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ORIGINAL ARTICLE

Clinical probability of pulmonary embolism: Comparison of different scoring systems

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KEYWORDS

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Abstract Pulmonary embolism is one of the greatest diagnostic challenges in emergency medicine and clinical probability assessment is a fundamental step in its diagnosis.

Aim: To evaluate the role of estimating clinical probability of pulmonary embolism and to compare between different pre-test probability scoring systems as regards their sensitivity and specificity.

Patients and methods: We used seven scoring systems (original Geneva score, revised Geneva score, simplified Geneva score, Wells score, simplified Wells score, simplified Charlotte rule, Pisa model) to assess the clinical probability of PE in 41 patients with suspected pulmonary embolism for whom the final diagnosis was based on multislice CT pulmonary angiography (CTPA).

Results: Twenty-four patients (58.5%) had pulmonary embolism. The scores with the strongest correlation with the result of CTPA were the Pisa model ($P \leq 0.001$) followed by the original Geneva score and the Wells score ($P \leq 0.01$). Simplified Wells score had the highest sensitivity (0.92), Pisa model had the highest specificity (0.82) and the highest overall accuracy (0.76).

Conclusion: For most patients, clinical probability assessment is an easy and effective way to decide which patient should undergo further investigations. Among the studied seven scores, the Pisa model has the best correlation with the CTPA results and it has a good sensitivity, specificity, positive and negative predictive values and the highest overall accuracy.

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Introduction

Suspected acute pulmonary embolism (PE) is a common cause for acute hospital attendance and admission. Clinical assessment is necessary to estimate a pre-test probability of PE and determine what (if any) diagnostic testing is required. Clinical assessment may be used in an unstructured manner to generate a pre-test estimate of probability or may be used in a formal clinical probability score to categorize patients into (typically) low, intermediate or high-risk groups [1].

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The main challenge in the diagnostic workup of patients with clinically suspected pulmonary embolism is to accurately and rapidly distinguish the approximately 25% of patients who have the disease and require anticoagulant treatment from the 75% who do not [2,3].

Aim

The aim of this study was to evaluate the role of estimating clinical probability of pulmonary embolism and to compare between different pre-test probability scoring systems as regards their sensitivity and specificity.

Patients and methods

The present study included 41 patients with suspected pulmonary embolism admitted to chest department, Menoufiya University hospitals in the period from February 2011 to April 2012. After having an informed consent from the patients, they underwent history taking, clinical examination, radiographic examination of the chest (P-A view), ECG, echocardiography and arterial blood gases. Multislice CT angiography of the chest was used to confirm or exclude the diagnosis of PE.

Different probability scores for pulmonary embolism were calculated for each patient.

The original Geneva score (Wicki criteria): [4]

The revised Geneva score: [5]

The simplified Geneva score [6]

Wells score: [7]

Table 1 The original Geneva score.

Variable	Score
<i>Age</i>	
60–79 years	1
80+ years	2
<i>Previous venous thromboembolism</i>	
Previous DVT or PE	2
<i>Previous surgery</i>	
Recent surgery within 4 weeks	3
<i>Heart rate</i>	
Heart rate > 100 beats per minute	1
<i>PaCO₂ (partial pressure of CO₂ in arterial blood)</i>	
< 35 mm Hg	2
35–39 mm Hg	1
<i>PaO₂ (partial pressure of O₂ in arterial blood)</i>	
< 49 mm Hg	4
49–59 mm Hg	3
60–71 mm Hg	2
72–82 mm Hg	1
<i>Chest X-ray findings</i>	
Band atelectasis	1
Elevation of hemidiaphragm	1

< 5 Points indicates a low probability of PE.

5–8 Points indicates a moderate probability of PE.

> 8 Points indicates a high probability of PE.

Simplified Wells score [6]

As the simplified Geneva score, the simplified Wells scoring system replaced the weighted scores for each parameter with a 1 point score for each parameter present. PE is considered unlikely if the score is ≤ 1 and is likely if the score is > 1 (Table 1–4).

Simplified Charlotte rule [8]

If any two boxes are checked the patient is considered high risk.

- Age > 50.
- HR > systolic blood pressure (SBP).
- Surgery in the past month.
- Unilateral leg swelling.
- Hemoptysis.
- Unexplained room air pulse oximetry < 95%.

Pisa model: [9]

The model includes 10 variables positively associated with PE and six variables negatively associated with PE. Positive variables are older age (57–67 years, 68–74 years, 75 years and older), male gender, immobilization, history of deep venous thrombosis, sudden onset of dyspnea, chest pain, fainting or syncope, hemoptysis, unilateral leg swelling, and ECG with acute cor pulmonale. Negative variables are history of cardiovascular disease, history of pulmonary disease, orthopnea, fever $> 38^{\circ}\text{C}$ (100.4°F), wheezes, and crackles. Two calculators based on the Pisa model are available online. One calculator model uses chest X-ray findings (Pisa model 1) [10] or [11]. The other model does not need chest X-ray findings (Pisa model 2) (we used this model) [12] or [13], the score is calculated as a percentage and the probability of PE is classified as follows:

Slight risk if score ≤ 10 , moderate risk if score = 11–50, substantial risk if score = 51–80 and high risk if score ≥ 80 .

Statistical analysis

Data were analyzed using SPSS 16, Spearman's correlation was used for non parametric data. Sensitivity is defined as the proportion of patients classified as having PE among those

Table 2 The revised Geneva score.

Variable	Score
Age 65 years or over	1
Previous DVT or PE	3
Surgery or fracture within 1 month	2
Active malignant condition	2
Unilateral lower limb pain	3
Haemoptysis	2
Heart rate 75–94 beats per minute	3
Heart rate 95 or more beats per minute	5
Pain on deep palpation of lower limb and unilateral edema	4

0–3 Points indicates low probability.

4–10 Points indicates intermediate probability.

11 Points or more indicates high probability.

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