Diagnostic Imaging Pathways - Pulmonary Embolism (Haemodynamically Unstable)

Population Covered By The Guidance

This pathway provides guidance on the imaging of haemodynamically unstable adult patients with suspected pulmonary embolism.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

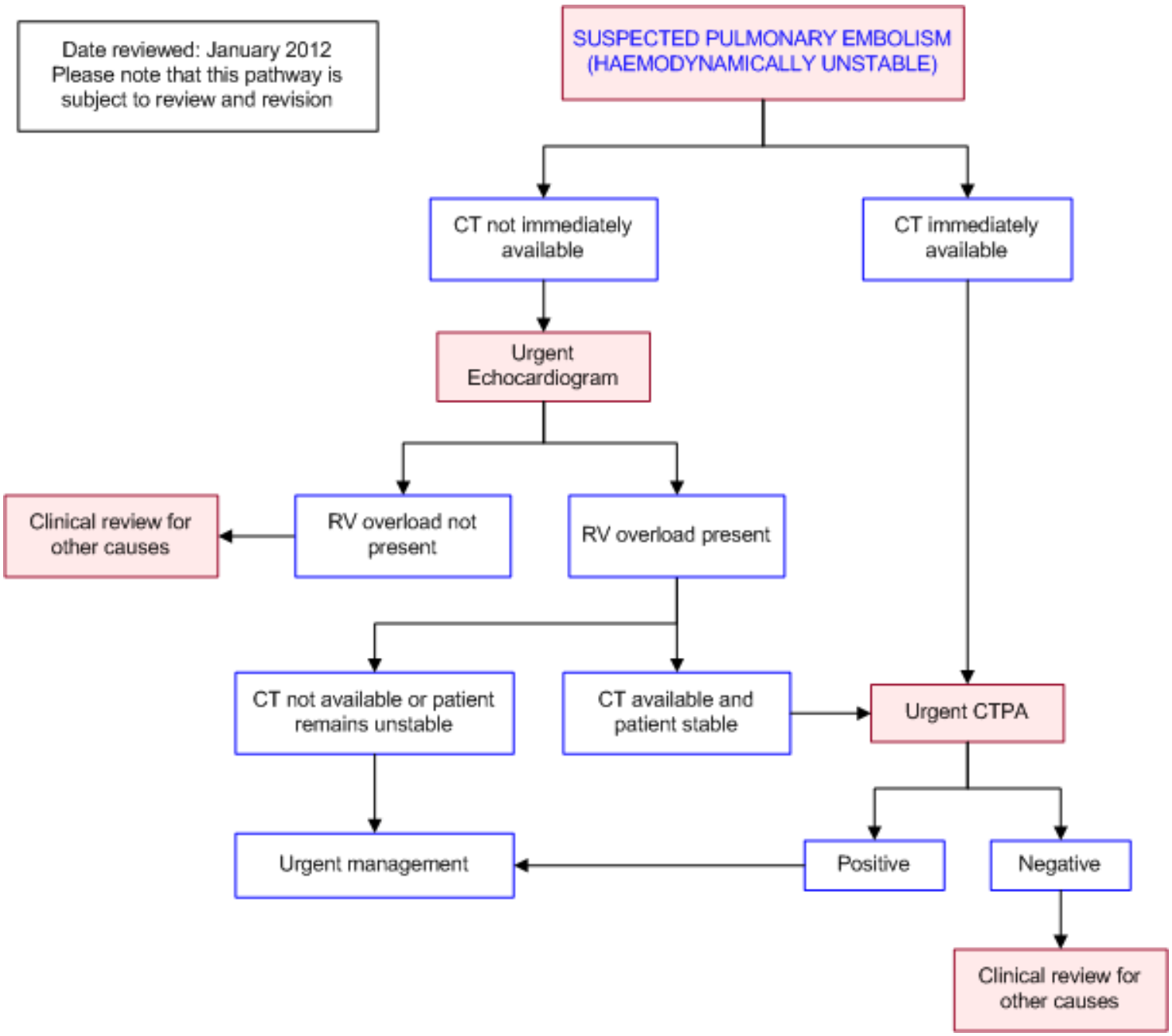


Image Gallery

Note: These images open in a new page

1

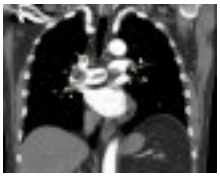
Hampton's Hump

Image 1 (Plain Radiograph): There is a peripheral wedge shaped opacity representing pulmonary infarction and atelectasis secondary to a pulmonary embolus (arrow). This radiographic sign is referred to as Hampton's Hump.

