Pulmoner Emboli: Elektron Beam Komputerize Tomografi ile Non invaziv Teshis

PULMONARY EMBOLISM: NON INVASIVE DIAGNOSIS USING ELECTRON BEAM CT

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Özet

Amaç: EBCTAngiografi ile pulmoner emboli teshisi ve pulmoner arterlerin degerlendirilmesi.
Materyal ve Metod: Mart 2000 ile Kasim 2001 arası donemde pulmoner emboli suphesiyle merkezimize gonderilen 5 hasta EBCTA metodu ile incelendi.
Bulgular: 4 hastada pulmoner emboli saptandı. 75% tromboz unilateraldi, ve sagdaydı. PE saptanan bir hastada EBCTA sonuclarını invaziv angiografi ile mukayese edebildik.
Sonuc: EBCTA, PE teshisindeki diger metodlarla kıyaslandıgında noninvaziv, zahmetsiz, butun torasik yapıların, mediastenin, akciger parankiminin degerlendirilmesini olanaklı kılan, PE benzeri klinik bulgular veren diger nedenleri de ekarte etmede onemli rolu olan, pahalı olmayan bir metoddur.

Anahtar kelimeler: Elektron Beam Komputerize Tomografi (EBT), emboli, trombus

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Summary

Background: To evaluate and detect pulmonary embolism by using EBCT (Electron Beam Computerised Tomography) Angiography of the pulmonary arteries.
Methods: Within eighteen months period (between march 2000 and november 2001), five patients suspected of having pulmonary embolism (PE) underwent contrast material enhanced thin section EBCTAngiography of the pulmonary arteries.
Results: Four of the five patients had pulmonary embolism. Thrombosis was unilateral in 75% of patients and located in the right side of the lung.
In one patient with pulmonary embolism we were able to compare EBCTA results with invasive angiography.
Conclusion: EBCTAngiography is a cost effective, noninvasive and comprehensive diagnostic method for pulmonary embolism, making possible the evaluation of all thoracic structures, including mediastinum and parenchyma as well as ruling out pathology simulating the symptoms of pulmonary embolism.

Keywords: Electron Beam Computerized Tomograhy (EBCT), embolism, thrombus

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Introduction

EBCT is an ultrafast CT scanning technique enabling examination of the pulmonary arteries. EBCTA has a high accuracy in the detection of pulmonary emboli (1). In addition it can evaluate the anatomy of thorax, mediastinal and parenchymal structures by using the same set of data. Thus potentially life threatening alternative pathologic entities can be reliably identified. In this study we tried to emphasize the importance of computerised tomography and EBCTfor toracic and pulmonary vasculature evaluation, as a rapid and reliable imaging method.

Materials and Methods

Between march 2000 and november 2001, five patients (one woman, four men; age range, 33-70 years; mean age 47) referred for suspected pulmonary embolism to TEST Cardiovascular Imaging Center, were examined with EBCT. Four patients were diagnosed with pulmonary emboli.
First, a localisation scout imaging was obtained. Scanning was performed from a level above the aortic arch to the base of the heart by using the continuous volume mode of the Electron Beam CT scanner (C-150 XP; Imatron San Francisco, California).
All patients underwent scanning craniocaudally in a supine position and at end inspiratory suspension during a single breath hold. Each study was performed with ECG gating and in

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a single breath hold. Scan parameters were; 16 cm. z- axis coverage, 130 kV, 630 mA., 0.3 second exposure, 3 mm collimation and 2 mm section thickness.
The studies were contrast material enhanced with a bolus injection of 100 mL of a nonionic low viscosity contrast material. 20 cc of contrast, was used for the timing run preceding the definitive study. The rate of injection administered was 3 mL/sec. The contrast material was administered through a 18 gauge venous access in the cubital vein by using an angiographic injector with a 16 second delay. The scanning level was adjusted to ensure coverage of the main pulmonary arteries and the central subsegments of most of the upper, middle and lower lobe lung segments. To improve the quality of the data, the scanning was ECG triggered to the diastolic phase of the heart at 70% of the cardiac cycle.
Written informed consent was obtained from each patient after the nature of the procedure had been fully explained.

