RADY 401 Case Presentation

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Ed. John Lilly, MD
Focused patient history and workup

- 75 yo female with Afib, CAD s/p CABG, T2DM, HTN, HLD, CHF, Asthma who presents to the ED with bilateral leg edema, NV and abd pain
- Nothing new about her symptoms, possibly worse today
- PE: 189/98  77  16   36.7   98% Chronic ill-appearing, NAD, minimal abd tenderness, 3+ pitting edema to knees bilaterally, elevated JVP
- EKG unchanged, BNP >60K, Trop 0.055

Next steps?
ACR Appropriateness Criteria: CP\textsuperscript{5}

- Acsearch.acr.org
- “CXR/ CTA/ US are generally nonoverlapping and can be used sequentially”\textsuperscript{5}

<table>
<thead>
<tr>
<th>Clinical Condition: Acute Nonspecific Chest Pain—Low Probability of Coronary Artery Disease</th>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X-ray chest</td>
<td>9</td>
<td>X-ray, CTA, and US are generally nonoverlapping and can be used sequentially.</td>
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<tr>
<td></td>
<td>CTA coronary arteries with IV contrast</td>
<td>7</td>
<td>X-ray, CTA, and US are generally nonoverlapping and can be used sequentially.</td>
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<td></td>
<td>CTA chest with IV contrast</td>
<td>7</td>
<td>X-ray, CTA, and US are generally nonoverlapping and can be used sequentially.</td>
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<tr>
<td></td>
<td>US echocardiography transthoracic resting</td>
<td>7</td>
<td>X-ray, CTA, and US are generally nonoverlapping and can be used sequentially.</td>
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<td></td>
<td>Tc-99m SPECT MPI rest and stress</td>
<td>6</td>
<td></td>
<td>5</td>
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<td></td>
<td>Tc-99m V/Q scan lung</td>
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<td>3</td>
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<tr>
<td></td>
<td>X-ray rib views</td>
<td>5</td>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>MRA chest without and with IV contrast</td>
<td>5</td>
<td></td>
<td>0</td>
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<tr>
<td></td>
<td>MRI heart stress perfusion without and with IV contrast</td>
<td>5</td>
<td>This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.</td>
<td>0</td>
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<tr>
<td></td>
<td>MRI heart function and morphology without and with IV contrast</td>
<td>5</td>
<td>This procedure may be appropriate but there was disagreement among panel members on the appropriateness rating as defined by the panel's median rating.</td>
<td>0</td>
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<td>US echocardiography transthoracic stress</td>
<td>5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>MRA chest without IV contrast</td>
<td>4</td>
<td></td>
<td>0</td>
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<tr>
<td></td>
<td>X-ray barium swallow and upper GI series</td>
<td>4</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>X-ray thoracic spine</td>
<td>4</td>
<td></td>
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<tr>
<td></td>
<td>US abdomen</td>
<td>4</td>
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<td>0</td>
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<tr>
<td></td>
<td>MRI heart function and morphology without IV contrast</td>
<td>4</td>
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<td>0</td>
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<td>US echocardiography transesophageal</td>
<td>2</td>
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<td></td>
<td>Arteriography coronary</td>
<td>1</td>
<td></td>
<td>1</td>
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</tbody>
</table>

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level*
### ACR Appropriateness Criteria: Abd Pain

#### Variant 4:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
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</thead>
<tbody>
<tr>
<td>CT abdomen and pelvis with IV contrast</td>
<td>Usually Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>CT abdomen and pelvis without IV contrast</td>
<td>Usually Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without and with IV contrast</td>
<td>Usually Appropriate</td>
<td>O</td>
</tr>
<tr>
<td>US abdomen</td>
<td>May Be Appropriate</td>
<td>O</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without IV contrast</td>
<td>May Be Appropriate</td>
<td>O</td>
</tr>
<tr>
<td>CT abdomen and pelvis without and with IV contrast</td>
<td>May Be Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>X-ray abdomen</td>
<td>May Be Appropriate</td>
<td>++</td>
</tr>
<tr>
<td>FDG-PET/CT skull base to mid-thigh</td>
<td>Usually Not Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>In-111 WBC scan abdomen and pelvis</td>
<td>Usually Not Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>Tc-99m cholecintigraphy</td>
<td>Usually Not Appropriate</td>
<td>+++</td>
</tr>
<tr>
<td>Tc-99m WBC scan abdomen and pelvis</td>
<td>Usually Not Appropriate</td>
<td>++++</td>
</tr>
<tr>
<td>X-ray upper GI series with small bowel follow-through</td>
<td>Usually Not Appropriate</td>
<td>+++</td>
</tr>
<tr>
<td>X-ray contrast enema</td>
<td>Usually Not Appropriate</td>
<td>+++</td>
</tr>
</tbody>
</table>
List of imaging studies

