CHEST RADIOGRAPHS IN ACUTE PULMONARY EMBOLISM

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Background: Pulmonary embolism (PE) is a serious clinical entity carrying significant morbidity and mortality. Clinically, it is a difficult condition to diagnose and remains under treated condition in Pakistan due to non-availability of objective tests and lack of awareness among physicians. This study was conducted to determine the chest radiographic presentation in known cases of acute PE presenting to a tertiary care hospital. **Methods:** Hospital records of patients with a diagnosis of acute PE were reviewed from June 2000 until June 2004. Fifty diagnosed cases of acute PE on Spiral Computed tomography (CT) of the chest demonstrating an intraluminal-filling defect were selected. Two chest physicians reviewed the chest radiographs obtained during that hospitalization. In case of discrepancy, a radiologist made final interpretation. **Results:** The chest radiograph was interpreted as normal in only 18% of patients with acute PE. The most common chest radiographic abnormalities were cardiac enlargement (38%), pulmonary parenchymal infiltrates (34%), atelectasis (26%), pleural effusion (24%), and pulmonary congestion (24%). Other rare findings were elevated hemi diaphragm (14%), pulmonary artery enlargement (14%), and focal oligemia (8%). **Conclusions:** Cardiomegaly is the most common chest radiographic abnormality associated with acute pulmonary embolism. Chest radiography is not useful in making the diagnosis of acute pulmonary embolism. Its major role is in identification of alternative disease processes that can mimic thrombo-embolism

Keywords: Chest radiograph, Echocardiography, Pulmonary embolism

INTRODUCTION

Pulmonary embolism results in significant morbidity and mortality. It remains largely under diagnosed and under treated clinical problem amongst hospitalized patients in Pakistan due to non-availability of objective tests and lack of awareness among physicians. The diagnosis of PE is difficult because clinical features are nonspecific and all diagnostic tests have certain limitations[1,2]. The ventilation-perfusion (V/Q) scan is non-diagnostic in 60-70% of patients [1,2]. Helical (spiral) CT has limited sensitivity for sub-segmental embolism. Pulmonary angiogram is the 'gold standard' but is invasive, impractical or unavailable in most clinical settings [3].

The chest radiograph is a fundamental test in the initial evaluation of cardiopulmonary disease and has advantage of being non-invasive [4]. 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. Data that describe chest radiographic findings associated with the diagnosis of pulmonary embolism are limited [5].

The purpose of our study was to evaluate the chest radiographic findings in diagnosed cases of acute pulmonary embolism.

MATERIALS AND METHODS

We conducted a retrospective, cross-sectional study on chest radiographs of all patients admitted with a diagnosis of acute PE from June 2000 until June 2004 at Aga Khan University, a tertiary care hospital in Karachi, Pakistan. We identified 50 consecutive patients who were diagnosed as acute pulmonary embolism on helical CT scan during the study period.

We carefully analyzed the chest radiograph findings along with gender, risk factors, associated diseases, clinical features, laboratory findings, echocardiography, treatment and outcome of these cases.

Two Pulmonologists interpreted chest radiographs. If there was any discrepancy, final interpretation was made by a Radiologist. The chest radiographs were characterized as normal or abnormal. If abnormal, then we looked for presence of one or more abnormal features like; cardiomegaly (cardio thoracic ratio > 0.5), pleural effusion, atelectasis (loss of lung volume), enlargement of a major pulmonary artery (Fleischner's sign), pulmonary parenchymal infiltrate, pulmonary congestion, elevated hemi diaphragm, focal oligemia (Westermark's sign) and a peripheral wedge-shaped opacity above the diaphragm (Hampton's hump).

Statistical package for social science (SPSS) version 11 was used for data analysis. The descriptive analysis was done for demographic, clinical, radiographic features and laboratory results. Results were expressed as mean ± standard deviation, and number (percentage).

RESULTS

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%), hemoptysis (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. Table 1 describes the findings of chest radiograph.