Results

EBCT examinations were well tolerated by all patients.
Four patients had pulmonary embolism.
The first patient with pulmonary embolism, was a 33 year old man with a history of prior pulmonary embolism. There was thrombus in the right main pulmonary artery which subtotally occluded, in the right upper lobe pulmonary artery subsegmentary level and in the right lower pulmonary artery segmentary levels. Catheter angiography results were equally correlated with EBCTA results, filling defects and pulmonary arteriel hipertension were detected. Parenchymal consolidation and infarcts have been detected in the right lower lobe (figure 1, Patient had right main pulmonary artery subtotal thrombus. Figure 2, right lower lobe subsegmentary thrombus.
Figure 3, right lower lobe periferal infarct. figure 4, operative specimen, thrombus. Figure 5, Catheter pulmonary angiography showed 100% correlation. Figure shows right main pulmonary artery subtotal thrombus. Patient had a complicated appendicitis operation when he was 20 year old. Then in a very short time period he had three more abdominal operations, probably related to the first operation. Patient had lower extremity deep venous thrombosis several times and had chronic pulmonary embolism history.
The second patient with pulmonary emboli was a 70 year old man, showed radiologic evidence of right- sided cardiac chamber dilatation, pulmonary hypertension, central arterial enlargement (5 cm. main pulmonary artery transvers dimension) and right lower lobe segmental pulmonary artery thrombus. Figure 6, shows dilated pulmonary artery.
The third and fourth patient with Behcet disease had segmentary pulmonary artery thrombus in the lower lobes of the lung bilaterally, and they were 35 and 40 year old respectively.
The fifth patient was a 56 year old woman, suspected but did not have pulmonary embolism, had left lower lobe mild bronchiectasis and mosaic patern lung parenchyma in the left lower lobe.

Discussion

Pulmonary embolism symptoms are not specific, different diagnoses, including unknown malignancies or life threatening conditions such as aortic rupture or dissection can arouse similar complaints and discomforts. Location and extention of the emboli, origin of the disease are easily can be shown by EBCT. Although pulmonary angiography is considered to be the reference standard for the detection of emboli, it is used infrequently because it is invasive and can cause complications (1). In addition its ability to depict isolated peripheral emboli does not seem to exceed the accuracy of CT (2). CT appears to be the most cost efective tool in the diagnostic algorithm of pulmonary embolism (1).
Scintigraphy enables a reliable functional assesment of lung ventilation and perfusion, but it lacks spatial resolution. Thus potentially life threatening alternative causes of the patient`s clinical signs and symptoms are easily missed (1). According to the specific advantages of spiral CT angiography over conventional or digital angiography, this technique is now considered as the first diagnostic procedure whenever direct imaging of endovascular clots is required (3). Maximum intensity projection (MIP) and volume rendering (VR) are recently introduced techniques for creating angiographic like images of the pulmonary vasculature.
Ventilation-perfusion scanning and spiral CT can be used interactively to diagnose pulmonary embolism (4,5), but CT is more sensitive and specific than V-Pscanning(20).
Because pulmonary embolism and venous thrombosis are different aspects of the same disease, a single study that accurately defines both process would be a valuable addition to the diagnostic regimen. Combined CT venography and pulmonary angiography test, consists of helical CT pulmonary angiography followed by venous phase CTperformed from the diaphragm to the calves, allows concurrent evaluation of pulmonary embolism and deep venous thrombosis (6).
CT provides high spatial resolution and enables objective noninvasive visualization of thoracic anatomy (7,8,9). Sources of chest pain other than pulmonary embolism can be identified. The location of emboli and the extent of disease can be assessed to determine the need for and feasibility of anticoagulation therapy, thrombolysis or more invasive measures.
Pulmonary embolism and deep venous thrombosis are difficult to diagnose clinically. Diagnostic algorithms for the evaluation of suspected thromboembolism have traditionally included ventilation-perfusion lung scanning and conventional pulmonary angiography to evaluate the lungs and lower extremity sonography to evaluate the leg veins, but they have recently evolved to include CT (11).
CT pulmonary angiography is increasingly being used to evaluate suspected pulmonary embolism because it accurately defines emboli to the level of segmental pulmonary arteries and reveals other nonembolic causes of thoracic symptoms (12).
Pulmonary thromboembolism is a common and fatal complication of deep venous or pelvic vein thrombosis, right atrial neoplasia or thrombus, thrombogenic i.v. catheters, endocarditis of the tricuspid or pulmonic valves. Pulmonary embolism are multiple quite frequently, bilateral and located in the right lung most of the time.
The mortality rate in untreated cases is 25%-30%, whereas the mortality rate in treated cases decreases to 5%-8% (14).
Pulmonary hypertension is the hemodynamic consequence of vascular changes within the precapillary or postcapillary pulmonary circulation. These changes may be idiopathic but