- **CXR** can rule in or out numerous causes of chest pain - pleural pathology, CHF, pneumonia, masses - the list goes on.
  - CXR, like the history, is not sensitive in the case of nonspecific abdomen or chest pain. It can be very specific, and has a very low radiation dose, but further imaging is often necessary. Sensitivity and specificity numbers vary by diagnosis.
- **CT Abdomen and Pelvis (A/P) w/ IV contrast** evaluate for sources of abdominal pain. Like the CXR with chest pain, the CT A/P can find numerous causes for abdominal pain, but cannot rule out many causes (ie. chronic pain syndromes)
- **CTA Chest** evaluate for PE. While there are some classic CXR findings for PE and infarction (Hampton’s Hump and Westermark Sign), the vast majority of CXRs are normal in patients experiencing a PE. Thus, a CTA is an essential part of the workup.
- **Lower extremity venous US (doppler)** assess for clot burden in the lower extremities.
Streaky perihilar opacities - Pulmonary edema, cardiomegaly, stable from prior exams
New small L pleural effusion
Positive “silhouette sign”
In the previous CXR, the enlarged cardiac silhouette completely obscures the left hemidiaphragm. Only on the lateral view can we see the blunting of the costophrenic angle and definitively say that there is an effusion.

Hence the expression, one view is no view.
CT A/P with IV contrast, transverse
Chronic thrombotic disease, old thrombi in SMA and R renal artery, small splenic infarcts
Findings?
Coronal plane:
Incidental PE, R lower lobe segmental pulmonary artery
CTA Pulmonary, slice 7

Findings?
R lower lobe segmental PE
Diagnosed with acute on chronic CHF, admitted to MPCU, treated with IV furosemide
Incidental PE treated with IV Heparin
Lower extremity venous US shows acute DVT in left common femoral and left great saphenous veins
Pulmonary Embolism

- **Standard imaging:**
  - D-dimer if low pretest probability
  - VQ Scan if no contrast or pregnant
  - CTA if high pretest probability
- **Our patient:**
  - Low pre-test probability, more likely CHF, PE was incidental finding with CT AP for abdominal pain
  - Right now, guidelines and limited data (no clinical trials) suggest that incidental PE should be treated, especially if concomitant DVT, but not necessarily hospitalized
Suspected pulmonary embolism

CTPA
- Unstable
  - Negative: Other diagnosis
  - Positive: Treatment
- Stable
  - PXR
    - Clinical score
      - Low-to-moderate pretest probability
        - D-dimer
          - Negative: CTPA or V/Q scan
          - Positive: Radionuclide V/Q scan
            - Low/intermediate probability: Consider CTPA
            - High probability for PE: Treatment
            - Negative and low or medium probability for PE: No further test
        - High pretest probability
          - Large body habitus allergic to contrast non-cooperative
          - Abnormal PXR previous chronic lung diseases
            - CTPA
              - Negative and high probability for PE: Lower limb US +/- radionuclide scan
              - Positive for PE: Treatment

PXR, plain X-ray; CTPA, computed tomography pulmonary angiogram; V/Q scan, ventilation/perfusion scan; US, Ultrasonography.
Pulmonary Embolism: Classic Findings

CTA PE protocol with bilateral PE

VQ Scan with small R segmental PE
## Sensitivity/Specificity & Radiation

<table>
<thead>
<tr>
<th></th>
<th>Clinical Impression (based on Well’s criteria)</th>
<th>D-Dimer(^1)</th>
<th>CTAp(^1)</th>
<th>VQ Scan(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
<td>85%</td>
<td>96%</td>
<td>83% (90% if high suspicion)</td>
<td>81%</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td>51%</td>
<td>40-60%</td>
<td>96%</td>
<td>74%</td>
</tr>
<tr>
<td><strong>Radiation</strong></td>
<td></td>
<td></td>
<td>10 mSV</td>
<td>&lt;2 mSv (gamma)</td>
</tr>
<tr>
<td><strong>Cost(^4)</strong></td>
<td></td>
<td>$20-100</td>
<td>$400-2000</td>
<td>$700-2000</td>
</tr>
</tbody>
</table>

Other option: MR angiography
What works for diagnosing PE?

- Well’s criteria: “high probability of PE”, per the largest study to date, is >16.2 % incidence of PE\(^6\)
  - Mean 37% incidence in “high probability” group\(^6\)
  - 20.4% of patients sent to CTA were diagnosed with PE\(^6\)
- CTA is by far the most specific study, with sensitivity comparable to clinical suspicion\(^7\)
- The use of Well’s criteria sends four patients to the CT scanner for every patient diagnosed, despite. However, a Well’s score <2 is how clinicians achieved an 85 percent sensitivity\(^7\)
The Moral of the Story

- Well’s criteria sacrifices specificity for sensitivity.
- CTA offers excellent specificity and comparable specificity, but is a large radiation dose.
- In combination, CTA and Well’s criteria offer excellent sensitivity and specificity.
- There is great potential for improving resource utilization and avoiding unnecessary radiation.
A stable 58 yo female with anxiety, HTN and T2DM presents with shortness of breath. She has had no swelling, recent surgery or prior DVT/PE. She had a previous anaphylactic reaction to contrast.

- CXR wnl; EKG sinus tach
- What test to order?
  - CTA PE protocol
  - VQ Scan
  - D-dimer
References

1. UpToDate- Clinical presentation, evaluation, diagnosis of the nonpregnant adult with suspected acute pulmonary embolism