

A Retrospective Evaluation of Patients Admitted to Emergency Departments with Pulmonary Thromboembolism

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Abstract

Aim: To examine the clinical, radiological, and laboratory findings of pulmonary thromboembolism (PTE) patients who were admitted to our emergency department and to evaluate the effectiveness of clinical diagnosis scores.

Materials and Methods: We retrospectively evaluated 33 PTE patients who were referred to our emergency department.

Results: The mean age of the patients was 56.2±18.2 years. The female:male ratio was 1.5. The most common cause of complaints was dyspnoea (51.5%). Risk factors in the majority (39.3%) included immobilisation due to surgery. According to the Wells clinical scoring system, 29 patients (87.8%) had a high probability of PTE; however, 18 of the patients (55.5%) had high probability of PTE according to the modified Geneva score. The estimated rate ratio of high probability of PTE with the Wells score was statistically significant compared with the estimate rate ratio with the modified Geneva score ($p=0.017$). The most common clinical findings included tachypnoea (69.6%) and tachycardia (27.3%). Fifteen (45.4%) patients had pathologic chest X-ray findings. Computed tomographic (CT) angiography most often showed PTE placement of the bilateral pulmonary main branches. While standard low-molecular-weight heparin and warfarin treatment was administered to 27 (81.8%) patients, tissue plasminogen activator (tPA) treatment was administered to 6 (18.2%) patients.

Conclusion: The evaluation of clinical, laboratory and radiological findings together in PTE diagnosis is important. It is preferable to use the Wells score for the estimation of clinical probability in patients with suspected PTE. (*JAEM 2015; 14: 8-11*)

Key words: Emergency, pulmonary thromboembolism, treatment, diagnosis

Introduction

Pulmonary thromboembolism (PTE) is the obstruction of the pulmonary artery and/or its branches by thrombus or other agents such as air, fat, tumor cells, and septic materials (1, 2). PTE manifests itself as a complication of deep vein thrombosis (DVT) of the lower extremities and may sometimes become a fatal disease (1). It frequently results from venous thromboembolism (VTE) of deep leg veins and, albeit rarely, from pelvic, axillary, subclavian veins, and right cardiac problems (3, 4). Concurrence of DVT and PTE is called VTE. The average annual incidence of VTE is reported to be 70-113 /100.000 (5).

Risk factors for venous thromboembolism include acquired risk factors such as major surgical intervention, short-term immobilization, cancer, myocardial infarction, trauma, pregnancy, oral contraceptive use, hormone therapy, advanced age, obesity, smoking, inflammatory bowel disease, nephritic syndrome, and hyperviscosity as well as genetic disorders such as antithrombin III deficiency, protein C and

protein S deficiency, factor V Leiden mutation, prothrombin gene mutation, ACE gene insertion/deletion, Methylenetetrahydrofolate reductase (MTHFR), and high factor VIII levels (1, 5, 6). The diagnosis of PTE generally relies on clinical suspicion. This increases the importance of clinical risk factors for PTE. Therefore, clinical scoring methods which evaluate clinical symptoms and risk factors together are used for the determination of the diagnostic and treatment approaches (7).

In this study, clinical signs and symptoms, demographic data, risk factors, clinical scores, laboratory and radiological findings, and treatment outcomes of PTE cases admitted to the Emergency Department of Ondokuz Mayıs University Hospital were evaluated.

Materials and Methods

Of the 247 patients with suspected PTE admitted to the Emergency Department of Ondokuz Mayıs University Medical Faculty between January 2009 and January 2010, 33 cases diagnosed with PTE



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via CT angiography were examined retrospectively. Demographic characteristics of the patients, clinical symptoms and signs, risk factors, clinical scores, laboratory and radiological findings, treatment, and treatment outcomes were analyzed.

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) 15.0 and Minitab 15.0 programs. Results were expressed as n (%) and mean \pm standard deviation. The significance of the differences between estimation ratios of Wells and modified Geneva Test scores was analyzed using Fisher's exact test. A P value ≤ 0.05 was considered statistically significant.

