

Reduction of inconclusive results in the evaluation of pulmonary embolism with ventilation and perfusion lung scintigraphy using SPECT-CT – Experience of a tertiary cardiology hospital

Authors: Fernanda Salomão, Maria Marta Sabra, Gabriela Sadeck, Isabella Palazzo, Jader C Azevedo, Nilton Lavatori, Claudio Tinoco e Alan Cotrado

Abstract:

Pulmonary embolism is a common condition and can be detected by radiologic and nuclear images. About nuclear images there are two well-known methods for this purpose, being one the classic scintigraphy and the other the hybrid image – SPECT CT which is not so available. This study was designed to prove SPECT CT images, using PLOPED SPECT, is superior to planar images analyzed by Modified PLOPED and show how SPECT CT images can solve inconclusive results. For this, we studied images from 30 patients that were separately analyzed by the same observer and used mathematic methods to test both test, using European classification as pattern. Our conclusion proved SPECT CT is superior than planar images to valuate pulmonary embolism.

Introduction:

Pulmonary thromboembolism is a common condition, with variable presentation/severity. Precocity diagnosis and a well indicated and fast begin of the anticoagulation therapy can reduce mortality and morbidity. V/Q scan is one of the best methods to study patients with preserved hemodynamic stability. It is cited, in different sources, as method of choice to patients as: morbidly obese, pregnant, renal failure and allergic to iodine contrast - common scenario in tertiary centers, as ours.

V/Q scan has high sensibility, although low specificity, with best accuracy in patients with regular thorax XR and its use was reaffirmed with "Prospective Investigation of Pulmonary Embolism Diagnosis II" study (PLOPED II), which classified the image as normal, low probability, medium probability and high probability, literature confirms that normal results or high probability are enough to close the diagnosis, but when results are low or medium probability, scintigraphy is not enough and this is most part of the cases.

To solve this cases, we are able to associate low dose SPECT CT, this association is even more accurate than angiography. It differs the normal perfusion images than normalized images because of perfused area overlap and so show more and smaller lesions, demonstrating higher sensibility and specificity – consequently accuracy. Moreover, we can diagnose differences causes of hypoperfusion, studying the CT.

We compared planar images with SPECT CT images using the final report as pattern.

Materials e methods:

We made an observational, retrospective, unicentric clinical trial, including 50 patients (23 women), selected between January 1st 2013 and January 30 2015, ages between 30-92 year old, comparing SPECT to planar images. Images were acquired in a Symbia T2 scintigraphy dual-head gamma camera (Siemens®), planar inhalations scan were obtained with 8 projections with a 256X256 matrix, while inhalation SPECT with 64 projections were obtained with 20 seconds for projection, in a 128X128 matrix and planar perfusion scan also with 8 projections is done with 700Kcts for each position, SPECT with 64 projections were obtained with 10 seconds for projection, in a 128X128 matrix. Low dose CT where performed free breathing, with 2,5mm slice thickness, 110kV tube voltage and 30mAs tube current.

Modified PLOPED, PLOPED SPECT, PISAPED and European to analyze the images.

The images were analyzed by the same observer to evaluate the differences of the two complementary methods. Pattern was the emitted report that evolved the two methods and is always seen by three observers.

Results:

31 patient's exams were reviewed to compare planar images to SPECT CT images, using European classification as pattern.

Comparing Modified PLOPED to European using Fisher test we achieved $p < 0,05$, followed by the Qui Quadrante test when we find a sensibility = 78% and specificity = 82%. Comparing PLOPED SPECT to European using Fisher test the $p = 0$, since there are no false negatives for this test, meanwhile Qui Quadrante test showed sensibility = 100% and specificity = 88%.

Confronting both studied methods, using now PLOPED SPECT as the pattern, the sensibility of Modified PLOPED reduces to 68% which leads to an evolution of the nuclear methods.

Conclusion:

We conclude that hybrid SPECT/CT imaging has a high diagnostic efficacy in the diagnosis of PE. Lung perfusion scintigraphy performed with a hybrid SPECT/CT device has clearly higher sensitivity and specificity than scanning performed with the planar or SPECT alone technique, reducing inconclusive results, which was a problem to assistant doctors.

References:

Mortensen J, Gutte H. SPECT/CT and pulmonary embolism. *Eur J Nucl Med Mol Imaging*. 2014; 41(Suppl 1): 81–90. Published online 2013 Nov 9.

Miles S; Rogers KM; Thomas P, Soans B, Attia J, Abel C, Holt E, D'Este AC, Hensley MJ. A Comparison of Single-Photon Emission CT Lung Scintigraphy and CT Pulmonary Angiography for the Diagnosis of Pulmonary Embolism. *CHEST* 2009; 136:1546–1553

Gutte H, Mortensen J, Jensen CV, von der Recke P. Comparison of V/Q SPECT and planar V/Q lung scintigraphy in diagnosing acute pulmonary embolism. *Nucl Med Commun* 31:82–86_c 2010

