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Original Article

Probability Scores and Diagnostic Algorithms in Pulmonary Embolism: Are They Followed in Clinical Practice?☆,☆☆

Pilar Sanjuán,[a] Nuria Rodríguez-Núñez,[a] Carlos Rábade,[a] Adriana Lama,[a] Lucía Ferreiro,[a] Francisco Javier González-Barcala,[a,b] José Manuel Álvarez-Dobaño,[a,b] María Elena Toubes,[a] Antonio Golpe,[a,b] Luis Valdés[a,b,*]

[a] Servicio de Neumología, Complejo Hospitalario Clínico-Universitario de Santiago, Santiago de Compostela, Spain
[b] Grupo Interdisciplinar de Investigación en Neumología, Instituto de Investigaciones Sanitarias de Santiago (IDIS), Santiago de Compostela, Spain

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ABSTRACT

Introduction: Clinical probability scores (CPS) determine the pre-test probability of pulmonary embolism (PE) and assess the need for the tests required in these patients. Our objective is to investigate if PE is diagnosed according to clinical practice guidelines.
Materials and methods: Retrospective study of clinically suspected PE in the emergency department between January 2010 and December 2012. A D-dimer value ≥500 ng/ml was considered positive. PE was diagnosed on the basis of the multislice computed tomography angiography and, to a lesser extent, with other imaging techniques. The CPS used was the revised Geneva scoring system.
Results: There were 3924 cases of suspected PE (56% female). Diagnosis was determined in 360 patients (9.2%) and the incidence was 30.6 cases per 100 000 inhabitants/year. Sensitivity and the negative predictive value of the D-dimer test were 98.7% and 99.2% respectively. CPS was calculated in only 24 cases (0.6%) and diagnostic algorithms were not followed in 2125 patients (54.2%): in 682 (17.4%) because clinical probability could not be estimated and in 482 (37.6%), 852 (46.4%) and 109 (87.9%) with low, intermediate and high clinical probability, respectively, because the diagnostic algorithms for these probabilities were not applied.
Conclusions: CPS are rarely calculated in the diagnosis of PE and the diagnostic algorithm is rarely used in clinical practice. This may result in procedures with potential significant side effects being unnecessarily performed or a high risk of underdiagnosis.

Escalas de probabilidad clínica y algoritmo diagnóstico en la embolia pulmonar: ¿se siguen en la práctica clínica?

Palabras clave:
Embolia pulmonar
Escalas de probabilidad clínica
Algoritmo diagnóstico
Dímero-D
Angiotomografía computarizada multicorte

RESUMEN

Introducción: Las escalas de probabilidad clínica (EPC) determinan la probabilidad pretest de embolia pulmonar (EP) y valoran la necesidad de las pruebas a realizar en estos pacientes. Nuestro objetivo es investigar si el diagnóstico de EP se realiza de acuerdo a las guías de práctica clínica.
Material y métodos: Estudio retrospectivo de las sospechas clínicas de EP en el servicio de urgencias entre enero de 2010 y diciembre de 2012. Se consideró positivo un dímero-D ≥ 500 ng/ml. El diagnóstico de EP se hizo en función de la angiotomografía computarizada multicorte y, en menor medida, por otras técnicas de imagen. La EPC utilizada fue la de Ginebra revisada.

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* Corresponding author.
E-mail address: luis.valdes@mundo-r.com (L. Valdés).

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Resultados: Las sospechas de EP fueron 3.924 (56% mujeres). El diagnóstico se estableció en 360 pacientes (9,2%) y la incidencia fue de 30,6 casos/100.000 habitantes/año. La sensibilidad y valor predictivo negativo del dímero-D fueron 98,7 y 99,2% respectivamente. La EPC solamente se calculó en 24 casos (0,6%) y los algoritmos diagnósticos no se siguieron en 2.125 pacientes (54,2%): en 682 (17,4%) porque no se pudo estimar la probabilidad clínica y en 482 (37,6%), 852 (46,4%) y 109 (87,9%) con probabilidad clínica baja, intermedia y alta respectivamente, porque no se aplicaron los algoritmos diagnósticos para tales probabilidades.

Conclusiones: Las EPC para el diagnóstico de la EP raramente se calculan y el seguimiento del algoritmo diagnóstico en la práctica clínica es bajo. Esto puede ocasionar el realizar técnicas innecesarias que pueden dar lugar a importantes efectos secundarios, o a incurrir en un elevado riesgo de infradiagnóstico.

