

RATIONAL IMAGING

Investigating suspected pulmonary embolism in pregnancy

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A woman in her early 30s presented at 25 weeks' gestation with shortness of breath and chest pain. Clinical examination was unremarkable. The patient was referred for imaging to exclude suspected pulmonary embolism, as this potentially fatal disorder increases in incidence during pregnancy and is a leading cause of maternal mortality. Physiological changes in pregnancy often cause symptoms that mimic pulmonary embolic disease, such as chest pain and shortness of breath. Objective symptom scoring for assessing the pre-test probability is therefore less reliable in pregnancy and is used only rarely.

What test do I order?

Venous thromboembolism is an important diagnosis to confirm or refute, as the risks of inappropriate use of anticoagulants or missing a pulmonary embolism far outweigh the risks associated with exposing mother and fetus to ionising radiation. In pregnant patients with suspected pulmonary embolism who are acutely and seriously ill, a portable echocardiogram should be the initial test to detect pulmonary embolism if expertise is readily available. In all other pregnant patients, chest radiography should be the first line imaging investigation.

Chest x ray—This is required to exclude a chest infection or pneumothorax.

Compression ultrasonography of the lower limb—Ultrasonography is required to exclude deep vein thrombosis. Although this has a low diagnostic yield, it does not expose the mother or fetus to any risk and, if

positive, allows appropriate treatment.

If the ultrasound is negative, the chest x ray is normal, and the patient has no history of lung disease including asthma, a half dose lung perfusion scintigram should be performed. Alternatively, if the patient has lung disease or the chest x ray is abnormal (and a suspicion of pulmonary embolism remains) a computed tomographic pulmonary angiogram should be performed.

Radionuclide lung scintigraphy—This test has a high negative predictive value and has been carefully evaluated in a prospective case series of pregnant women (n=120) with suspected pulmonary embolism.¹ The incidence of non-diagnostic scans is high in non-pregnant patients, mainly as a result of chronic lung disease. However, pregnant patients are generally younger and less likely to have abnormal lungs. Non-diagnostic scans can be minimised by triaging patients with an abnormal chest radiograph to computed tomographic pulmonary angiography.² Fetal radiation exposure is higher with scintigraphy (0.11-0.22 mGy) than with computed tomographic pulmonary angiography (0.01-0.06 mGy), but it is well below the threshold for any specific risks.³ The only theoretical risk from in utero radiation exposures of less than 50 mGy is induction of malignancy.⁴ The estimated incidence of childhood malignancy after in utero exposure is about one in 16 000 per mGy.⁵ To minimise fetal radiation exposure, half dose perfusion scintigraphy is performed as standard practice during pregnancy, with no loss in diagnostic accuracy.

Computed tomographic pulmonary angiography—This is the gold standard diagnostic test in non-pregnant patients with suspected pulmonary embolism, but its use in pregnancy has not been validated. For example, a large multicentre prospective trial (n=824) to assess the efficacy of this test in patients with suspected pulmonary embolism formally excluded pregnant women.⁶ Importantly, this test exposes mothers to high doses of radiation. Estimated exposure of maternal breast tissue is up to 35 mGy per breast.⁷ The latent carcinogenic effects of radiation exposure are uncertain, but radio-sensitive, proliferating, breast tissue is likely to be at increased risk. The lifetime risk of breast carcinoma has been reported to increase after a single 10 mGy dose of radiation to the breast in women under 35 years.^{8,9} The estimated exposure of breast tissue to radiation from half dose perfusion scintigraphy is several magnitudes smaller (0.25 mGy) than that from computed

LEARNING POINTS

- Physiological changes during pregnancy can mimic pulmonary embolism, making clinical diagnosis unreliable
- Imaging is essential to avoid inappropriate treatment and can be performed without exposing the fetus to any specific risks
- A chest x ray should always be performed to exclude other causes
- Half dose perfusion scintigraphy can be used in most patients
- Computed tomographic pulmonary angiography should be used only in patients with lung disease such as asthma—which makes scintigraphy less likely to be diagnostic—or an abnormal chest x ray, because it exposes maternal breast tissue to high doses of radiation

This series provides an update on the best use of different imaging methods for common or important clinical presentations. The series editors are Fergus Gleeson, consultant radiologist, Churchill Hospital, Oxford, and Kamini Patel, consultant radiologist, Homerton University Hospital, London

