Detection of Central Pulmonary Embolism on Non-Contrast CT

Thesis

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in **Radio diagnosis**

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List of Abbreviations

Abb.	Full term
3D	*Three dimensional*
CPR	*Curved planar reformat*
CT	*Computerized tomographic*
CTPA	*Computed tomography pulmonary angiography*
DVT	*Deep venous thrombosis*
FN	*False negative*
FP	*False positive.*
I.V.	*Intra Venous.*
LOCM	*Low osmolar contrast medium*
MDCT	*Multidetector computed tomography*
MIP	*Maximum intensity projection*
MPR	*Multiplanar reformation*
MRI	*Magnetic resonance imaging*
MRPA	*Magnetic resonance pulmonary angiography*
MSCT	*Multi-slice computed tomography*
NPV	*Negative predictive value*
PE	*Pulmonary embolism*
PIOPED	*Prospective Investigation of Pulmonary Embolism Diagnosis*
PPV	*Positive predictive value*
TN	*True negative*
TP	*True positive*
US	*Ultrasonography*
V/Q	*Ventilation/perfusion scan*
VR	*Volume rendering*
VTE	*Venous thromboembolism*

INTRODUCTION

Pulmonary embolism is an important cause of patient morbidity and mortality. The ante-mortem diagnosis of PE is difficult to establish clinically, because the symptoms and signs are nonspecific and may be absent ***(Rosenow, 1995).***

The potentially life-threatening nature of acute pulmonary emboli (PE) reinforces the importance of their early detection for patient survival. Acute PE have an incidence between 23 and 69 cases per 100,000 individuals ***(Anderson et al., 1991)*** with a variable fatality rate reaching up to 30 % if untreated, based on the extent of the emboli ***(Konstantinides, 2008).***

The perils of the misdiagnosis of pulmonary thromboembolism are well known to clinicians: the risks of unnecessary anticoagulant treatment are as undesirable as the danger of a missed diagnosis of pulmonary thromboembolism. The clinical manifestations of pulmonary thromboembolism are extremely variable and depend primarily on the size of the embolus. Small emboli are often sub clinical, whereas larger emboli may give transient symptoms, which can mimic other conditions. Finally, massive embolism in a previously symptomless individual can be fatal, with the diagnosis only made at autopsy ***(Tocino et al., 1984).***

Clinical diagnosis of pulmonary embolism offers many challenges that are not settled despite the use of numerous imaging modalities and various diagnostic schemes ***(Goodman & Lipchik, 1996).***

Pulmonary embolism (PE) can be diagnosed accurately with pulmonary arteriography, which is recognized as the diagnostic standard of reference, with sensitivity and specificity both greater than 95%. However, arteriography is not routinely performed because it is more invasive, Ventilation-perfusion (V/Q) radionuclide lung scanning is the most frequently performed noninvasive imaging study for the diagnosis of PE. Yet, the sensitivity of V/Q scanning is high, and specificity is low; therefore, a more accurate non-invasive diagnostic study has long been sought ***(Drucker et al., 1998).***

An imaging modality that combines the noninvasive nature of V/Q scanning with a high sensitivity and specificity and that enables direct visualization of PE is desirable ***(Garg et al., 1998).***

The introduction of spiral Computed tomographic (CT) angiography has modified the diagnostic approach regarding pulmonary embolism and has enabled a noninvasive insight into the endovascular abnormalities ***(Remy-Jardin et al., 1997).***

Computed tomography pulmonary angiography (CTPA) had initially been shown to be a valid modality for the detection of thromboemboli in second- to fourth-division (segmental)

pulmonary vessels but has now largely replaced pulmonary angiography as modality of choice for the detection of PE regardless of location, as newer multi-detector scanners are capable of reliably detecting emboli even at the sub segmental level. At the same time, CTPA allows simultaneous evaluation of the mediastinum, lung parenchyma, identification of calcified lesions, and the concurrent diagnoses of alternative etiologies of chest pain, such as aortic dissection. Compared to ventilation and perfusion scintigraphy, CTPA offers greater availability and shorter acquisition times, with almost immediate delivery of results ***(Stein et al., 2006).***

The detection of PE located in the central pulmonary arteries is critical, as an obstruction at this level can significantly compromise central perfusion and result in sudden death. Because certain authors have reported the detection of PE on a non-contrast chest CT ***(Tatco and Piedad, 2011),*** this should be added to the list of incidental findings that the radiologist should be on the lookout for when reporting an unenhanced study as they are commonly performed for the investigation of a variety of cardiopulmonary symptoms ***(Müller, 2002).***

The incidental detection of a PE on non-contrast CT could be advantageous in the emergent context and also in patients with pre-existing renal disease or known allergies to contrast agents in a situation without viable alternative ***(Kanne et al., 2003).***

Although non-contrast CT is not a valid diagnostic modality for the detection of PE, recent studies have reported reasonably consistent recognition of pulmonary clots on non-contrast CT, most notably in cases of centrally located emboli ***(Taco and Piedad, 2011).*** These studies show that hyper density on non-contrast chest CT can be a sign of a recent clot in central pulmonary arteries.