



PULMONARY EMBOLISM: LOOKING BEYOND WELL'S SCORE

Cardiology

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ABSTRACT

Background: Pulmonary embolism is known as the great masquerader as it has a wide range of clinical manifestations and thus, its diagnosis is often missed despite it being a fatal medical emergency. Clinical prediction rules such as the Wells score have been traditionally used for assessing probability of embolism however, they have poor sensitivity and specificity as it is subjective. Other less commonly used prediction rules are the modified Geneva score. There are limited scores comparing these scoring systems in different clinical settings. **Objectives:** To understand the differences in clinical features, ECG and echocardiography findings in patients with CTPA proven pulmonary embolism with a low and high Modified Wells score and to determine whether Geneva score and pulmonary embolism rule out criteria are better tools to assess pre -test probability in patients with a low Well's score **Methods:** After ethical committee clearance, 64 patients who provided informed consent with CTPA proven pulmonary embolism were assessed for their symptoms, associated medical conditions, CTPA and 2D echo findings and ECG changes. Well's score and Geneva score were applied for risk assessment. **Results:** 42% patients had Well's score <4 and a statistically significant difference was seen in presence of fever in low Wells score group and leg pain, difficulty in breathing and DVT in the high Wells score group. 85% of patients with low Wells score had intermediate to high probability using Geneva score while all patients with a high Wells score had a high probability of pulmonary embolism using the Geneva score. All patients were ruled in via pulmonary embolism rule out criteria. **Conclusion:** Pulmonary embolism affects people of all ages with a wide range of clinical manifestations. Well's score which is commonly used for risk prediction has several limitations especially in cases without classical risk factors. In the presence of fever or inflammatory conditions and absence of DVT, the Geneva score is a better diagnostic tool and is also less subjective.

KEYWORDS

Pulmonary embolism, Well's score, Geneva Score

INTRODUCTION:

Pulmonary thromboembolism is a relatively common and potentially fatal medical emergency. Pulmonary embolism (PE) and deep venous thrombosis (DVT) exist on the spectrum of venous thromboembolic disease (VTE). It is the third most common cardiovascular disease after acute coronary syndrome and stroke, with an incidence rate of 112 cases per 100,000 in the general population. More than 100,000 deaths are attributed to pulmonary embolism in USA annually.¹ There are limited data with regard to PE, its management and associated complications in India. Studies in the Indian context have reported an incidence of 22 per 10,000 hospital admissions.²

Pulmonary embolism is known as "Great Masquerader" due to its wide range of clinical manifestations. Clinical signs and symptoms are often non specific and laboratory investigations give non specific results. Hence, cases go undiagnosed leading to misdiagnosis and death. Inaccurate estimates of pulmonary embolism prevalence might, in part, be attributable to under recognition of atypical presentations of this disorder.³ With the improvement in diagnostic techniques the incidence of pulmonary embolism is increasing as well as our understanding of the spectrum of clinical manifestations it presents with. Traditionally diagnosis of Pulmonary thromboembolism was based on Wells scoring system which is also the most common tool to assess the pre -test probability of pulmonary embolism. A score of greater than 4 indicated a high probability of pulmonary embolism. sensitivity of high Wells score was 43%, specificity 78%, positive predictive value 66% and negative predictive value 59%.⁴

The Geneva score is another scoring system that is used to rule-in pulmonary embolism.

A study done by Ceriani et al showed the prevalence of pulmonary embolism with a low, intermediate and high Revised Geneva score was 9%, 26% and 76% respectively.⁵

The pulmonary embolism rule-out criteria (PERC) rule is an 8-item criteria that comprises arterial oxygen saturation (SpO₂) of 94% or less, unilateral leg swelling, pulse rate of at least 100/min, haemoptysis, age of 50 years or older, prior PE or deep venous thrombosis (DVT) recent trauma or surgery, and exogenous oestrogen use. If all are absent, pulmonary embolism is excluded. The prevalence of PE is less than 1% in PERC-negative patients.

PERC has poor specificity (around 23%) and cannot be used alone to justify further testing especially in a low resource setting.⁶

Thus, there is a need to understand the limitations of these scoring systems and develop alternative models to predict the risk of embolism especially in patients with atypical presentations of the disease.