Results

The mean age of the patients was 56.2 ± 18.2 years. Of these cases, 15 (45.4%) were ≥ 65 years. Of the 33 patients, 20 (60.6%) were female and 13 (39.6%) were male. The most common complaint on admission was shortness of breath (42.4%). Complaints on admission are shown in Table 1. Risk factors were as follows: malignancy in three cases (9.1%), history of PTE due to deep vein thrombosis in four cases (12.1%), and history of immobilization due to surgery in 13 cases (39.3%). Only seven (21.2%) cases had clinical findings of DVT. 75.8% of the patients (25/33) underwent venous Doppler ultrasonography. On venous Doppler ultrasonography of lower extremity, thrombosis was only detected in 10 (30.3%) patients. Six patients (18.2%) had no etiological risk factors. Advanced age was considered as a risk factor for 14 (45.4%) patients.

Arterial blood pressure values, physical examination findings, Wells and Geneva clinical test scores and blood gas results are shown in Table 2. Among clinical findings, 23 (69.6%) cases had tachypnea (>20 /min), nine (27.3%) had tachycardia, two (6.1%) had hypotension (systolic blood pressure <90 mmHg), and two (6.1%) had hypertension. Clinical conditions of the cases according to the Wells and modified Geneva test scores are shown in Table 3. High-probability PTE prediction ratio of Wells score was significantly higher than that of the modified Geneva test score ($p=0.017$). However, there was no significant difference between the Wells and modified Geneva scores in massive and submassive cases ($p=0.448$ and $p=0.735$, respectively). Only 15 (45.4%) patients had chest X-ray findings. The chest radiograph findings are shown in Table 4. On Computed tomography (CT) and angiography, PTE mostly displayed bilateral pulmonary artery branch localization. The CT angiography findings were shown in Table 5. Of the cases, five (15.2%) were massive and the remaining 28 (84.8%) were submassive PTE. Among echocardiographic findings, 12 patients (36.4%) had increases in pulmonary artery pressure, three (9.1%) patients had septal shift, and four (12.1%) had right ventricle dilatation. ECG record was available for only two patients. Of these, one had evidence for S1Q3T3.

Considering the treatment and follow-up outcomes of the patients with pulmonary thromboembolism, 27 (81.8%) patients received standard low-molecular-weight heparin + warfarin therapy, and six (18.2%) patients received tissue plasminogen activator (tPA) therapy. Of the patients receiving thrombolytic therapy, two were hypotensive while the other four cases were submassive PTE cases with extensive involvement findings on CT angiography. Twenty-six patients (78.8%) were hospitalized in Chest Diseases Service and seven (21.2%) cases were followed-up in the Emergency Department. No mortality was observed during the follow-up period.

Table 1. Complaints of patients

Symptoms	Number	(%)
Shortness of breath	14	42.4
Syncope	4	12.1
Leg pain	4	12.1
Chest pain	3	9.1
Pleuritic chest pain	3	9.1
Cough	2	6.1
Shortness of breath and hemoptysis	2	6.1
Shortness of breath and Chest pain and Syncope	1	3
Total	33	100

Table 2. Laboratory values and clinical scores of patients

Parameter	Result [mean \pm SD (min-max)]
Breathing rate/min	24.2 \pm 5.5 (12-40)
Pulse/min	94.9 \pm 18.3 (68-146)
Systolic TA	118.4 \pm 18.4 (80-160)
Diastolic TA	73.7 \pm 11.7 (50-100)
Ph	7.42 \pm 0.03 (7.36-7.50)
PaCO ₂	31.6 \pm 8.0 (19.3-54.5)
PaO ₂	83.3 \pm 37.2 (24-145)
Wells score	4.9 \pm 2.2 (0-9.0)
Geneva score	5.0 \pm 2.1 (2-9.0)

SD: standard deviation; min: minimum; max: maximum

Table 3. Clinical probability according to the modified Geneva score and Wells score distribution

Clinical probability	Wells score n (%)	Modified Geneva score n (%)
High	2 (6.1)	0
Moderate	2 (6.1)	15 (45.5)
Low	29 (87.8)	18 (55.5)

Discussion

Clinical diagnosis of pulmonary thromboembolism is quite difficult and it can be fatal if left untreated. Its incidence increases with age (300-500/100.000/year among population aged 70-79 years). The incidence of PTE is reported to be 70-113/100.000/year (5).

