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Technical Challenges on CT Pulmonary Angiogram: Our Data

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Abstract
Purpose: This study aims to evaluate the role of imaging modalities, especially CTPA in diagnosing pulmonary embolism and briefly summarize PE distribution according to age and gender.**Material and methods:** Data of patients were collected at the "Shefqet Ndroqi" University Hospital, Department of Imaging, Tirana, Albania; during one year period, January 2017 – January 2018.Based on clinical and laboratory data, the study included 300 patients with suspected pulmonary embolisms; 53% were women and 47% were men with an average age of 64.2 years. The patients underwent this diagnostic protocol: physical examination, laboratory examination, and imaging diagnosis (radiography, CTA, MN). Chest X-ray (standing position, PA projection) was performed in all patients included in the study; 98% of patients underwent angio-CT examination, after injection of 50-65 mL of contrast media, Ultravist 370. Nuclear medicine was performed in 2% of patients after injection of 5mCi Tc-99m labeled with MAA.**Results:** The study shows that pulmonary embolism was found in 17.7 % of the total sample population (54 % of women and 46% of men). And the group aged 61-70 years old was more affected. CTPA examination data resulted in the final diagnosis and exclusion of PE in 98% of cases: 17.4 % positive for PE; 81.2 % negative for PE and 1.4 % indeterminate due to poor opacification of pulmonary arteries. Perfusion defect was found in two cases.**Conclusion:** CTPA is the imaging modality of choice in the diagnosis of PE, allowing direct visualization of the thrombus in the vascular lumen by determining the optimal time of pulmonary arteries opacification.
Keywords: pulmonary embolism, CTPA, MN, radiography
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1. Introduction

Pulmonary embolism is an acute cardiovascular disorder with high early mortality rates which is characterized by occlusion of blood flow in a pulmonary artery or its branches, typically due to a thrombus originating from one of the deep veins of the legs or pelvis[1,2]. Fast and accurate detection is critical as PE is a potentially fatal condition and is related to other complications. Imaging modalities are essential in diagnosing and managing these patients[3]. The role of chest radiographs in patients with suspected PE is not the diagnosis of PE, but to get a differential diagnosis to other causes of chest pain such as pneumonia, pneumothorax, or pulmonary edema[4]. On the other hand, Computed tomography (CT) Pulmonary Angiography (CTPA) is the standard of accurate diagnosis by visualizing filling defects within pulmonary vasculature and other etiologies of chest pain and shortness of breath[5,6]. In recent times, this crucial position is supported by the introduction of Multi-Detector Computed Tomography (MDCT) which allows the study of the entire region of interest in a short period of time, which is especially important in dyspneic patients [7]. Although, CTPA is the most reliable test for the diagnosis of pulmonary embolism, lung scintigraphy scan perfusion, and ventilation may be preferred in some clinical situations due to their safety such as cases with kidney failure, allergic reactions to contrast dye, young women in the interest of lower radiation dose[8,9].

2. Methods

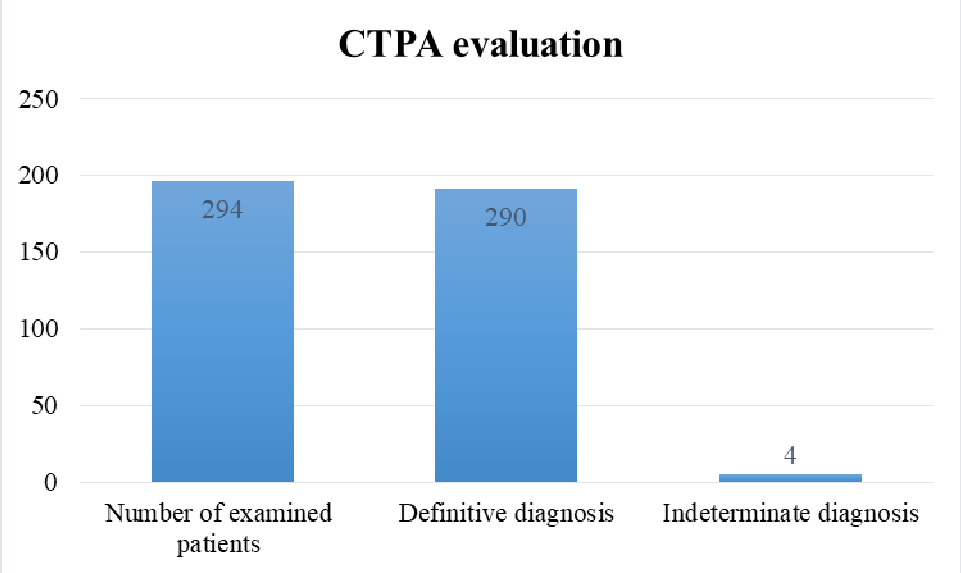
Our cohort study was carried out from January 2017 – January 2018 at "Shefqet Ndroqi" University Hospital, Tirana, Albania, by identifying patients suspicious of PE who underwent Computed Tomography-Pulmonary Angiogram (CT-PA) to confirm or exclude this condition. CT angiograms were acquired with CT Siemens SOMATOM Definition Dual Source 128-slice scanner after injection of 50–65 mL of contrast material, Ultravist 370. Images were reconstructed with a slice thickness of 1 mm in mediastinal windows, filter B 30 medium smooth. Our radiologist and a pulmonologist evaluate images for the presence of PE.