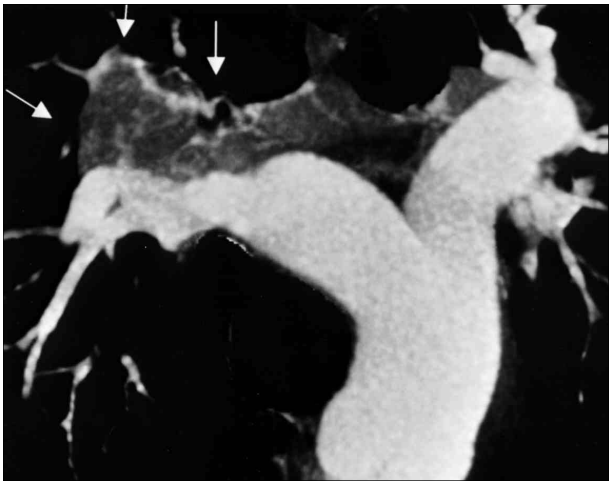

Figure 1. 33 year old male with pulmonary embolism, right main pulmonary artery subtotally occluded, there is subtotal thrombus at the right main pulmonary artery.
Right upper lobe pulmonary artery subsegmentary level and the right lower pulmonary artery segmentary levels.

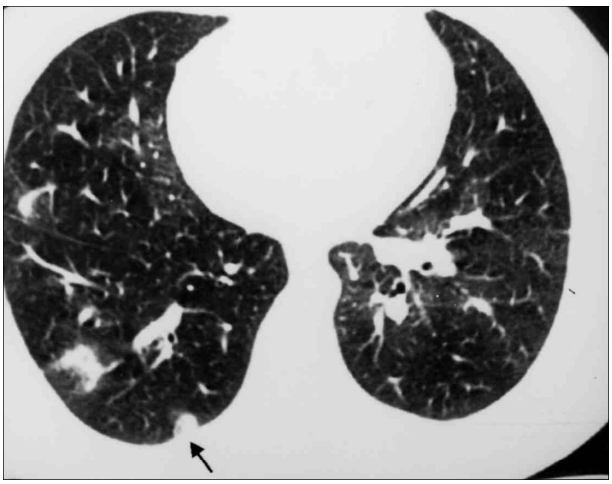

Figure 3. Rright lower lobe peripheral wedge shaped infarct.

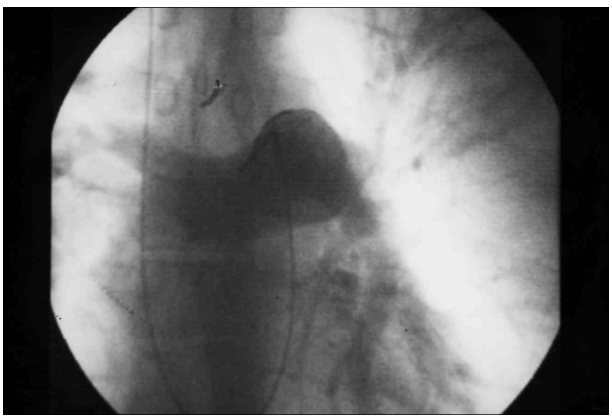

Figure 5. Catheter pulmonary angiography. Figure shows right main pulmonary artery subtotal thrombus.

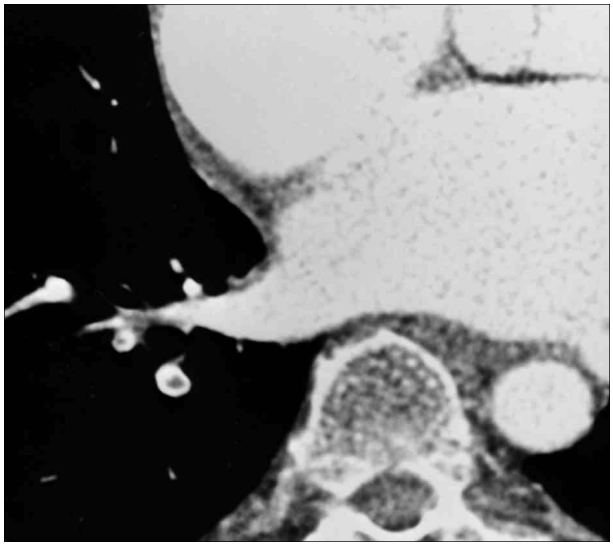

Figure 2. Right lower lobe subsegmentary thrombus.

