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DIAGNOSTIC EVALUATION OF ACUTE PULMONARY EMBOLISM – CHEST X-RAY & MULTIDETECTOR CTPA

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ABSTRACT Pulmonary embolism (PE) is a potentially life-threatening condition requiring adequate diagnosis and treatment. CTPA is the first-choice diagnostic imaging technique in patients suspected of having acute PE. CT also provides information on other potential causes of acute chest pain. Due to its wide availability and low invasiveness, CTPA tends to be overused. Chest radiograph has limited utility, occasionally showing findings of PE or infarction, but is useful in evaluating other potential causes of chest pain. In this article, we review the role of CTPA & chest XRAY in the evaluation of acute PE.

KEYWORDS : Computed tomography (CT); chest XRAY; pulmonary embolism; Polo mint sign

INTRODUCTION:

Pulmonary embolism is the third most common acute cardiovascular disease after myocardial infarction and stroke, and it leads to thousands of deaths each year because it often goes undetected. Acute pulmonary embolism (PE) is a common and often fatal complication of venous thromboembolic disease (VTE). Imaging plays a pivotal role in the diagnosis and management of these patients. Now a day's multi-detector computed tomography (CT) pulmonary angiography (CTPA) is the most commonly used modality in the workup of suspected PE. In this article, we will review the role of chest X-RAY & CTPA in the evaluation of acute pulmonary embolism.

Acute pulmonary emboli:

- Complete arterial occlusion with failure to opacify vessel lumen.
- Artery may be enlarged compared to others of same order.
- Central filling defect surrounded by contrast producing "**POLO MINT SIGN** "acquired perpendicular to the long axis of vessel & "**RAILWAY TRACK SIGN**" on longitudinal images of vessel.
- Peripheral intraluminal filling defect that makes an acute angle with arterial wall.

Chronic pulmonary emboli:

- Complete occlusion of vessel that is smaller than others of same order branching.
- Peripheral crescent shaped intraluminal filling defect that makes obtuse angles with the vessel wall.
- Contrast flowing through vessels that appear thick walled often smaller arteries due to recanalization.
- A web or flap within a contrast material –filled artery.
- Secondary signs include: extensive bronchial or other systemic collaterals vessels, an accompanying mosaic perfusion pattern, or calcification within eccentric vessel thickening.

CHEST RADIOGRAPH:

It is not a diagnostic test for PE but is extremely helpful in evaluation of other common cardio-respiratory diseases, which mimic PE, like Congestive heart failure (CHF), Pneumonia and Pneumothorax.

In a retrospective, cross sectional study on chest radiographs of patients admitted with diagnosis of acute PE conducted in Aga university, Karachi by Ali Bin Sarwar Zubairi et al & Shahid Javed Husain et al & others, 50 patients (21 males, 29 females) were identified during the study period. The mean age was 52 years (12 to 88 years). Almost all of the patients (98%) had symptoms of acute PE and only 2% were asymptomatic. Principal symptoms were breathlessness (88%), chest pain (32%), cough (26%), haemoptysis (8%) and wheezing (4%). Risk factors included the following: prolonged bed rest or immobilization (34%), major surgery in past 3 months (26%), trauma in past 3 months (18%), malignancy (18%), hypercoagulable states (6%) and traumatic spinal cord injury (2%). Only one patient had positive family history of venous thromboembolism. None had prior history of venous thromboembolism (VTE), pregnancy or postpartum state or use of oral contraceptives. Chest radiographs of all selected cases were interpreted. *Only nine patients (18%) had normal chest radiographs and forty-one (82%) had abnormal chest radiographs*.

In their study they also found out Cardiomegaly in 38%, Infiltrate in34%, Atelectasis in 26%, Pleural effusion in 24%, Pulmonary congestion in 24%, PA enlargement in 14%, Elevated hemi diaphragm 14%, Oligemia in 8% of chest radiographs. *Cardiomegaly is the most common chest radiographic abnormality associated with acute PE*.

In another observational analysis from PIOPED study was done by Daniel F. Worsley MD et al, Abbas Alavi MD et al & others to determine the sensitivity, specificity & positive & negative predictive values of chest radiographic findings in suspected patients of acute PE in which 1,063 patients with suspected PE were reviewed. PE was confirmed angiographically in 383(36%) patients & excluded in 680(64%) patients. The chest radiograph was interpreted as normal in 12 % of patients with PE. Majority of chest radiographs were found abnormal in the study. The most common chest radiographic findings in patients with suspected PE was atelectasis &/or parenchymal areas of increased opacity; however, the prevalence was not significantly different from that in patients without PE.