Epidemiological studies on PTE are scarce in our country. Although no gender difference has been reported, there are several publications indicating that PTE is more common in men (1, 8, 9). In addition, there may be ethnic and genetic predispositions (5, 10). Studies have revealed that the incidence of PTE is 2.5-4-fold less frequent in the Asian and Pacific states (10). Unlike the literature, PTE was more common in women in our study. This may be attributed to the ethnic and genetic predisposition of the people in our region. In Evliyagil et al.'s (11) study, PTE was found to be more common in

Table 4. Chest x-ray findings

Radiologic findings	n (%)
Normal	18 (55.5)
Pleural effusion	6 (18.2)
Focal infiltration	4 (12.1)
High diaphragm	2 (6.1)
Mediastinal width	2 (6.1)
Atelectasis	1 (3)

Table 5. The CT angiography findings of PTE

PTE localization	n (%)
Bilateral pulmonary artery	8 (24.2)
Bilateral pulmonary segmental branches	8 (24.2)
Right subsegmental pulmonary branche	6 (18.2)
Left subsegmental pulmonary branche	3 (9.1)
Right segmental pulmonary branche	3 (9.1)
Left segmental pulmonary branche	2 (6.1)
Right pulmonary artery	2 (6.1)
Left pulmonary artery	1 (3)
Total	33 (100)

CT: computed tomography; PTE: pulmonary thromboembolism

females. In our study, the age group of patients (aged ≥ 65) with PTE constitutes nearly half of the cases.

The great majority of pulmonary thromboembolism cases (75%) are due to the thrombus in deep leg veins (1, 12). Risk factors for PTE include both acquired and hereditary factors. Genetic risk factors include antithrombin III deficiency, which causes hypercoagulability, protein C and S deficiency, plasminogen deficiency, Factor VII deficiency, and Factor IX increase. Acquired factors include advanced age, history of major surgery in the last 3 months, cancer, nephrotic syndrome, oral contraceptive use, long travel history, trauma, pregnancy, and congestive heart failure (5, 7, 9, 13, 14). In addition, idiopathic causes (25%-50%) constitute a significant part of all risk factors. It was reported in several studies that cancer cases were responsible for the etiology of PTE with a rate of 15%-25%, and history of major surgery within the past 3 months was reported to be the cause of PTE (20%) (9, 13). In studies conducted in our country, causes of hypercoagulability were involved in the etiology at varying rates (0%-55%) (1). In addition, in Kiral et al.'s (15) study of 27 PTE cases, 37% of the cases had advanced age, 18.5% had surgical intervention, and 18.5% had heart disease risk factors. In Atikcan et al.'s (16) study of 42 PTE cases, history of DVT and abdominal surgery were found to be the most frequent risk factors for PTE. No risk factor was reported in 38% of the cases. In our study, the most frequent risk factor was the history of immobilization due to the surgery in the last 3 months (39.3%). Six (18.2%) patients had no risk factors in the etiology. Because our study is a retrospective one, the determination of the risk factors is quite difficult. In addition, the participants were the patients admitted to the emergency department and this makes identification of other etiologic factors difficult.

The clinical course of the disease varies by localization of the embolism, the accompanying diseases, and the age at onset of the

disease (11). In addition, the final diagnosis heavily relies on clinical suspicion. Therefore, those having clinical risk factors are diagnosed based on the presence of concomitant initial findings. PTE should be suspected if there is a presence of shortness of breath accompanied by tachycardia and without any finding on chest radiography (1). In studies conducted in the literature, shortness of breath (73%-85%), pleuritic chest pain (64%-85%), and cough (37%-53%) were reported as the most common clinical symptoms in patients without cardio-pulmonary disease (16). Consistent with the literature, shortness of breath (51.5%) was the most frequent finding in our study. Among clinical findings, tachypnea and tachycardia were the most common ones (17).