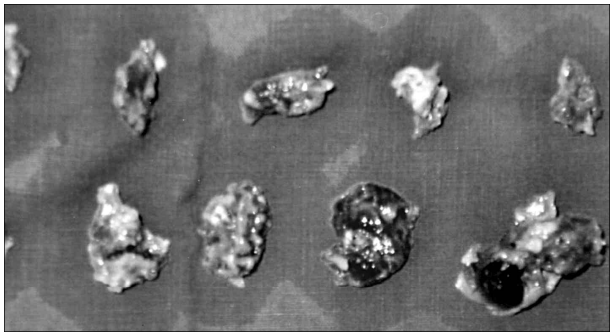

Figure 4. Operative specimen, thrombus.

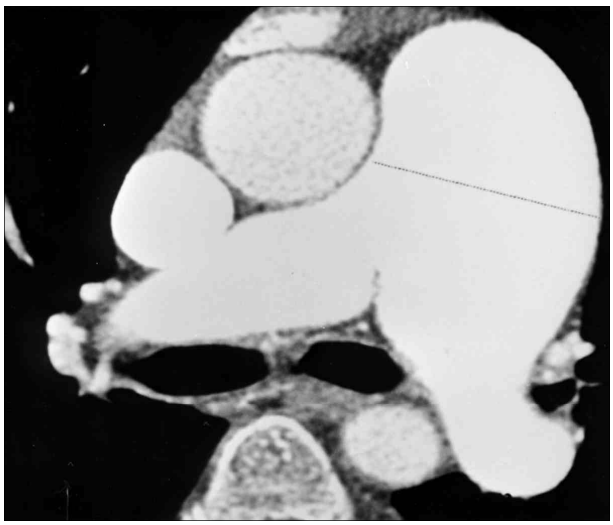

Figure 6. 70 year old male with pulmonary emboli, right-sided cardiac chamber dilatation, pulmonary hypertension, central arterial enlargement, main pulmonary artery transvers dimension is 5 cm, and right lower lobe segmental pulmonary artery thrombus.

more commonly represent a secondary response to alterations in pulmonary blood flow. The pulmonary and systemic bronchial circulations form broad anastomoses that largely prevent infarction except in settings of markedly elevated pulmonary venous pressure, underlying malignancy, or excessive embolism. Gastric carcinoma is the most common clinically occult neoplasm to embolise and produce pulmonary hypertension (17,18).

Causes of precapillary pulmonary hypertension include long standing cardiac left to right shunt, chronic thromboembolic disease, and widespread pulmonary embolism arising from intravascular malignant cells, parasites, or foreign materials(15).

If the ratio of pulmonary artery diameter to aortic diameter is exceed one, a strong correlation with elevated mean pulmonary artery pressure has been shown.

The classic radiologic features of precapillary pulmonary hypertension are central arterial enlargement, tapered peripheral vascularity, right sided cardiac and chamber dilatation.

It has been shown that ultrafast CT has greater sensitivity and accuracy for depicting central disease than either pulmonary angiography or MR imaging (10,13,16).

Spiral CT angiography and pulmonary angiography have a similar rate of suboptimal examinations, varying between 2% and 4% of cases with CTand reported in 3% of the angiograms of the prospective investigation of pulmonary embolism (19).

Magnetic Resonans Imaging has not widespread use in emergency medicine mainly because of its long examination time and the difficulties in patient monitoring. A limited study with MRI in patients with Behcet`s disease, recommended MRAngiography instead of catheter angiography, because of the high risk of thrombophlebitis at the site of venous punction and pseudoaneurysm at the site of arterial punction in these patients with catheter angiography (21).

CTpulmonary angiography defines the level and exact place of the emboli and reveals other nonembolic causes of thoracic symptoms. EBCT when available, has superiorities at the paracardiac areas because of less affectiveness from respiratuary and cardiac motion artefacts. EBCTA is an excellent, dose saving noninvasive modality to detect pulmonary embolism create three -dimentional data sets that have greater diagnostic possibilities than do standart projection angiographic image.

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