An enlarged pulmonary artery, referred to as the Fleischner sign, is secondary to pulmonary hypertension or distension of the vessel by pulmonary embolus.

Regional oligemia from PE is dubbed the Westermark sign, and this has 14% sensitivity, 92% specificity, 38% positive predictive value (PPV), 76% negative predictive value (NPV) in diagnosis of PE.

In patients with pulmonary infarction, a peripherally located wedge shaped opacity may be seen and is called a Hampton hump (*Figure 1*) (sensitivity 22%, specificity 82%, PPV 28%, NPV 76%).

Other non-specific findings include pleural effusion (sensitivity 36%, specificity 70%, PPV 28%, NPV 76%), elevated diaphragm (sensitivity 20%, specificity 85%, PPV 30%, NPV 76%) and vascular redistribution (sensitivity 10%, specificity 87%, PPV 21%, NPV 74%). It was concluded from this study that; *the role of chest radiographs is essential in diagnosis of acute PE but their main role is to exclude other causes of acute chest pain and disease processes that may mimic PE*.

Multidetector CTPA:

CTPA is the imaging modality of choice for the workup of patients with suspected acute PE and is a crucial component in commonly used clinical diagnostic algorithms. CTPA has high sensitivity and

specificity, with PIOPED II trial demonstrating sensitivity of 83% and specificity of 96%. When combined with clinical probability, the positive predictive value rose to as high as 96% when there was high or low clinical probability and 92% when there was intermediate clinical probability. CTPA has the advantages of being readily available, non-invasive, cost effective and fast with scan duration in modern scanners of less than one second. CTPA also has the capability of directly visualizing the thrombus & may also provide alternative diagnosis for etiologies of chest pain & shortness of breath like pneumonia, vascular pathologies like pulmonary AVM or pericardial abnormalities etc.

However, CTPA has its own disadvantages like risk of radiation exposure & contrast induced nephropathy in patients of deranged KFT & anaphylactoid reactions. However, advances in protocols and technique can render diagnostic studies while minimizing the amount of ionizing radiation. Various contradiction of CTPA are pregnancy, children, patient with low GFR or deranged KFT, allergic patients, Moreover, Woo *et al.* showed a significant benefit-to-risk ratio of CTPA when taking into account the mean lifetime attributable risk of cancer mortality. Images are displayed with three different grey scales for interpretation: Lung window (1500/600), Mediastinal window (400/40), Pulmonary embolism –specific (700/100) window. Multiplanar reformatted images through the longitudinal axis of a vessel are used to overcome difficulties encounter with axial sections or obliquely or axially oriented arteries. Reformatted images can help differentiation between true pulmonary embolism & patient related, technical, anatomic & pathological factors that can mimic PE.

Methods & materials:

The study has been conducted in department of radiodiagnosis of a tertiary institute in central part of India on 200 suspected patients of pulmonary embolism (of which 120 were female & 80 were females) referred from medicine department for CTPA for a duration of 2 years with following inclusion & exclusion criteria:

Inclusion Criteria—

- Patients with sudden onset of breathlessness with not maintaining saturation
- SCD with breathlessness
- Clinically suspected DVT pts
- Suspected Congenital heart diseases
- High risk patients for screening.

Exclusion Criteria-

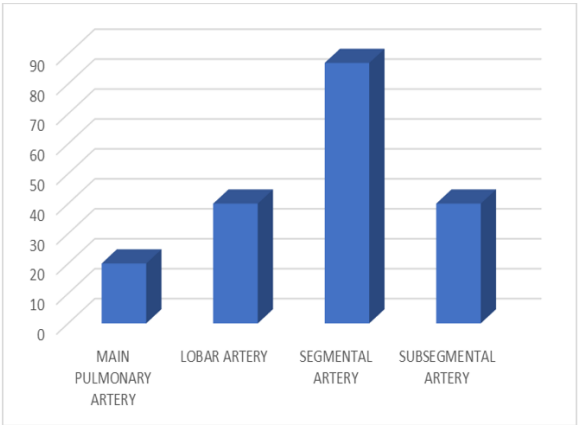
- Renal insufficiency
- Contrast allergy
- Pregnant females
- Severe obesity

Observation & results of study:

