

### Diagnosis and treatment of pulmonary embolism

Overall mortality in patients with acute pulmonary embolism (PE) remains high despite modern diagnostic and reperfusion strategies. In outpatients, D-dimer testing is a rapid and highly sensitive tool with a very high negative predictive value, making it an excellent screening test for patients with suspected PE. New non-invasive and accurate diagnostic and prognostic tests of biomarkers in patients with acute pulmonary embolism such as troponin and brain natriuretic peptide (BNP) are currently under investigation. The use of algorithms or protocols is not always sufficient to avoid missed diagnosis and the individual physicians' diagnostic performance and clinical experience is as important as the best algorithm!

When a decision to image the pulmonary arteries has been made, the choice of the ideal imaging test is still the topic of considerable controversy especially the use of pulmonary angiography, once considered as the "gold standard" for the diagnosis of PE. In addition to that, also the use of ventilation-perfusion lung scintigraphy, once considered the first line imaging test in the diagnosis algorithm of PE, is declining due to the high percentage of inconclusive results and poor interobserver correlation. In addition to that, a definitive exclusion of PE is only possible in a small minority of patients in whom lung scintigraphy is negative. This requires further diagnostic steps to finally exclude or confirm PE to initiate or withheld appropriate treatment. Computed tomography (CT) is rapidly becoming the reference standard for imaging acute PE since this test is more and more available in most hospitals. Spiral CT is the only non-invasive test which allows direct visualization of the pulmonary emboli to estimate clot burden. The most important advantage of this method is the ability to directly visualize clots as well as parenchymal and mediastinal structures since a significant number of patients with an initial suspicion of PE receive another diagnosis such as aortic dissection, lung cancer and other potentially life-threatening diseases. Despite all these advantages there is still considerably uncertainty within the medical community as to the utility, strength and limitations of spiral CT. Remaining doubts regarding the role of CT scans in the diagnosis of PE should finally be dispelled with the introduction of multidetector-row CT scans which do allow a very high resolution within a single breath-hold allowing also the diagnosis of subsegmental pulmonary emboli. Spiral CT should therefore be considered as the first-line imaging test for acute PE. Whether multidetector CT will allow using CT as a stand-alone test remains to be shown by ongoing studies.

In patients with massive PE right ventricular dysfunction assessed by echocardiography represents the single most important prognostic factor for in-hospital death. Which of the available reperfusion therapies (anticoagulation, enzymatic thrombolysis by tissue plasminogen activator (t-PA), catheter fragmentation or surgical embolectomy) is associated with a mortality benefit is still under debate. However some data do indicate that thrombolytic therapy does show some benefit in patients with severe pulmonary embolism (shock index  $\geq 1$ ) when comparing with heparin treatment. In addition, there are no controlled data for catheter fragmentation or surgical embolectomy in comparison to thrombolysis or heparin therapy. For these reasons there is a need for a simple management strategy for subjects suffering from pulmonary embolism to identify patients at high risk who do need immediate diagnostic testing and emergency treatment to reduce overall mortality.

Knowledge of the different diagnostic and therapeutic options is crucial to all physicians dealing with patients suffering from PE. By the way, how many of us know what type of CT scan or D-dimer assay is in use in their institutions?

The lecture gives an overview about the optimal diagnostic tools and therapeutic options for PE and discuss the reasons for uncertainty within the medical community as to the utility, strength and limitations of different diagnostic approaches.