Introduction

Clinical probability scores (CPS) are reliable, noninvasive tools that, based on history and clinical findings, determine pretest probability and assess the need to perform various diagnostic tests in patients with suspected pulmonary embolism (PE).

Different CPS models, including the Geneva revised score, have been validated for PE diagnosis.[1–4] These scores, used as part of a diagnostic algorithm in combination with the determination of D-dimer (DD) levels, may help exclude PE in low risk groups and make further tests to rule out this diagnosis unnecessary.[5–12] Although it is well accepted that imaging tests should only be carried out when there is a high clinical probability (CP) of PE,[10,12] guidelines are clearly not followed, and multislice computed tomography angiography (MSCT) of lung or ventilation-perfusion scintigraphy (V/Q scan) is performed as a first step in PE diagnosis.[9,11] Thus, several studies in recent years have shown positivity rates in MSCT of less than 10% in patients with suspected PE,[13–16] while prospective clinical trials conducted two decades ago, in which pretest clinical evaluations were carried out before V/Q scan, revealed the disease in at least one third of the patients.[17,18] These results suggest overuse of the technique, and possibly poor selection criteria. The probability of confirming positive PE on MSCT in patients without risk factors is extremely small (0.95%). Therefore, it seems that MSCT is probably unnecessary in this scenario,[19] and the indiscriminate use of MSCT raises concerns regarding increased exposure to radiation.[9]

Our hypothesis is that CPS are poorly implemented in practice, and diagnostic protocols are not being applied. The objectives of this study were to determine the degree of compliance with CPS and diagnostic algorithms in clinical practice in our hospital in cases of suspected PE.

Materials and Methods

Patient Selection

The clinical records of patients attending the emergency department (ED) of a tertiary hospital, serving a population of 392 359 inhabitants, for suspected PE were retrospectively reviewed. The study period was from January 2010 to December 2012. The search was made, focusing on DD and MSCT requests from the ED. Tests requested for suspected deep vein thrombosis or causes other than suspected PE were excluded.

We evaluated whether the revised Geneva CPS had been applied to these patients during the diagnostic process, or whether the necessary data were available in the medical record for *a posteriori* calculation (Table 1).[4] Once the CPS was calculated, it was determined whether the adequate diagnostic algorithm had been followed.[20]

Table 1
Revised Geneva Score.

Variable	Score
Predisposing factors	
Age>65 years	+1
Previous DVT or PE	+3
Fracture or surgery in the previous month	+2
Active malignancy	+2
Symptoms	
Unilateral leg pain	+3
Hemoptysis	+2
Clinical signs	
Heart rate	
75–94 bpm	+3
≥95 bpm	+5
Pain in deep veins of lower limbs on palpation and unilateral edema	+4
Total clinical probability	
Low	0–3
Intermediate	4–10
High	≥11

PE, pulmonary embolism; DVT, deep venous thrombosis; bpm, beats per minute.

Definition of Pulmonary Embolism

PE diagnosis was established by high probability results in a V/Q scan (according to PIOPED study criteria: two or more large segmental perfusion defects [>75% of a segment] without abnormalities in the V/Q scan or chest X-ray or defects substantially greater than the ventilation defects or concurrent radiological abnormalities; two or more moderate segmental perfusion defects [>25% and ≤75% of a segment] without concurrent scan abnormalities in the V/Q scan or chest X-ray, with a large non-concurrent segmental defect perfusion; four or more moderate segmental perfusion defects without changes in the V/Q scan or chest X-ray)[17]; by compression ultrasonography of the lower limbs, showing proximal deep venous thrombosis in patients with non-diagnostic findings in V/Q scan[21]; or diagnostic chest MSCT.[22] V/Q scan was performed only if there was a risk of contrast nephropathy when performing MSCT[23] (serum creatinine >1.3 mg/dl, normal range: 0.4–1.1 mg/dl).

D-dimer Analysis

DD in serum was determined using D-Dimer HemosIL HS 500 (Instrumentation Laboratory, Milan, Italy), an immunoassay based on latex particles automated in the ACL TOP 700 (Instrumentation Laboratory, Milan, Italy) (turbidimetric immunoassay). Cutoff for DD was 500 ng/ml. The sensitivity and negative predictive value of this test for all CP subsets is 100%, and the lower limit