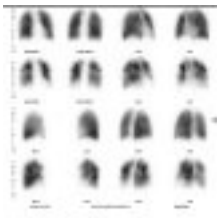
2a **Bilateral Pulmonary Embolism**

Image 2a and 2b (Computed Tomography): Axial and reconstructed images of bilateral pulmonary arterial emboli (arrows)

2b



3



Bilateral Pulmonary Embolism

Image 3 (Ventilation Perfusion Scan): The ventilation series demonstrates uniform distribution of tracer throughout both lung fields. The perfusion series demonstrates generalised reduced tracer uptake in the right lung with multiple segmental and subsegmental perfusion defects throughout both lung fields. These findings have a high probability for recent pulmonary embolism.

Teaching Points

- Suspected PE in the setting of haemodynamic instability represents a specific clinical problem as it is immediately life threatening and requires urgent investigation and treatment
- Multidetector CT pulmonary angiography is a highly sensitive and specific test which can directly demonstrate PE through filling defects within contrast filled pulmonary arteries. Although CT emits ionising radiation, the urgency of the situation justifies its use as a first line investigation if it is immediately available
- If CTPA is not available, beside echocardiography is the most useful test as it can provide indirect signs of acute pulmonary hypertension due to PE and can also assess for cardiac differential diagnoses of shock

Computed Tomography Pulmonary Angiography (CTPA)

- Demonstrates pulmonary embolism by showing a filling defect within contrast filled pulmonary arteries
- The performance of CTPA varies in the literature depending on whether single slice or multidetector CT (MDCT) is used and also on the expertise of the institution
- The sensitivity and specificity of 4-row MDCT in the largest trial to date (PIOPEDII Trial) is reported at 83% and 96% respectively. The negative predictive value in high risk patients is 60%. Single slice CT has a sensitivity and specificity of approximately 85% 10,11,12
- MDCT has a number of advantages over older scanners including
    - High acquisition speed meaning larger volumes can be covered more quickly 1
    - Better detection of subsegmental emboli (although in the setting of haemodynamic instability, emboli are likely to be large and central) 2,3,4,5,6,
    - Better interobserver agreement rates 6
- CTPA is associated with significantly higher radiation exposure compared to radionuclide (VQ) scans. The effective dose of CTPA is estimated at around 8-10 mSv, compared to around 1.3 mSv for a VQ scan. 13,14 However, due to the urgency of the clinical situation in patients with

haemodynamic instability, CTPA is the preferred modality if immediately available due to its accuracy and rapidity
- CT is also able to provide information on alternative diagnoses that may mimic PE 7,8
- Limitations include
    - Radiation exposure
    - Risk of contrast allergy and renal impairment
    - Subsegmental emboli may be difficult to visualise
    - Subject to interpretive pitfalls such as respiratory motion artifact, streak artifact and problems related to patient body habitus. Lymph nodes may also result in false positives 9

Bedside Echocardiography

- Bedside echocardiography is a useful test in the situation of suspected PE with haemodynamic instability
- Transthoracic echo may detect indirect signs of acute pulmonary hypertension and right ventricular overload or may detect a right heart thrombus in transit. Transoesophageal echo allows direct visualisation of thrombus in the pulmonary arteries 13
- Echocardiographic signs of PE include
    - Increased right ventricular size
    - Decreased right ventricular function
    - Tricuspid regurgitation
- Reported sensitivity ranges from 60-70%. In the setting of haemodynamic instability, the absence of echocardiographic signs of right ventricular overload or dysfunction practically excludes PE as a cause of the instability 10,14
- Echo may also assist in the differential diagnosis of shock by detecting cardiac tamponade, acute valvular dysfunction, acute myocardial infarction and hypovolaemia
- Echo is currently not recommended in the diagnostic approach to haemodynamically stable, normotensive patients 13

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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