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Research Article

Evaluation of the Clinical Probability of Patients Previously Suspected with Pulmonary Embolism, with the SPECT Method of Planar Lung Perfusion Scan

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Abstract

Introduction: Lung perfusion scan, as diagnostic imaging procedure in Nuclear Medicine, is used to assess blood flow within the lungs. We evaluated the ratio between lung perfusion scan scans, chest x-ray and compared with the number of d-dimmer tests in patients with very low clinical probability of pulmonary embolism.

The purpose of this presentation is to review the diagnostic results in order to choose the most appropriate objective test for the diagnosis or exclusion of pulmonary embolism.

The Methods: One hundred and four (104) patients, who underwent a lung perfusion scan suspected of pulmonary embolism, were analysed from April 2017 to August 2019.

Results. The average age of the patients was 54.17 years; 59 (56.73%) were women, 45 (43.24%) were men. Fifty-five 55 (52.88%) of 104 patients had positive lung perfusions an results for pulmonary embolism, 33 (33.65%) had negative results, 9 (8.65%) were evaluated as suspicious, and 5 (4.8%) with non-typical perfusion defects. LA D-dimmer levels less than 250 ng/ml. were considered negative, and were found in 31 (29.81%), a positive D-dimmer result for Pulmonary Embolism (> 250 ng/mL), was found in 73 patients (70.19%) and had a sensitivity of 75.34% (interval 95% confidence interval, 0.29–0.97) and a negative predictive value of 88.57% (95% confidence interval, 0.62–0.98). We found a significant difference in D-dimmer levels in patients with an abnormal lung perfusion score (mean, 750 ng/mL) compared to patients with a normal lung perfusion score (mean, 250 ng/mL) (P = 0.01, X 2 test).

Discussion: Lung perfusion scan has the potential to become a first-line tool for the diagnosis of pulmonary embolism, especially in acute cases. Based on the standard technology and the new comprehensive criteria, and the assessment of the need for the required tests in these patients, it is imperative to make an early diagnosis of pulmonary embolism and the adequate interpretation. Without a doubt, treatment is fundamental.

Keywords: SPECT-Lungs with 99mTc-LyMAA; E-cam Dual Head Gamma Camera; D-dimmer

Introduction

Pulmonary embolism is usually caused by the sudden complete or partial blockage of an artery or several arteries of the lungs, due to a blood clot that usually originates in the deep venous system of the lower extremities, preventing blood flow to the segments certain lung. Clots can be of different sizes and numbers, and the larger the clot and if we have more than one clot, the greater the risk of sudden death.

Incidence

The estimated number of Americans who die from pulmonary thromboembolism (PE) ranges from 60,000 to 100,000, and 10-30% of people die within the first month after diagnosis.

Although clinical signs and symptoms allow the clinician to determine the pre-test probability of a patient with pulmonary embolism-EP (PE), they are insufficient to diagnose or rule out the condition [1]. The diagnosis of EP can be aided by d-dimmer analysis, pulmonary arteriography, CT pulmonary angiography (CTPA) and ventilation-perfusion (V/Q) or only perfusion (Q) scanning when we also have a lung graph. Despite recent advances, however, mortality from pulmonary embolic disease has remained unchanged over the past 25 years [2].

Undiagnosed PE could be fatal in up to 25% of patients [3] therapy carries a risk of bleeding [4].

The proposed clinical criteria according to the Wells score and the Geneva score, which are clinical prediction rules intended to risk stratify persons with suspected PE [5].

Clinical reasoning as well as disease history, symptoms, findings on physical examination and clinical assessment of probability is the basic principles in making decisions to perform medical imaging.

Methods and analysis

Patient selection: random patients from the Emergency Clinic, some after CABG and pre-suspected patients. Clinical setting criteria such as clinical probability for PE, additional testing including D-dimmer, chest x-ray, in some cases CT- angio were obtained.

