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# THE CHALLENGES OF IMAGING PULMONARY EMBOLISM IN PREGNANCY

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In this issue, Armstrong and colleagues, succinctly highlight that despite acute pulmonary embolism (PE) being a staple of the general radiologist's workload, the diagnosis in pregnancy is both challenging and important (1). Thromboembolic disease remains a leading cause of mortality in pregnancy and the puerperium in the developed world (2). The main challenges are related to a low incidence, yet high mortality rate, with a requirement to keep exposure to ionising radiation to a minimum. This is further complicated by a high level of breathlessness in pregnancy making the identification of pulmonary embolism challenging (3). It is important to be accurate in the diagnosis: a missed pulmonary embolism risks maternal death, whilst false positives expose the mother and foetus to the risks of anticoagulation (3). The radiation dose delivered to the foetus for both computed tomography pulmonary angiography (CTPA) and ventilation/perfusion single photon emission tomography (V/Q SPECT) are comparably low (foetal dose from V/Q scanning estimated to be 0.1-0.6mGy and from CTPA 0.24-0.66mGy (4)). CTPA, however, exposes the radiosensitive breast tissue of the mother to significantly more radiation, increasing the risk of malignancy (5). The risks to the foetus from radiation are greater in the first trimester, during organogenesis, than the third trimester (6). Thus, careful consultation with the patient is required. In addition, there are reports of high proportions of indeterminate scans in pregnant patients due to alterations in physiology (5). Although, in their review of 995 pregnant patients scanned across multiple centres for suspected PE, Armstrong et al, showed a low indeterminate rate of CTPAs of only 9% (largely due to poor contrast opacification) and comparable to the low indeterminate rate for scintigraphy (also 9%) (1).

Recently, the American Thoracic Society and the Society of Thoracic Radiology have reached consensus in this clinical scenario. They recommend V/Q scintigraphy as a first line test to identify PE in patients with normal chest radiographs, with CTPA reserved for those with abnormal chest radiographs or indeterminate V/Q scans (3,7). The Royal College of Obstetrics and Gynaecology guideline offers practical guidance for implementation, including the availability and timeliness to the decision, with an emphasis on patient counselling (8). It is particularly interesting that Armstrong et al. show a wide variation in the rates and method of investigation for PE in pregnancy, suggesting heterogeneous practise and an incomplete adherence to guidelines (1).

Whilst deaths from thrombo-embolic disease in pregnancy are decreasing (2), the optimal approach to diagnosis is not clear and differs greatly between centres. With a high negative predictive value, the d-dimer is used to exclude pulmonary embolism. As the D-dimer is physiologically elevated in pregnancy, its usefulness is potentially limited, despite maintaining its high negative predictive value (3,9). It is possible that identification of D-dimer thresholds that account for physiological elevation may improve clinical utility. Furthermore, the modified Wells' score has not been validated in the pregnant population, although there have been promising results to identify a higher risk group for investigation (10). Magnetic resonance imaging (MRI) and ultrasonography both offer the potential to identify patients with thrombo-embolic disease without requiring any exposure to ionising radiation. The PIOPED III study (2010) for the use of magnetic resonance angiography in suspected acute pulmonary emboli had high numbers

of technically limited MRA exams and only modest sensitivity for the detection of PE ( 77%) (11). There are centres in the USA who have published high levels of clinical effectiveness for the use of MRA as a primary diagnostic test for PE, with published negative predictive values for venous thromboembolic disease of 98% (12,13). Ferumoxytol may be used in pregnancy as a treatment for anaemia (14). Fortuitously this intravascular super-paramagnetic iron oxide nanoparticle is also an excellent MRA contrast agent that and can be used in the pregnant population (15). In combination with dynamic contrast enhanced perfusion MRI and MR venography of the lower limbs, MRI may offer high diagnostic accuracy, whilst avoiding ionising radiation, and further studies are warranted. The role of deep vein thrombosis (DVT) scanning for suspected pulmonary embolism in pregnancy is also debated. The American Thoracic Society only recommend the use of compression ultrasound of the limbs to assess for DVT in patients with clinical features of a deep venous thrombosis, to reduce the burden of investigation with low positive rates (7).

Unfortunately, data regarding duplex ultrasound of the leg veins was not assessed in the article in the paper in this month's issue.

Suspected pulmonary embolism in pregnancy offers many challenges. The work by Armstrong et al, published in this issue identifies the many difficulties in imaging this population and helps to clarify current practise across a large number of centres in the UK (1). With a low, and comparable number of indeterminate CTPA or V/Q scans, it suggests that the choice of which imaging modality to use in pregnancy should be based on local accessibility and patient choice. Future work is required in the assessment of the role of clinical screening tools and methods to further reduce dose in suspected pulmonary embolism in pregnancy, both through improvements in current imaging technologies and development of novel imaging markers.

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