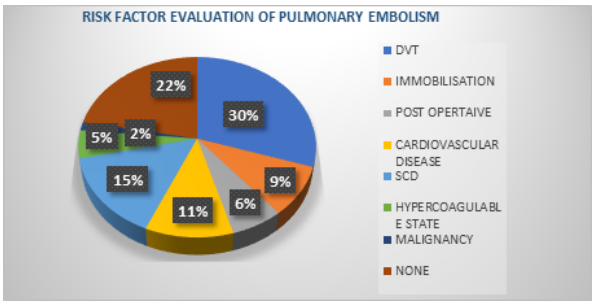
In this study, 25 % patients (50 out of 200) were found to have pulmonary thrombus with majority of thrombus are unilateral however very few patients presented with bilateral thrombus. Pulmonary thrombus has a typical distribution based on location of thrombus with majority being found in segmental & subsegmental branches & least were found in main pulmonary artery (see graph I). However, in one patient we found V-shaped or saddle thrombus as well . There were few patients who were diagnosed with alternative diagnosis like congenital heart disease like cyanotic heart disease, VSD, heterotaxy & pulmonary hypertension etc. There is typical risk factors distribution with majority of patients having DVT as the major etiological factor (see graph II). The sensitivity & specificity of CTPA in evaluation of pulmonary thrombus is found to be 98.2% & 37.0%, positive & negative predictive values are 90.9% & 76.2%. In summary CTPA is the investigation of choice for establishing diagnosis of pulmonary thrombus & also other alternative diagnosis for symptoms of patients like congenital heart disease, lung infection & malignancy etc.

CONCLUSION:

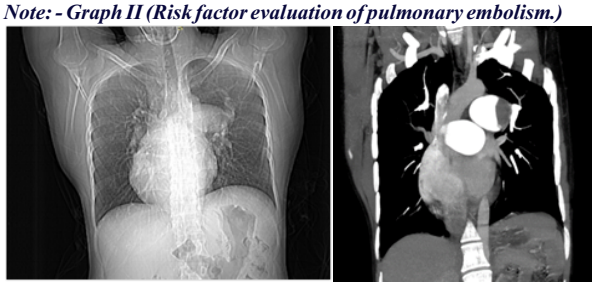
The role of chest radiographs is essential in diagnosis of acute PE but their main role is to exclude other causes of acute chest pain and disease processes that may mimic PE. However multidetector CTPA with its wide availability, cost effectiveness, faster scan time, providing alternative diagnosis & being non-invasive outweighs its benefits over its disadvantages of radiation exposure & contrast induced nephropathy in patient with low GFR. The sensitivity & specificity of CTPA is more than chest radiographs.



Note: -Graph I (Pulmonary emboli distribution by location in our study majority of thrombus were found in segmental & subsegmental branches of pulmonary artery.)



Note: - Graph II (Risk factor evaluation of pulmonary embolism.)



Note: figure I (Chest Xray shows grossly dilated pulmonary artery, dextroposed heart& dilated right atrium & right ventricle. CTPA shows focal eccentric contrast filling defect seen in left main pulmonary artery causing nearly 50% luminal compromise.)

REFERENCES:

1. Daniel F. Worsley, MD, Abbas Alavi, MD, Judith M. Aronchick, MD, James T.T. Chen, MD, Richard H. Greenspan, MD, Carl E. Ravi , MD. Chest radiographic findings in patient with acute PE – observation from the PIOPED study.
2. Ali Bin Sarwar Zubairi, Shahid Javed Husain, Muhammad Irfan, Kulsoom Fatima*, Muhammad Atif Zubairi, Muhammad Islam** Chest radiographs in acute pulmonary embolism.
3. Worsley DF, Alavi A, Aronchick JM, Chen JT, Greenspan RH, Ravin CE. Chest radiographic findings in patients with acute pulmonary embolism: Observations from the PIOPED Study. Radiology 1993;189(1):133-6.'
4. Alastair J. E. Moore, Jason Wachsmann, Murthy R. Chamarthy, Lloyd Panjikaran, Yuki Tanabe, Prabhakar Rajiah. Review article Imaging of acute pulmonary embolism: an update
5. RM Subramaniam, D Blair, K Gilbert, J Sleigh and N Karalus Departments of 1Radiology, University of Auckland, Hamilton, New Zealand- CTPA diagnosis of pulmonary embolism.
6. Yair Safriel*, Harry Zinn – CTPA in the detection of pulmonary emboli-A meta-analysis of sensitivities and specificities
7. Zhongyi Chen, Simon Deblois, Kevin Toporowicz, Irina Boldeanu, Marie-Odile Francoeur, Manel Sadouni, Luigi Lepanto1,2 and Carl Chartrand-Lefebvre - Yield of CT pulmonary angiography in the diagnosis of acute pulmonary embolism short report
8. Yen-Ting Lin • I-Chen Tsai • Wei-Lin Tsai Tain Lee • Min-Chi Chen • Pao-Chun Lin •
9. Si-Wa Chan- Comprehensive evaluation of CT pulmonary angiography for patients suspected of having pulmonary embolism