Aims And Objective Of The Study:

1. To compare the clinical features, ECG and echocardiography findings in patients with CTPA proven pulmonary embolism with a Low and high Modified Wells score.
2. To ascertain whether the Geneva score is better to rule in pulmonary embolism compared to the Wells score

Methodology:

Source Of Data

The present data was conducted on patients attending to hospitals attached to Bangalore Medical College and Research Institute, Bangalore.

Study Design: Descriptive study

Study Period: August 2022 to January 2024

Place Of Study: Hospitals attached to Bangalore Medical College and Research Institute, Bangalore

Inclusion Criteria:

- Age >18 years
- Informed consent
- All patients with a CT pulmonary angiogram diagnosis of Pulmonary thromboembolism

Exclusion Criteria:

- Patients who do not provide informed consent for participation in the study.
- Age <18 years

Sample Size:64.

All Participants will be assessed for

- Demographic data
- Risk factors including history of COVID 19 and vaccination status
- **Clinical Features:** cough, dyspnoea, chest pain, syncope, fever, others
- **ECG changes:** Sinus tachycardia, Right ventricular strain, S1Q3T3, RBBB
- CT thorax findings
- **2D echo:** PAH, Right ventricular dysfunction, thrombus in right atrium, pulmonary artery hypertension, Ejection Fraction

- Venous doppler for evidence of DVT
- D-dimer
- Wells score

The patients were divided into 2 subgroups: Well's score <4 and >4 and a subgroup analysis was carried out with respect to above variables using SPSS. For the patients with a low Wells score Geneva score was calculated to test for improvement in diagnostic accuracy.

RESULTS:

The mean age of presentation was 50 years. 39.1% were below the age of 45 years, 35.9% were aged between 45 to 65 years and only 25% were above the age of 65. 52% were female. The most common symptom was dyspnoea (95.31%) cases followed by pedal oedema (48.43%), cough (39.06%), fever (21.87%) leg pain (15.62%), haemoptysis (7.81%) and abdominal pain (6.25%). Past history of venous thromboembolism and infection were the most common risk factors seen in 15.6 % cases each followed by malignancy in 9.4%.

All patients had pulmonary artery hypertension and 31.2% had severe PAH. Sinus tachycardia was the most common ECG finding seen in 68%.

In the study population 27 patients had a Well's score <4 and 37 patients had a Well's score >4. There is no significant difference in age and gender in the two groups.

Table 1: Difference in the clinical features in those with Well's score >4 and <4.

	Wells score<4 (n=27)		Wells score≥4 (n=37)		p-value
	Yes	No	Yes	No	
Dyspnoea	88.9% (n=24)	11.11% (n=3)	100% (n=37)	0% (n=0)	0.04
Chest pain	22.22% (n=6)	77.78% (n=21)	18.92% (n=7)	81.08% (n=30)	0.74
Cough	51.85% (n=14)	48.15% (n=13)	29.73% (n=11)	70.27% (n=26)	0.07
Fever	33.33% (n=9)	66.67% (n=18)	13.51% (n=5)	86.49% (n=32)	0.05
Hemoptysis	7.41% (n=2)	92.59% (n=25)	8.11% (n=3)	91.89% (n=34)	0.91
Edema	37.04% (n=10)	62.96% (n=17)	56.76% (n=21)	43.24% (n=16)	0.12
Leg pain	0% (n=0)	100% (n=27)	27.03% (n=10)	72.97% (n=27)	0.003
Abdominal pain	3.7% (n=1)	96.3% (n=26)	8.11% (n=3)	91.89% (n=34)	0.47

A statistically significant difference was seen with patients with a high Well's score having symptoms of dyspnoea and leg pain. Presence of fever in patients with low Well's score was also significant.

Table 2: Difference in CTPA findings in those with Well's score >4 and <4.