All the data used in this report were analyzed using SPSS (Statistical Package for Social Sciences, Version 15.0).

3. Results

The study included 300 cases of both genders ranging from 36-90 years. Pulmonary embolism was found in 17.7 % of the cases of the total population (29 females and 24 males). The highest percentage was in the age of 61-70 years in both genders.

294 patients in our study underwent CTPA scan inspection, while 6 patients referred for strong allergic reactions to iodine-based contrast agents underwent scintigraphy. Nuclear medicine test was performed using 5mCi Tc-99m labeled with MAA (macro aggregated albumin). Perfusion defect was found in two cases. CTPA scan data gave a clear report on 98.6 % of cases (17.3 % positive for PE; 81.2 % negative for PE); 1.4 % of CT scan data were insufficient for accurate diagnosis due to technical and patient-related factors, such as flow artifacts which results in a poor opacification of pulmonary arteries due to an increase in the flow of unopacified blood from the inferior vena cava (IVC) to the right side of the heart, despite optimal contrast administration.



4. Discussion

This study includes a brief summary of pulmonary embolism distribution according to age and gender, in Albania. Based on our data analysis, our survey displayed positive pulmonary embolism results in 17.7 % of our total suspected subjects with slight differences among males and females respectively at the ratio of 1:1.2. Pulmonary embolism occurs most frequently in the age group *61-70 years. Our data were compared with other studies where* PE affects approximately equal numbers of women and men over 60 years old[10, 11].

Although CTPA is the gold standard modality for detecting pulmonary embolism, the diagnostic quality of acquired images depends on optimal contrast within the pulmonary vasculature (PA). The most common cause of low contrast attenuation within pulmonary arteries is the interruption of the contrast bolus more frequent in patients who performed a deep inspiration before scanning[12, 13, 14]. In our study, 4 patient data were excluded due to suboptimal pulmonary arteries opacification. This phenomenon was found in 3 young adult patients who performed a sharp inspiration that resulted in increasing unopacified blood flow from the inferior vena cava (IVC) to the right side of the heart and one obese patient. Our team decided to repeat the exam in the large body habitus case, instructing the patient to suspend the breath before scanning and also increase the flow rate of contrast medium administration to 5.5 ml/sec resulting in adequate images of pulmonary arteries.

When we use a dual source 128-slice CT scan, the incidence of contrast bolus interruption is too low compared to other study results[15,16] as in the fast scan it may be possible to acquire appropriate images without any error or missing data.

The main limitation of this study is the small number of participants. Also, our sample of positive pulmonary embolism cases is too small and these data do not evaluate the distribution of pulmonary embolism in the general population in Albania, so further research is needed on this topic in the future.

In conclusion, CTPA remains the best option for emergency departments to confirm or exclude pulmonary embolisms, although it does not mean overusing this modality taking into consideration other modalities, especially the nuclear medicine scanning in young patients, and others who cannot get contrast medium.

As mentioned above, the diagnostic accuracy of CTPA is surely dependent on the patient-related factor highlighting the need to use standardized protocols for the administration of contrast media as well as patient preparation depending on the cardiovascular status, age, body habitus, and equipment features.

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