph nodes
  - Pleural:serum protein, pleural:serum LDH, pleural cholesterol in exudative range

  Against:
  - Pleural cytology negative for malignancy
  - Albumin, protein not in support of exudative process
  - Does not meet clinical picture (no weight loss, fatigue, hemoptysis)

• (3) Pneumonia (Exudative Pleural Effusion)
  
  For:
  - CXR revealing R middle lobe radio density
  - Pleural:serum protein, pleural:serum LDH, pleural cholesterol in exudative range

  Against:
  - Albumin, protein not in support of exudative process
  - Does not meet clinical picture (no fever, cough, leukocytosis)
Diagnosis?
Diagnosis: Pleural Effusion Secondary to Congestive Heart Failure

PA and AP Chest radiographic features of pleural effusion can include:
- **Blunting of the costophrenic angle**
- **Blunting of the cardiophrenic angle**
- Fluid within the horizontal or oblique fissures
- **Meniscus**
- **Contralateral Mediastinal shift** (in case of large effusions)
Diagnosis: Pleural Effusion Secondary to Congestive Heart Failure

- In heart failure, pleural effusion results from increased interstitial fluid in the lung due to elevated pulmonary capillary pressure due to elevated left sided filling pressures.
- More than 80% of patients with pleural effusions caused by congestive heart failure have bilateral pleural effusions, and thus thoracentesis is indicated if there is unilateral pleural effusion in this setting.
- Of unilateral pleural effusions in CHF, most do occur on the right side.
- While Light’s criteria is often used to distinguish pleural effusions as exudative versus transudative, the criteria have lower specificity in identifying exudative effusions (next slide).
- An estimated 25% of pleural effusions secondary to CHF actually fall into the exudative range on biochemical analysis.
- The measurement of pleural fluid NT-proBNP is the best way to identify pleural effusions that meet the exudative criteria of Light but are due to HF.
Diagnosis: Pleural Effusion Secondary to Congestive Heart Failure

*TABLE 3. SENSITIVITY OF TESTS TO DISTINGUISH EXUDATIVE FROM TRANSDUATIVE EFFUSIONS.*

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity for Exudate</th>
<th>Specificity for Exudate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light’s criteria (one or more of the following three)</td>
<td>98%</td>
<td>83%</td>
</tr>
<tr>
<td>Ratio of pleural-fluid protein level to serum protein level &gt;0.5</td>
<td>86%</td>
<td>84%</td>
</tr>
<tr>
<td>Ratio of pleural-fluid LDH level to serum LDH level &gt;0.6</td>
<td>90%</td>
<td>82%</td>
</tr>
<tr>
<td>Pleural-fluid LDH level &gt; two thirds the upper limit of normal for serum LDH level</td>
<td>82%</td>
<td>89%</td>
</tr>
<tr>
<td>Pleural-fluid cholesterol level &gt; 60 mg/dl (1.55 mmol/liter)</td>
<td>54%</td>
<td>92%</td>
</tr>
<tr>
<td>Pleural-fluid cholesterol level &gt; 43 mg/dl (1.10 mmol/liter)</td>
<td>75%</td>
<td>80%</td>
</tr>
<tr>
<td>Ratio of pleural-fluid cholesterol level to serum cholesterol level &gt; 0.3</td>
<td>89%</td>
<td>81%</td>
</tr>
<tr>
<td>Serum albumin level – pleural-fluid albumin level ≤1.2 g/dl</td>
<td>87%</td>
<td>92%</td>
</tr>
</tbody>
</table>

*LDH denotes lactate dehydrogenase.

Resources