Acute Pulmonary Embolism : Epidemiologic And Tomodensitometric Study

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Embolie Pulmonaire Aigue : Etude Epidemiologique Et Tomodensitometrique

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RÉSUMÉ

Prérequis: l'embolie pulmonaire aiguë est une pathologie fréquente et grave nécessitant un diagnostic positif de certitude rapide.
Buts : Evaluer la prévalence de l'embolie pulmonaire aiguë et calculer la sensibilité et la spécificité du scanner multicoupe pour le diagnostic positif de l'embolie pulmonaire aiguë dans un hôpital spécialisé en pathologies cardio-thoraciques.
Méthodes : il s'agit d'une étude prospective, menée à l'hôpital Abderrahmène Mami de l'Ariana, ayant inclus 200 patients consécutifs suspects d'embolie pulmonaire aiguë et explorés par un angioscanner pulmonaire multicoupe (16 coupes).
Résultats : La prévalence de l'embolie pulmonaire aiguë a été calculée à 37,5%. Le scanner multicoupe a permis de réaliser un diagnostic alternatif chez 46 patients (40%). La sensibilité et la spécificité du scanner multicoupe ont été calculées respectivement à 89.6% et 100%,
Conclusion : La prévalence de l'embolie pulmonaire aiguë, dans un hôpital spécialisé en pathologies cardio-thoraciques, est supérieure à celle retrouvée dans les hôpitaux généraux. La sensibilité et la spécificité élevées du scanner multicoupe en font l'examen de référence pour le diagnostic de l'embolie pulmonaire aiguë.

Mots-clés

Embolie pulmonaire aiguë, scanner multicoupe

SUMMARY

Background: Acute pulmonary embolism is a common disease with substantial morbidity and mortality in untreated patients. It requires an urgent positive diagnosis.
Aim: To assess the prevalence of acute pulmonary embolism and calculate the sensitivity and specificity of multidetector CT for the diagnosis of acute pulmonary embolism in a hospital specialized in cardio-thoracic diseases.
Methods: This is a prospective study conducted at Abderrahmen Mami Hospital, which included 200 consecutive patients suspected of acute pulmonary embolism and explored by a multidetector CT pulmonary angiography (16 slices).
Results: Prevalence of acute pulmonary embolism was calculated at 37.5%. The multidetector CT has enabled an alternative diagnosis in 46 patients (40%). The sensitivity and specificity of multidetector CT were calculated respectively 89.6% and 100%.
Conclusion: The prevalence of acute pulmonary embolism, in a hospital specialized in cardio-thoracic diseases, is higher than that found in general hospitals. High sensitivity and specificity of multidetector CT makes it the gold standard for the diagnosis of pulmonary embolism.

Key-words

Acute pulmonary embolism, multidetector CT

Pulmonary embolism is a potentially fatal disease with substantial morbidity and mortality in untreated patients. Multidetector CT pulmonary angiography has become a first-line examination when acute pulmonary embolism is suspected because it's an accurate method for the diagnosis up to the subsegmental level. The purposes of our study are to define epidemiologic characteristics of patients with acute pulmonary embolism and to determine multidetector CT sensitivity and specificity for acute pulmonary embolism diagnosis in a hospital specialized in cardio-thoracic diseases.

METHODS

During a 10-month period (June 2006 through March 2007), 200 consecutive patients, were referred to the imaging unit, for suspicion of acute pulmonary embolism based on empiric clinical probability assessment. We noted gender and age patients. CT pulmonary angiographies were performed by using 16 detector row helical CT (Lightspeed 16; GE Medical Systems). Patients were scanned in a caudo-cranial direction including the entire chest during a single breath hold. Patients who were unable to hold their breath were asked to breathe as slowly as possible during the acquisition. The following parameters were used: 0.5 second per rotation, 1.25 mm collimation, 0.625 mm reconstruction interval, 120 kV. The contrast injection was not formally contraindicated to anyone. A mechanical injector was used for intravenous injection of iodinated contrast material (Télébrix 350® Guerbet) at a rate of 5 ml/sec and an amount of 80-90 ml. The scan delay was determined by using a "Test-Bolus" technique. Images were displayed side by side on two different screens. Multiplanar reformatted images were sometimes used to overcome various diagnostic difficulties.

