Should lung scan be abandoned for pulmonary embolism diagnosis in the age of multislice spiral CT? Yes

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Setting the scene

The diagnosis of pulmonary embolism is a frequent clinical challenge, with approximately 1–3 suspected cases per 1,000 population per year in the western world. Given the potential seriousness of the disease and the risk of significant complications due to treatment, it is vital that such patients are quickly and accurately evaluated to determine in which cases anticoagulant therapy can safely be withheld and which patients require treatment (as well as potential further work-up for underlying causes of thrombophilia).

One of the central issues is that the prevalence of disease (i.e. the actual presence of PE) in the evaluated population is 30% at best, and significantly less in patients who present in the emergency department (ED) [1]. In fact, many patients presenting with signs and symptoms of PE have disorders ranging from aortic dissection to infectious processes and congestive heart failure. Chest radiography alone is insufficient for most of these diagnoses.

Diagnostic strategies

It is possible to use a variety of non-invasive and simple tools for the initial assessment of patients. Most of these tests are aimed at rapid exclusion of pulmonary embolism, and they consist of semi-quantitative analysis of signs and symptoms (clinical decision rule) in combination with

plasma D-dimer level determination [2–4]. If both of these tools point to low likelihood of PE, it is safe to withhold further assessment for the disease, and instead focus on alternative diagnoses. Several studies have shown it is safe to withhold anticoagulant therapy.

In those patients where a clinical likelihood for PE remains and in the presence of elevated plasma D-dimer levels, additional evaluation of patients for presence of PE becomes mandatory. In such situations, the main options are lung scintigraphy or CT pulmonary angiography [5, 6].

CT pulmonary angiography

Since its initial description in the 1990s, CT pulmonary angiography has undergone rapid acceptance in clinical practice [7]. This is not surprising, as it became possible—for the first time—to have 24 h access to an imaging test that is easy to perform and has excellent diagnostic accuracy. With the subsequent rise of scanner technology, which now routinely means 16-slice or better CT scanners, the sensitivity and specificity for PE are in the order of 95% [1, 8–11].

Not only is CT pulmonary angiography able to accurately diagnose or rule out PE, it is also able to determine alternative diagnoses that may mimic the symptomatology of PE, including aortic dissection, pneumonia, pleural and pericardial effusions, pneumothorax and chest wall disorders such as rib fractures [12]. Several of these conditions are actual contraindications for treatment with anticoagulant therapy.

Furthermore, CT pulmonary angiography allows assessment of functional impairment due to the extent of the pulmonary embolism, and it is vital to include this in the evaluation. Thus, dilatation of the right ventricle with

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or without interventricular septal shift with compression of the left ventricle, enlargement of the main pulmonary artery and the presence of mosaic perfusion are all important signs for right heart pressure increase, which could determine a different therapeutic approach, as these patients have been shown to benefit from more aggressive treatment with fibrinolytic therapy in an acute setting [13, 14].

More recently, with the introduction of 64-slice CT technology, it has been suggested that “triple rule-out” testing could become reality [15]. This would include assessment of pulmonary embolism, aortic dissection and coronary artery disease as the three main diagnostic emergencies for most physicians faced with patients with chest pain. Whether this is rational remains to be proven.

Radiation dose issues

CT pulmonary angiography requires significant radiation exposure to the chest [16]. This is not an important issue for most patients, but extra care must be taken in younger females presenting with chest symptoms, as the breast tissue is sensitive to radiation. Thus, new applications have focused on reducing radiation dose using low-dose protocols [17, 18], and some have used breast shielding to reduce the breast exposure in women [19]. Nevertheless, when encountering these patients using an approach that aims at excluding the disease (and this should include clinical decision rule and plasma D-dimer) or by demonstrating the presence of deep vein thrombosis (using ultrasonography), ultimately it is most important to confirm whether PE is present or not, given that this is the main factor to determine short and long-term outcome [14]. In the end, it is clear that radiation dosage (provided the aims are to keep this as low as reasonably achievable) is subservient to ensuring appropriate patient care.

Should CT pulmonary angiography be used in every patient?

When we look at the above outline, it is clear that CT pulmonary angiography is a very good test in the setting of patients with chest pain. It is applicable to the vast majority of patients, is easily accessible and interpretation is equally fast and accurate.

The main factors determining the use of CT pulmonary angiography is to reduce radiation exposure to the population-at-large, and to particular subsets of patients in particular. Thus, patients who are young, those in whom the PE probability is relatively low, and pregnant patients may require a different work-up, which could include ultrasonography for deep vein thrombosis or even

pulmonary perfusion scintigraphy (in those with a normal chest radiograph) [14]. Nevertheless, in the vast majority of patients presenting with suspected PE, CT pulmonary angiography should be the preferred imaging test.

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