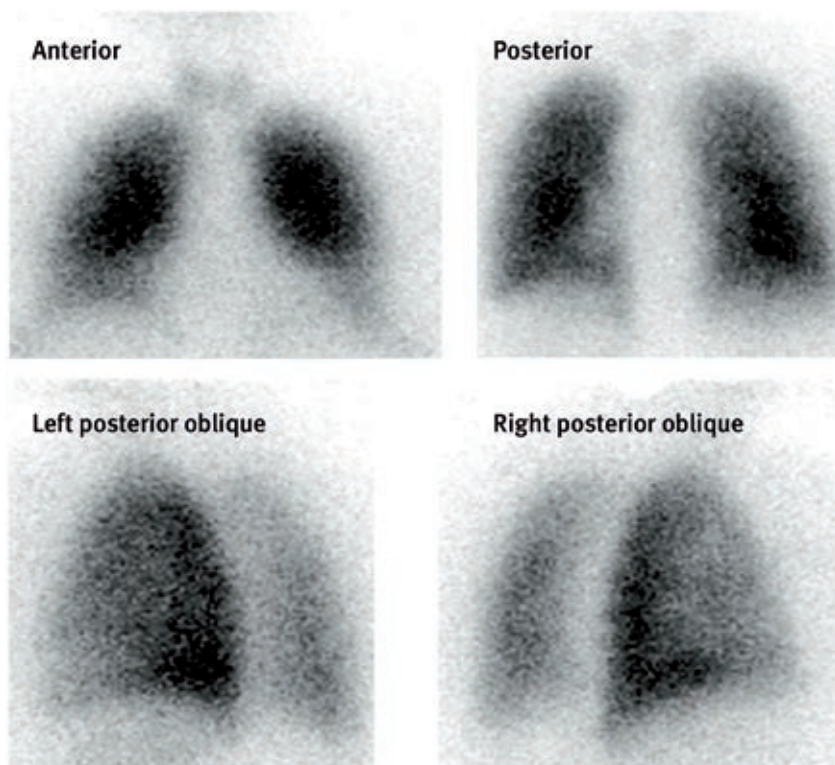


Fig 1 | Normal four view lung perfusion scan

USEFUL READING

- Scarsbrook AF, Evans AL, Owen AR, Gleeson FV. Diagnosis of suspected venous thromboembolic disease in pregnancy. *Clin Radiol* 2006; 61:1-12

tomography pulmonary angiography.¹⁰ In addition, during computed tomography pulmonary angiography both the mother and fetus are exposed to intravenous iodinated contrast medium. Data on the risks associated with this exposure are limited, but neonatal hypothyroidism should be excluded postnatally if this test has been performed during pregnancy.¹¹

Pulmonary angiography—Although this test was considered the gold standard against which other imaging techniques were compared, it is now thought to be no more accurate than well performed computed tomographic pulmonary angiography. The technique is invasive and

is associated with a significantly higher radiation dose than CTPA. For these reasons it has a limited role in evaluating patients with suspected pulmonary embolism, especially those who are pregnant.

Outcome

Our patient had no history of lung disease, a normal chest x ray, and negative lower limb ultrasonography. She therefore underwent half dose perfusion scintigraphy, which was normal (figure). Her symptoms resolved spontaneously and the remainder of her pregnancy was uncomplicated.

Contributors: FVG had the original idea. AFS selected the patient, searched the literature, and wrote the paper. FVG reviewed and edited the paper and reanalysed the literature. FVG is guarantor.

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Stornoway sausages—the surgical solution at sea

We set sail from North Harris on Friday evening to find a mooring in a bay where we could see a white tailed sea eagle on the nest. It was the epitome of a peaceful and remote Scottish inlet, with not even a mobile (cellphone) signal on any of our available networks.

While watching the nest, I was asked if I could leave my telescope just for a moment to give some medical advice to one of our party. He had started taking warfarin two weeks earlier, before cardioversion from atrial fibrillation a few days before our trip. He was bleeding quite heavily from piles and had been unable to staunch the flow. He didn't want to cause a disturbance, nor to soil the cabin, but suggested that he lay down to be examined on the "poop" deck.

There was nothing remotely useful in my first aid kit save a rolled up crepe bandage. Pressure seemed to be of little avail. I searched through the ship's equipment and found some surgical gloves. With advice from the cook, I stuffed a frozen sausage inside a finger of a surgical glove, coated it with corticosteroid cream for someone

else's eczema, and inserted it into the appropriate orifice. Amazingly enough, the bleeding diminished and, after a couple more sausages, stopped.

We reached St Kilda without major incident, though our patient developed a bad cold and thought he'd take a few ibuprofen and a fair amount of whisky with his warfarin for symptom relief. I ended up being pleased about this effect on his anticoagulation, as my suggestion that the patient reduce his warfarin dose had returned him to atrial fibrillation. Would I be responsible for his transient ischaemic attack, potentially the next medical challenge?.

I am so glad I am a general practitioner, as the drama of surgical life is really not for me.

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Competing interests: Both patient and doctor were due to have sausages the next morning for breakfast.