	Wells score<4 (n=27)		Wells score≥4 (n=37)		P Value
	Yes	No	Yes	No	
Right Main PA	55.56% (n=15)	44.44% (n=12)	54.05% (n=20)	45.95% (n=17)	0.905
Left Main PA	40.74% (n=11)	59.26% (n=16)	48.65% (n=18)	51.35% (n=19)	0.530
Segmental arteries	62.96% (n=17)	37.04% (n=10)	70.27% (n=26)	29.73% (n=11)	0.539
Saddle embolus	0% (n=0)	100% (n=27)	2.7% (n=1)	97.3% (n=36)	0.389

There was no statistically significant difference in CTPA findings and echocardiography findings in patients with low and high Well's score.

Table 3: DVT screening in patients with Well's score >4 and <4

	Wells score<4 (n=27)		Wells score≥4 (n=37)		P value
	Positive	Negative	Positive	Negative	
DVT screening	3.7% (n=1)	96.3% (n=26)	56.76% (n=21)	43.24% (n=16)	<0.01

56.76% of patients with Well's score greater than 4 had DVT and this was statistically significant compared to 3.7% of patients with Well's

score less than 4 who had DVT.

Table 4: ECG changes in patients with Well's score >4 and <4.

	Wells score<4 (n=27)		Wells score≥4 (n=37)		P value
	Yes	No	Yes	No	
Sinus tachycardia	48.15% (n=13)	51.85% (n=14)	83.78% (n=31)	16.22% (n=6)	0.002
RBBB	25.93% (n=7)	74.07% (n=20)	16.22% (n=6)	83.78% (n=31)	0.34
Right axis deviation	18.52% (n=5)	81.48% (n=22)	16.22% (n=6)	83.78% (n=31)	0.809
P pulmonale	37.04% (n=10)	62.96% (n=17)	24.32% (n=9)	75.68% (n=28)	0.272
S1 Q3 T3	14.81% (n=4)	85.19% (n=23)	13.51% (n=5)	86.49% (n=32)	0.882

The percentage of patients with sinus tachycardia in the high Wells score group (83.78%) was significantly greater than those with a low Well's score (48.15%).

85.18% of cases with a low probability of pulmonary embolism with the Well's score had a moderate to high probability of embolism using the Geneva score.

DISCUSSION:

As pulmonary embolism has a wide range of clinical presentations, the pretest probability of having an embolism is assessed using prediction tools which combine clinical assessment and presence of risk factors. The most commonly used prediction rules is the Well's score.

In this study, 27 patients had a Well's score <4 and 37 patients had a Well's score >4. A subgroup analysis was carried out to compare the clinical features and investigations in both these groups. The presence of breathlessness and leg pain in the high Wells score group (>4) and the presence of fever in the low Well's score group was statistically significant. Radiological evidence of deep vein thrombosis was seen in 56.76% of patients with Well's score greater than 4 compared to 3.7% of patients with Well's score less than 4.

This finding is of importance as three points in the Well's score is given for pulmonary embolism being the primary diagnosis. Another three points are given for the presence of deep vein thrombosis. In patients with atypical manifestation of pulmonary embolism and those without symptoms of deep vein thrombosis (leg pain being an important complaint) Well's score becomes unreliable. Fever being an important complaint in the low Well's score group implies the role of underlying infection/inflammatory process in the development of pulmonary embolism in the absence of deep vein thrombosis.

Sinus tachycardia was seen in 83.78% with a high Well's score and in 48.15% of cases with a low Well's score. This was extremely significant (p<0.002). Tachycardia is another important component of the Well's score. The use of scores like the Revised Geneva score gives points to heart rate greater than 75 beats per minute and has more objective criteria was found to improve accuracy to diagnose pulmonary embolism. In this study, 85.18% of cases with a low probability of pulmonary embolism with the Well's score had a moderate to high probability of embolism using the Geneva score. A study done by Xiong et al which included 3168 cases of pulmonary embolism also demonstrated the superiority of the Revised Geneva score as it uses more objective measures especially in non- surgical patients.⁷

CONCLUSION:

Pulmonary embolism despite being a fatal emergency has multiple clinical manifestations its diagnosis is missed due to limitations in its scoring systems. Wells score though commonly used is subjective and has poor sensitivity in cases with atypical risk factors. In these situations, modified Geneva score was found to be more specific. There is a need to develop more comprehensive algorithms to rule in pulmonary embolism with atypical characteristics.

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