CT pulmonary angiography was considered inconclusive in several cases: important artefacts making segmental pulmonary arteries poorly analysed, high image noise, poor enhancement of pulmonary arteries and pulmonary infarction images without embolus in the corresponding pulmonary artery.

Acute pulmonary embolism was defined as pulmonary arterial occlusion by a large filling defect, a partial filling defect surrounded by contrast material and a peripheral intraluminal filling defect that forms acute angles with the pulmonary arterial wall. The most proximal location of pulmonary embolism was recorded.

The following ancillary findings were collected: peripheral pulmonary consolidation, peripheral wedge-shaped pulmonary consolidation containing central lucencies that may represent pulmonary infarction (1), atelectasis and pleural effusion.

We reported severity signs of acute pulmonary embolism (2) that consist of right ventricular dilatation in which ratio of the right to left ventricles short axis diameters (RV/RL) was greater than 0.9 in a 2 dimensional reconstructed 4-chamber view (3,4), leftward bowing of interventricular septum and CT index obstruction (5) greater than 40% (6,7).

We revealed differential and associated morbidities. Finally we looked for follow-up of patients with negative CT, after 6 months of a normal CT pulmonary angiography, to calculate sensitivity and specificity of multidetector CT.

RESULTS

From 200 CT pulmonary angiographies, 184 were considered conclusive: 69 showed diagnostic criteria for acute pulmonary embolism and 115 were negative. 16 CT (8%) were considered inconclusive. The prevalence of acute pulmonary embolism was 37.5%.

There were 111 men and 73 women. The prevalence of acute pulmonary embolism was equal to both genders (38% vs. 37%). There was no statistically significant age median difference between patients with and without acute pulmonary embolism (55.07±18.5 years vs. 59±16.65 years).

The CT findings in case of acute pulmonary embolism are summarized in the table 1.

Table 1 : CT findings

CT findings	No (%)
Ancillary findings	
Peripheral pulmonary consolidation	28 (40,6)
Pulmonary infarction	13 (18,8)
Atelectasis	13 (18,8)
Pleural effusion	29 (42)
Severity signs	
Right ventricular dilatation	28 (40.6)
Interventricular septal bowing	22 (31.9)
CT index obstruction > 40%	10 (14,5)

Emboli were located as follows: Pulmonary trunk and main pulmonary arteries: 14 (20.3%), lobar arteries: 19 (27.5%), segmental arteries: 29 (42%) and subsegmental arteries: 7 (10.2%).

Associated morbidities were present in 33 patients (47.8%) (pneumonia: 9, pulmonary cancer: 7, pulmonary fibrosis: 4, active pulmonary tuberculosis: 3, others: 10).

CT demonstrated alternative diagnoses in 46 patients (40%) (pneumonia: 19, interstitial oedema: 7, pulmonary cancer: 5, pulmonary fibrosis: 3, others: 12).

The six months follow-up was complete for 29 patients: 28 patients had no clinical signs of pulmonary embolism or deep venous thrombosis during follow-up and one patient developed an acute pulmonary embolism.

8 CT were considered as false negatives (pulmonary embolism during follow-up:1, deep venous thrombosis in the leg: 6, right auricular thrombus: 1). Sensitivity and specificity were estimated at 89.6% and 100%.

DISCUSSION

Our study shows that prevalence of acute pulmonary embolism, among patients of hospital specialized in cardio-thoracic

diseases, is higher than prevalence in patients of general hospitals which vary from 20.4% to 26% (8-11). Men are as affected as women in most studies, even in our study (12).

Figure 1: CT pulmonary angiography (mediastinal window setting) shows an eccentrically located embolism which forms an acute angle with the arterial wall in the right pulmonary artery and a centrally located embolism surrounded by contrast materiel producing the "railway track" sign in the left pulmonary artery.