Radiopharmaceuticals and lung perfusion scanning technique

Macro aggregated albumin (MAA 99mTc) was used where more than 90% of the injected particles measured between 10 and 90 μm, with a diagnostic dose of 3 mCi.

The SPECT study has been modified in the form of Rapid Statics of Lung Perfusion, worked with Siemens type gamma camera with two heads, detectors with LEHR, matrix size: 126x126, Zoom: 1.00, Both Detector, Starting Angle: 0; Detector Configuration:180, Orbit-noncircular; Mode- Step and Shut; Number of Views 4x2=8, and we get 8 views in total.

Segmental or lobar perfusion defects of acute pulmonary embolism ("PE") disease are classically wedge-shaped.

According to the modified PIOPED criteria, a Q-scan must show at least 2 "large" or segmental wedge-shaped defects that are discordant (meaning no correlation with the wedge-shaped defects on the Ventilation perfusion scan or X-ray chest) to be interpreted as "high probability for acute EP (Figure 1).

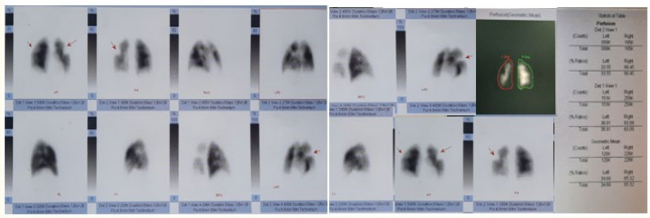


Figure 1: Scans show lack of perfusion in some segments of the lungs, which is characteristic of pulmonary embolism. Wedge-shaped defects suggest that the affected parts of the lungs are not receiving adequate blood supply, which may be caused by a blockage in the pulmonary arteries.

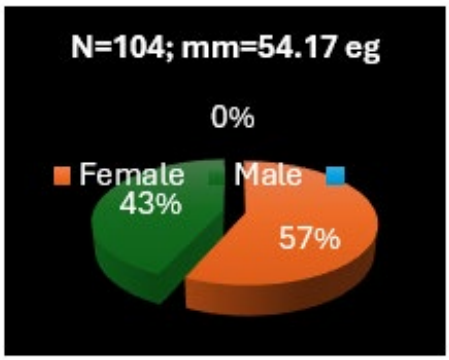
Presentation

104 patients who underwent lung perfusion scanning suspected of pulmonary embolism were analysed from April 2017 to August 2019

- The mean age of the patients was 54.17 years;
- 59 (56.73%) were female, 45 (43.24%) male (Figure a and graphic 1).

patient	No	%	mm
Female	59	56.73	55.25
Male	45	43.24	52.76
Total	104	100	54.17

Figure a



Graphic 1

Results

55 (52.88%) of 104 patients had positive lung perfusion scan results for pulmonary embolism, 35 (33.65%) had negative results, 9 (8.65%) were suspected, and 5 (4.8%) with non-typical perfusion defects.

D dimmer levels less than 250 ng/ml. were considered negative and were found in 31 (29.81%).

A positive D dimmer result for pulmonary embolism (> 250 ng/mL) was found in 73 patients (70.19%).

Had a sensitivity of (94.80%) 75.34% (range).-95% confidence interval, 0.29-0.97, and a negative predictive value of 88.57% (95% confidence interval, 0.62-0.98) (figure b).

female/male	No=104/PTE	%	D-dimer	%	RTg	%
PTE+	55/60	52.88	73	70.19	2	1.92
PTE-	35	33.65	31	29.81	89	85.57
PTE suspp	9	8.65	0	0	8	7.69
Effussion	2	1.92	0	0	2	1.92
Not typical	3	2.88	0	0	3	2.88

Figure b

Calculate Sensitivity, Specificity, PPV, and NPV

- Out of 104 patients, 60 of them sick, of them:
- 55 + (true positive); 2- (falls negative); Out of 44 healthy, we have:
- 35 – (True negative)
- 12 + (12 positive falls), of which 5 are not typical, 4 positive falls remain:
- The sensitivity was about 96.47%,
- The percentage of specificity in 89.79%, and
- Positive predictive value in 93.22%.
- The negative predictive value was about 94.59%
- The confidence interval was: 93.22%/94.59%=98.55%; (Figure c).