Clinical scores as well as symptoms and signs are used for the calculation of probability ratio in patients with suspected pulmonary thromboembolism. Classification of clinical scores as low, moderate and high facilitates the planning of diagnosis and treatment (1). The Wells and modified Geneva scoring are used for this purpose (7). In Perrier et al.'s (18) analysis of four angiography-controlled studies involving patients with suspected PTE (who were referred to the emergency department), the prevalence of PTE in patients with low, moderate, and high Wells and Geneva test scores were 10%, 30%-40%, and 67-81%, respectively. In our study, according to the Wells and modified Geneva scores, high probability ratios were 87.8% and 55.5%, respectively, suggesting that the Wells score is more sensitive in detecting the possibility of PTE. According to the Wells score, only two patients had low-probability PTE. The rate was lower than that in the literature. According to the modified Geneva score, there was no low-probability patient group. Although we have a high probability score of 88% according to the Wells score, the small number of patients in our study may have influenced the sensitivity. Therefore, further studies involving more patients are needed.

Clinical findings, diagnostic tests such as chest X-rays, biochemical tests (D-dimer), electrocardiography, echocardiography, and blood gas analysis are helpful but not sufficient to produce specificity (1). Although chest radiography is less effective in PTE diagnosis, it is useful for the exclusion of other lung diseases such as pneumonia, pneumothorax and contusion which are involved in the differential diagnosis. Other accompanying chest X-ray findings in PTE are atelectasis, pleural effusion, pleural-based opacity, diaphragmatic elevation, lack of local vascularization, and enlarged pulmonary artery (1). Spiral CT angiography and lung scintigraphy provide the highest diagnostic accuracy. In prospective studies conducted in recent years, spiral CT angiography has been shown to be more sensitive than the lung scintigraphy (19, 20). While negative predictive values of CT angiography in patients with low and moderate clinical probability were 96% and 89%, respectively, it was 60% in PTE suspected patients with high clinical probability (21). Furthermore, the ability to image vascular structures as well as other intrathoracic pathologies makes CT angiography superior to angiography (22). Conventional pulmonary angiography is the gold standard for the diagnosis of PTE. However, because it causes morbidity (0.5%) and mortality (1%) and the need for experienced personnel is present, its use is reduced. In our study, chest radiography findings were not detected in 55.5% of the patients. Pleural effusion was the most common finding. On CT angiography, PTE was most frequently localized in bilateral main pulmonary and segmental branches.

Treatment options for pulmonary thromboembolism involve three different approaches: (1) anticoagulant treatment with unfrac-

tionated heparin, low-molecular-weight heparin, thrombin inhibitors, fondaparinux, danaparoid, and vitamin K antagonists; (2) reperfusion treatment with thrombolytic therapy, embolectomy, and thrombolectomy; and (3) inferior vena cava filter (1). Anticoagulant therapy with unfractionated heparin or fondaparinux is recommended in patients with moderate or high probability (23). Placement of inferior vena cava filter should be considered in patients who cannot be treated with anticoagulants. If not contraindicated, thrombolytic treatment should be applied to the patients with massive PTE accompanied by hypotension and/or shock status. Addition of oral anticoagulant to the therapy within the first 24 h is recommended in nonmassive and submassive cases. Surgical embolectomy is recommended for the patients who cannot be treated with thrombolytic therapy (1). In our study, while 27 (81.8%) patients received low-molecular-weight heparin + warfarin therapy, the remaining six (18.2%) patients received thrombolytic therapy. No patients underwent surgical embolectomy or filter placement.

Study limitation

Our study has several limitations. First, it is a retrospective study and patients' records were inadequate. Second, the study involved limited number of patients.

Conclusion

Pulmonary thromboembolism can be a common and potentially lethal disease if the diagnosis and treatment is delayed. Evaluation of clinical, laboratory and radiological findings provides the clinician with the opportunity of early diagnosis and treatment and has a significant impact on PTE prognosis.

Ethics Committee Approval: Ethical approval was not received because the file is scanned retrospectively in our study.

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