Radiologic Features of The Pulmonary Embolus

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Our Patient: Mr. J

Mr. J is a 51 y.o. male who presented to the BIDMC ED w/ acute onset of:

- Left Hemiparesis
- Slurred speech
- Mild dyspnea
- Mild chest pain
- Hypotension
- Tachycardia
- O2 sat 88% on RA.

1. The EKG was normal sinus rhythm, with T wave inversion in V1 through V3, mild PR depression and PR elevation. Cardiac troponin was elevated. UA, CBC, Chemistry, LFT’s were wnl.

2. A chest x-ray was ordered
Signs and Symptoms of PE

Symptoms:
- Pleuritic & Non Pleuritic Chest pain
- Dyspnea
- Cough
- Hemoptysis
- Syncope
- 33% pts. w/ PE have DVT symptoms (calf pain, edema)

Signs:
- Tachypnea
- Tachycardia
- Hypoxia
- Fever
- Cyanosis
- Isolated Crackles
- Loud P2
- Elevated JVP

30-35% mortality rate of patients with untreated pulmonary embolus

Gross Specimen

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Mr. J’s chest x-ray

Normal

• no signs of acute cardio-pulmonary process.
Chest x-ray findings of a Pulmonary Embolus

14% Normal
68% Atelectasis or parenchymal density
48% Pleural Effusion
35% Pleural based opacity
24% Elevated diaphragm
15% Prominent central pulmonary artery
7% Westermark’s sign
7% Cardiomegaly
5% Pulmonary edema
Patient 2: Atelectasis (68%)

Chest radiograph:

- long linear bands of atelectasis (arrows).
Patient 3: Pleural Based Opacities (Hampton’s Hump)

• Indication of lung infarction distal to thrombus
Patient 4: Enlarged Pulmonary Artery (15%)

Dilated pulmonary Artery proximal to thrombus
Patient 5: Oligemia of Lung (Westermark’s sign) (5%)

Oligemia of the Right lower lung

- occlusion of large lobar or segmental artery
- also in widespread small vessel occlusion.
- not sensitive in the detection of small emboli

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Back to Mr. J

Head CT W/out contrast was performed:

- Low attenuation in right hemisphere consistent with stroke.

51 y.o. male w/ acute onset of
- Lft. Hemiparesis
- Slurred speech
- Mild dyspnea
- Mild chest pain
- Hypotension
- Tachycardia.
The following day Mr. J complained of more shortness of breath and his O2 sats remained in the mid 90 range on two liters.

His jugulovenous pressure had risen to 10.0 cm. Shortly thereafter, the patient's blood pressure was noted to be 80/50.

An Echocardiogram was ordered along with a normal saline bolus

The ECHO revealed right heart dilatation and strain consistent w/ pulmonary embolus
(Images not available)
Patient 6: Echocardiographic features of PE

- **RV dilatation**
- **RV size does not change from diastole to systole = hypokinesis**
- **D-shaped LV**
- **40% of pts. W/ PE have RV abnormalities seen by ECHO**

Transthoracic short axis parasternal view.

Mr. J’s Chest CT

CT w/Contrast was also ordered.

Pulmonary embolus beginning at distal right pulmonary artery.

Pulmonary embolus beginning from Left pulmonary trunk.
The Use of Spiral CT For the Diagnosis of PE

Pros:
Fast
- can be used during a single breath hold
Accurate
- 90% sens and 90% specific for main, lobar, and segmental arteries.
Utility
- can diagnose intrathoracic disease other than PE that may account for patients clinical presentation.

Cons:
Accuracy
- less accurate in imaging peripheral vessels.
- 53% sens and 75% spec for all vessels.
Artifact;
- Patients movements can cause 5-10% of CTA’s to be non-diagnostic
Poor contrast opacification
Requires dye load. Problematic if pt. allergic or suboptimal renal function.

Mr. J’s Abdominal CT

CT abdomin W/cont:

Left renal vein thrombosis
The Lung Scan

Perfusion:
• IV injection of human serum albumin labelled w/ technetium-99m
• Particles are same size as pulmonary capillaries and become trapped
• Lung peripheral to a clot is not perfused and will show defect

Ventilation:
• Inhalation of xenon-133 radioactive gas
• Degree of ventilation of all lung areas can be assessed
• Pneumonia, emphysema, tumors can cause defects
• Pulmonary embolism does not cause ventilation defect

Therefore, patients w/ a perfusion defect w/out a ventilation defect is suggestive of a pulmonary embolus.
Lung Scan cont...

Results:

• Normal - 4% chance of having PE

• Abnormal
  • Low-probability - 16% chance of having PE
  • Intermediate probability - 33% chance of having PE
  • High probability - 88% chance of having PE


Likelihood of PE based on Clinical Suspicion

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<th>Scan category</th>
<th>Clinical Suspicion</th>
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<tr>
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<tr>
<td>High</td>
<td>96%</td>
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<tr>
<td>Intermediate</td>
<td>66%</td>
</tr>
<tr>
<td>Low</td>
<td>40%</td>
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Pioped Investigators. Jama. 1990; 263:2753-2759
Patient 7: Pulmonary Embolus on Lung Scan

Normal ventilation w/ abnormal perfusion in both lungs
Mr. J

It was decided that Mr. J was not a candidate for surgical thrombectomy.

After consultation with Interventional radiology it was decided that pulmonary arteriography and thrombectomy would be performed.
Pulmonary Angiography

- Catheter accessed from the femoral or subclavian vein
  Radioopaque dye injected into pulmonary vasculature

- Considered to be the “Gold Standard” for diagnosis of PE

- There is a 2.3% chance of having PE after Negative Pulmonary Angiogram

- <1% mortality rate
- 2-5% morbidity rate
  Ryu, j. et.al. Diagnosis of Pulmonary Embolism With use of Computed Tomographic Angiography.

- Thrombectomy can be performed during procedure
Mr. J’s Pulmonary Arteriography

Distal Lft. main pulmonary artery thrombus
Mr. J’s Outcome

The pulmonary embolus was removed and blood flow was restored

A IVC filter was placed to prevent more emboli

It was later discovered that Mr. J had renal cell carcinoma of the left kidney
And underwent a left total nephrectomy.

He had a good recovery and was discharged in good condition
Take Home Message

**PE symptoms/signs:**
- Pleuritic & Non Pleuritic Chest pain
- Dyspnea
- Cough
- Hemoptysis
- Tachypnea
- Tachycardia
- Hypoxia

Patient with DVT symptoms has a 33% chance of having a PE

**Menu of Tests:**
- Chest x-ray
- Lung scan
- Spiral CT angiogram
- Echocardiogram
- Pulmonary angiogram
References


2. www.vh.org
   Jeffrey R. Galvin, M.D. and James J. Choi, B.S.


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