enter: Calculate Sensitivity, Specificity, PPV, and NPV	
positive	
True positive	55
False negative	2
reliability interval	98.03%
Negative	
False positive	4
True negative	35
reliability interval	98.55%
Output: (do not edit fields below)	**LPS**
Sensitivity	96.47%
Specificity	89.79%
Positive predictive value	93.22%
Negative predictive value	94.59%

Figure c

In the Prospective Investigational Study of Acute Pulmonary Acceleration Diagnosis (PISA-PED), which used perfusion scanning only in conjunction with chest radiography, the sensitivity and specificity of scintigraphy were 92% and 87%, respectively (Figure d).

LPS	No=23	%
PTE +	11	47.82
PTE -	9	39.13
PTE suspp	3	13.04

CT A	No=23	%
PTE +	8	34.78
PTE -	12	52.17
PTE suspp	3	13.04

D dimer	No=23	%
<200	2	8.69
200-1000	12	52.17
>1000	9	39.13

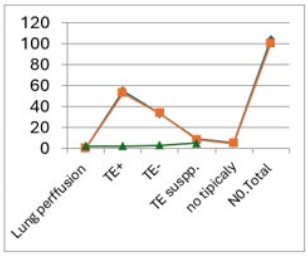


Figure d

Less than 1% of patients with EP are asymptomatic, and at least one symptom of chest pain—sudden onset dyspnoea, pallor/syncope, or haemoptysis—is present in 94% of patients with EP. (6).

Clinical features of EP have poor positive predictive value (PPV) when used alone.

Discussion

The pre-test probability is based on the Wells deep vein thrombosis score, the Wells EP score, or the revised Geneva score, followed by laboratory or imaging testing. In patients in whom deep vein thrombosis (DVT) or EP is considered possible based on clinical outcome, imaging is recommended without the step of intermediate D-dimmer testing [5].

After formulating the pre-test clinical probability of EP pulmonary embolism in a patient, CTPA is usually the next test that may be the first test to perform [7,8], in specific circumstances may allow alternatives to this approach. In deciding between perfusion (Q) scans and CTPA, a number of factors must be considered. The availability of physical and human resources in the medical institution usually dictates the choice of diagnostic test, and it should be noted that patients with obstructive pulmonary disease and those with abnormal chest radiographs are more likely to have perfusion scans (Q)(Scintigraphy lung perfusion) non-diagnostic [9].

Because most patients with chest pain suggestive of pulmonary embolism EP end up with other or nonspecific diagnoses, CTPA is useful in that it allows the determination of other pathologies. Indeed, in one study, CTPA found alternative diagnoses in more than 50% of patients evaluated by CTPA for EP [10].

A normal perfusion (Q) scan by definition should be with a homogeneous distribution of the radiopharmaceutical without any perfusion abnormalities and should not have true lung perfusion defects [11].

Criteria for interpretation

Two sets of criteria require only a perfusion (Q) scan and chest x-ray [12]. According to Parker JA., *et al*.

The clinical probability of pulmonary embolism (PE) should be considered when factoring in Q lung perfusion scan interpretations as pre-imaging probability affects the accuracy of interpretation.

Wells Criteria for Pulmonary Embolism-Objectifies the risk of pulmonary embolism. The Wells score has been validated many times in many clinical settings [5,13].

Conclusion

Lung perfusion scintigraphy has the potential to become a first-line tool for the diagnosis of pulmonary embolism, especially in acute cases. Based on the standard technology and the new comprehensive criteria, and the assessment of the need for the required tests in these patients, it is imperative to make an early diagnosis of pulmonary thromboembolism and the adequate interpretation. The obtained results confirm the effectiveness of the proposed method in the detection of pulmonary embolism.

Without a doubt, treatment is fundamental.

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