To V/Q or to Spiral CT? That is the Question

DALHOUSIE UNIVERSITY Inspiring Minds

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Victoria and Cameron

Victoria

Victoria, a 20-year-old female, presents to the ED with a 6-day history of right-sided pleuritic chest pain after a vacation to Cuba. She does not have calf swelling or tenderness or any abnormal cardio-respiratory signs or symptoms. Vital signs are normal and O_2 saturation is 97%. Air entry is good bilaterally, with no crackles or wheezes. Bloodwork shows D-dimer of 234 ng/mL.

Cameron

Cameron, a 43-year-old male, presents to the ED with 24-hour history of pleuritic, right lower chest pain. He has no cough or hemoptysis. Breath sounds are equal bilaterally, with no wheezes or crackles. Vital signs are normal and he has no fever, no calf swelling or tenderness. His past medical history includes being diagnosed with pulmonary embolism 7 months ago but no precipitating cause found. He was treated with warfarin initially, but was changed to clopidogrel 3 weeks previously.

Turn to page 4 for more on these cases.

Questions & Answers

1. What are the benefits of using a V/Q scan on suspected pulmonary embolism patients?

Ventilation perfusion scans are an excellent test for ruling out pulmonary embolism (PE). A normal ventilation/perfusion (V/Q) scan has a sensitivity of 98%. A low clinical probability combined with a low probability V/Q scan has a 4% likelihood of being a PE. A high clinical probability combined with a high probability V/Q scan is 95% likely to be PE. The radiation from a V/Q scan is low. The contrast used is not iodine-based, Technetium-99m or Xenon-133, so there is less end-organ damage or risk of allergic reaction.

2. What are the disadvantages of using a V/Q scan on suspected PE patients?

Scans that are not either (a) normal, (b) low probability V/Q scan combined with low clinical probability, or (c) high probability V/Q scan and high clinical probability are not diagnostic. Therefore, up to 72% of V/Q scans are non-diagnostic. Non-diagnostic V/Q scans do not help determine alternate diagnoses and alternate diagnoses are still possible with diagnostic scans. The patient must have the ability to breathe deeply for full lung distribution of the contrast, so patients with decreased respiratory function (such as COPD sufferers) may not be good candidates. Patients need to have a chest radiograph to compare to the V/Q scan, so patients with known or pre-existing lung pathology may be difficult to interpret.

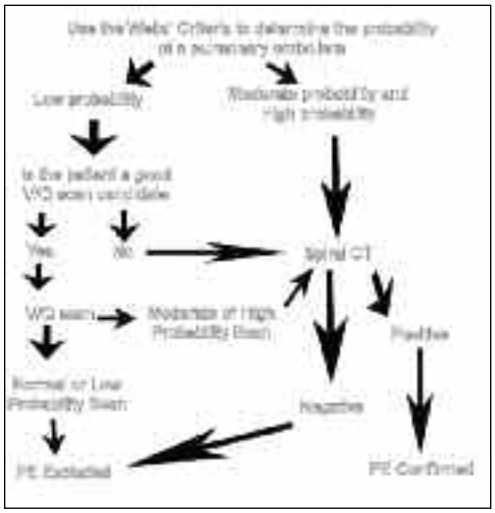

Figure 1. Using the Wells' Criteria to determine the probability of a pulmonary embolism (PE).

3. What are the benefits of using a spiral CT scan to diagnose a PE?

The sensitivity of a spiral CT scan is 83% and the specificity is 96%. Spiral CT scans have the ability to visually see exact locations of emboli and are accurate at diagnosing large emboli. Spiral CT scans are able to provide alternate diagnoses, such as lung abscesses, pneumothoraxes, pleural and pericardial effusions and allow for retrospective reconstructions. Spiral CT is readily available to physicians in many regions and is a relatively rapid test to complete.

4. What are the disadvantages of using spiral CT scan to diagnose a PE?

If a filling defect is confined to a subsegmental vessel, it is not diagnostic. A normal spiral CT scan does not rule out a small PE. Contrast may be problematic in patients with an allergy or renal insufficiency. Spiral CT scans must be read by an expert and are expensive:

- D-dimer (DD) + ultrasound (US) + V/Q = $845
- DD + US + spiral CT = $1230 for low clinical probability

Spiral CT scans give significant radiation exposure, equivalent to about 53 chest radiographs. Spiral CT gives 10 mGy to 50 mGy of radiation compared to the 0.28 mGy of radiation from V/Q scans.

To diagnose a PE, it is necessary to determine the patient's probability of a PE using a scale, such as the Modified Wells' Criteria.

Symptoms of a PE include:

- dyspnea,
- pleuritic chest pain,
- cough and
- hemoptysis.

Signs of PE include:

- tachypnea,
- rales,
- tachycardia,
- fourth heart sound,
- accentuated P2 heart sound and in extreme cases,
- circulatory collapse.

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More on the cases

Victoria

Victoria was sent for a V/Q scan which showed normal ventilation and perfusion. PE was felt to be ruled out as a cause for her symptoms, which resolved spontaneously within a few days.

Cameron

Cameron was sent for spiral CT which was positive for PE. He was started on low molecular weight heparin and consulted to hematology, who recommenced his warfarin therapy and recommended that he remain on it for life.

5. *Which case should have which test?*

Victoria should start with V/Q scan. Her modified Wells' score is zero, so she has a low clinical probability of having a PE. Victoria is a good V/Q candidate because she is young and active. She has the capacity to breath deeply enough for the scan and you would want to minimize her radiation exposure. It is unlikely that Victoria has a PE so a V/Q should rule out a PE from the diagnosis.

Cameron should start with a spiral CT scan. His modified Wells' Criteria score is 4.5. He has a moderate clinical probability of having a PE. By going directly to the spiral CT scan we would be able to quickly confirm or exclude a PE. Dx

Resources

1. Kearon C: Diagnosis of Pulmonary Embolism. CMAJ 2003; 168(2):183-94.
2. Roy PM, Colombet I, Durieux P, et al: Systematic Review and Meta-Analysis of Strategies for the Diagnosis of Suspected Pulmonary Embolism. BMJ 2005; 331(7511):259.
3. The PIOPED Investigators.: Value of the Ventilation/Perfusion Scan in Acute Pulmonary Embolism. Results of the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED). JAMA 1990; 263(20):2753-9.
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5. Wells PS, Rodger M: Diagnosis of Pulmonary Embolism: When is Imaging Needed? Clin Chest Med 2003; 24(1):13-28.

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