Echocardiography was done in 29 patients (58%) out of 50. Right ventricular strain was identified in 14 patients (28%); Right ventricle (RV) hypo kinesis in 11 (22%), RV dilatation in 14 (28%), tricuspid regurgitation in 18 (36%), pulmonary hypertension in 18 (36%) and interventricular septal shift in 8 (16%).

Six patients died due to refractory shock and hypoxemia. Thrombolytics were given in 4 patients (8%) out of which 3 survived and discharged home. Embolectomy was done in 4 patients (8%). All of them survived and IVC filter was placed in 5 patients (10%).

Table 1. Chest radiographic abnormalities associated with acute pulmonary embolism

Abnormalities	(%)	95% Confidence Interval
Cardiomegaly	38%	(0.247, 0.513)
Infiltrate	34%	(0.209, 0.471)
Atelactasis	26%	(0.139, 0.381)
Pleural effusion	24%	(0.122, 0.358)
Pulmonary congestion	24%	(0.122, 0.358)
PA enlargement	14%	(0.044, 0.236)
Elevated hemi diaphragm	14%	(0.044, 0.236)
Oligemia	8%	(0.005, 0.155)

DISCUSSION

PE has been described as the most preventable and most under diagnosed cause of hospital deaths. The majority of preventable deaths associated with PE can be ascribed to a missed diagnosis rather than to failure of existing therapies. An estimated 600,000 cases of PE occur per year in United States resulting in 50,000-100,000 fatalities and 5-10 % of hospital deaths [6]. No data is available from Pakistan. Wharton and Pierson[7] reported the first radiographic description of pulmonary embolism in 1922.

Historically, many radiographic signs of pulmonary embolism have been described but their specificity has probably been overstated. One of the few prospective studies, which evaluated the reliability of chest radiograph in the diagnosis of PE, has shown that chest radiography in isolation is a notoriously poor indicator of the diagnosis.

In the Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study, the chest radiographs of most patients (88%) were abnormal [8]. Plain chest radiograph cannot be used itself to diagnose or exclude PE, but it may rule out other potentially life-threatening conditions such as pneumothorax[9].

Although majority of patients with PE have abnormal chest x-ray findings, the most frequent abnormalities are non-specific as in our series. The highly specific findings of focal oligemia (Westermark's sign) or a peripheral wedge-shaped opacity (Hampton's hump) are rare. No abnormalities are seen on plain chest films in approximately 10-15% cases.

The contrast-enhanced helical CT has replaced V/Q scan as the diagnostic study of choice in patients with suspected PE at most centers including our hospital as it allows the direct visualization of emboli as well as the detection of parenchymal abnormalities that may provide an alternate explanation for patient's symptoms [10,11].

Our study extends previous observations of chest X-ray findings associated with acute PE. Patients with acute PE are likely to have an abnormal chest X-ray as reported by others. Cardiomegaly remains the most common radiographic abnormality associated with acute PE as reported by International Cooperative Pulmonary Embolism Registry (ICOPER) database [12]. Unlike the ICOPER study, we did not isolate the chest X-ray abnormality unique to PE by eliminating patients with prior cardio-pulmonary disease.

Right ventricular hypo kinesis, detected by echocardiography, is an important predictor of mortality that is associated with acute pulmonary embolism [13]. The ICOPER data suggest that neither cardiomegaly nor PA enlargement is sensitive or specific predictors of RV hypo kinesis.

Our study has some limitations. First, the sample size was small. Second, we did not exclude patients with underlying cardiopulmonary disease, which may influence chest radiograph findings. Interestingly, despite our limitations the data is similar to ICOPER database.

CONCLUSION

In summary, our data suggests that cardiomegaly is the most common chest radiographic abnormality associated with acute PE. Although the chest radiograph cannot be used to diagnose or exclude PE, it contributes to the non-invasive diagnostic assessment of PE through the exclusion of disease processes that may mimic PE.

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