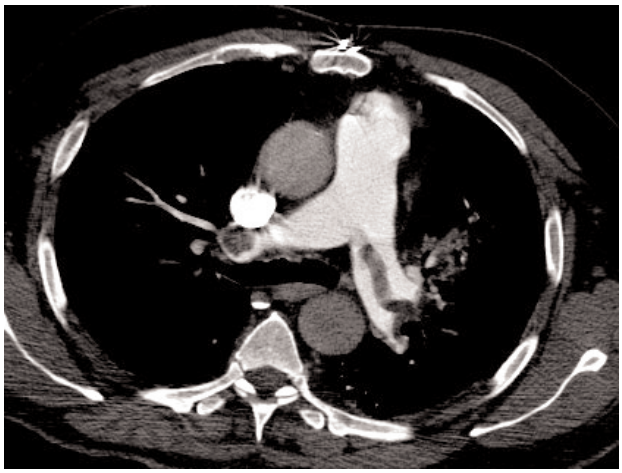
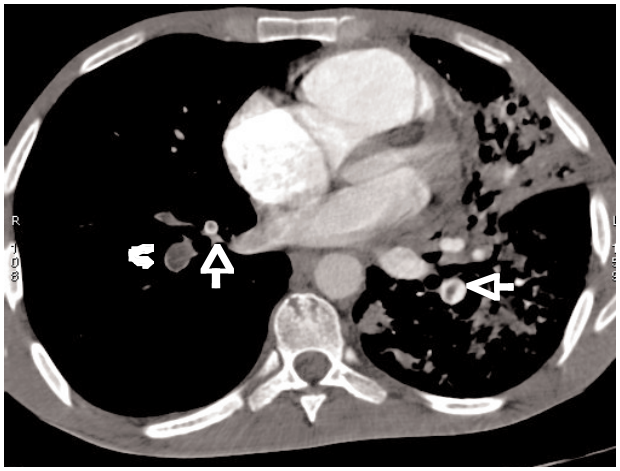


Figure 2 : CT pulmonary angiography (mediastinal window setting) shows centrally located embolisms surrounded by contrast materiel (arrows) and an embolism producing a total cut-off vascular enhancement and expanding the vascular diameter (curved arrow).

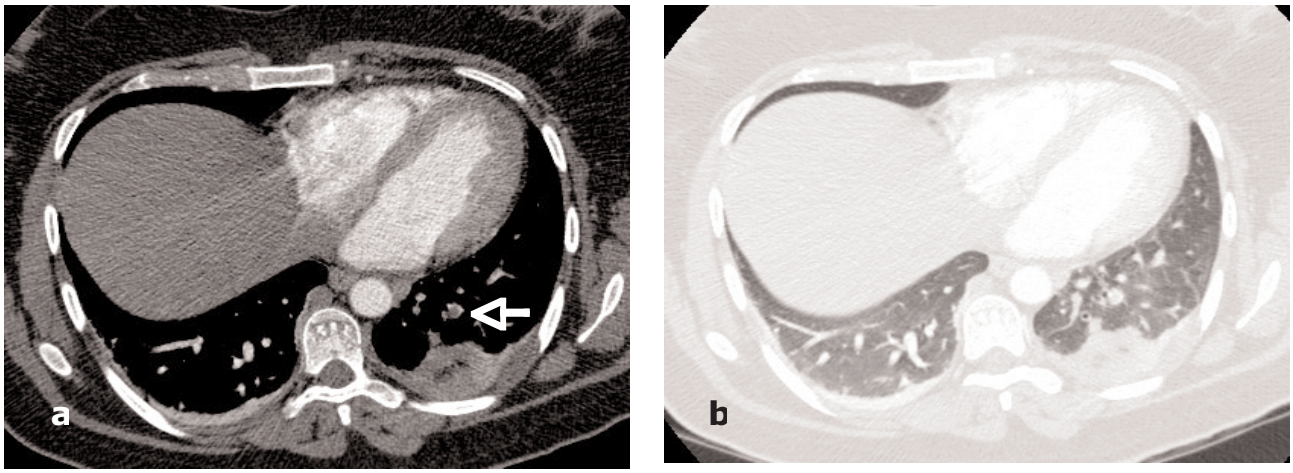


Clinical probability assessment for pulmonary embolism should be made prior to imaging. It must be made by calculation of specific scoring indexes because they are objective, reproducible and easy to apply for physicians having a slight experience. But these indexes are suitable only for patients in emergency department and do not apply to inpatients (13,14).
The chest x-ray is usually the first imaging study performed on patients with suspected acute pulmonary embolism. However findings are nonspecific. The advantage of chest x-ray is its ability to exclude many alternatives diagnoses that could be confused with pulmonary embolism such as pneumonia, pneumothorax or aortic dissection. The usefulness of the ECG is to quickly exclude a heart myocardial infarction. The quantitative rapid ELISA D-dimer assay has high negative predictive value and sensitivity for pulmonary embolism so no further testing is therefore required if it's normal in patients with low or moderate probability clinical assessment (15).
Although pulmonary angiography was presented as the gold standard for pulmonary embolism diagnosis and has poor mortality and morbidity rates, it has not gained widely acceptance because it is invasive and requires technical resources and expertise of an interventional radiologist. Moreover it's not accurate for diagnosis isolated embolism in subsegmental arteries (16).

Figure 3 : CT pulmonary angiography (mediastinal window setting) shows dilatation of the right ventricle and leftward bowing of the interventricular septum. Embolisms are shown in segmental arteries of the two lower lobes (arrows).

Multidetector CT pulmonary angiography has become accepted as accurate method for acute pulmonary embolism diagnosis. Intraluminal filling defect, consistent with embolism, whose characteristics has been described above is the only specific diagnostic criteria. The ancillary findings are non specific, but peripheral wedge-shaped consolidation that may represent pulmonary infarction is significantly associated with pulmonary embolism (17-19). The pulmonary infarction became highly probable if contains central lucencies (1).
Sensitivity and specificity of multidetector CT pulmonary angiography have been reported to vary from 83% to 100% and from 89% to 97% respectively and only 1 to 9% CT are inconclusive (9,20,21). The results of our study are similar with a sensitivity and specificity of 89.6% and 100% and a rate of inconclusive CT of 8%. Excellent diagnostic accuracy is linked to improvement in spatial resolution under the subsegmental artery (22) and to better temporal resolution made by increase rotation speed of the X-ray tube and detector assembly.
Multidetector CT pulmonary angiography can also make a rapid

Figure 4 : CT pulmonary angiography (mediastinal window setting: a, lung window setting: b), shows a peripheral wedge-shaped consolidation with central lucencies on the left lower lobe corresponding to a pulmonary infarction and an embolism in the corresponding pulmonary artery (arrow).



patient's risk stratification by evaluating CT index obstruction of arterial pulmonary bed and recognizing acute right-sided heart failure's findings (2). These consist of right ventricular dilatation and left bowing of interventricular septum. The quantification of arterial pulmonary bed obstruction can be made by different dedicated CT index (5, 23, 24). We routinely use the CT index planned by Qanadli et al. (5) as it seems to be easier and faster to calculate. Recent CT studies have concluded that a CT index greater than 40 or 60% is significantly predictive of death (6-7). A right ventricular dilatation predicts adverse clinical events and short-term death due to acute pulmonary embolism and identifies patients who could benefit from thrombolytic therapy or more invasive therapies (3, 4).
Additional and alternate diagnoses make the usefulness of the CT more efficient.
The need of diagnosis deep venous thrombosis after negative multidetector CT pulmonary angiography is still a matter of debate. For some authors, acute pulmonary embolism might be safely ruled out after negative D-dimer assays or multidetector CT pulmonary angiography without the use of lower limb venous ultrasonography in outpatient with low or intermediate probability of pulmonary embolism (8, 10, 11). Whereas most PIOPED II investigators recommend the combination of multidetector CT pulmonary angiography and CT venography to exclude pulmonary embolism for all patients (25).

CONCLUSION

Prevalence of pulmonary embolism among patients of hospital specialized in cardio-thoracic diseases is higher than prevalence among patients of general hospitals. Based on excellent sensitivity and specificity, multidetector CT pulmonary angiography became the most accurate exam for acute pulmonary embolism diagnosis.

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