

## Demographic characteristics of patients with pulmonary thromboembolism

### *Pulmoner tromboemboli hastalarının demografik özellikleri*

Ali Duman<sup>1</sup>, Ömer Salt<sup>2</sup>, Seda Özkan<sup>3</sup>, Polat Durukan<sup>4</sup>, Mücahit Avcı<sup>1</sup>

#### ABSTRACT

**Objective:** Pulmonary thromboembolism (PTE) is a common disease with high mortality and difficult diagnosis. The incidence in our country cannot be calculated because there is no adequate and regular data. In our study, we aimed to investigate the demographic characteristics, risk factors, incidence, Wells and Geneva scores diagnostic and treatment methods of the patients in our emergency department with a diagnosis of PTE.

**Methods:** Files of the 112 patients who were admitted to Erciyes University Medical Faculty Emergency Department between January 2010 - February 2012 were analyzed retrospectively. Data were analyzed with SPSS 17.0 statistical software.

**Results:** The mean age of patients was 65.02 ± 16.23. Forty-one (36.6%) of the patients were male and 71 (63.4%) were female. The most common complaint of patients was shortness of breath (81.3%), respectively. Immobilization(35.7%) and history of previous surgery (19.6%) were among the risk factors of the patients. Average troponin levels of the patients was 0.13 ± 0.48 ng/L and average d-dimer levels was 12.698.12 ± 8.779.92 µg/L. Geneva scores of the patients were: 4 patients (3.6%) low score, 88 patients (78.6%) medium score and 20 patients (17.9%) high score. Wells Clinical Probability scores of the patients were; 1 patient (0.9%) low probability, 74 patients (66.1%) intermediate probability and 37 patients (33%) high probability. In the treatment of patients; heparin infusion (36.6%), enoxaparin sodium (59.8%) and tPA (3.6%) were used.

**Conclusion:** In spite of improvements in diagnosis and treatment methods, pulmonary embolism diagnosis is still a problem. The first step to diagnosis in patients with risk factors begin to suspect. *J Clin Exp Invest* 2015; 6 (1): 10-15

**Key words:** pulmonary embolism, diagnosis, treatment, demographic characteristics

#### ÖZET

**Amaç:** Pulmoner tromboemboli (PTE) sık görülen, tanısında zorlanılan ve mortalitesi yüksek olan bir hastalıktır. Ülkemizdeki sıklığı ise yeterli ve düzenli veri bulunmadığı için hesaplanamamaktadır. Bu çalışmada acil servisimizde PTE tanısı alan hastaların demografik özellikleri, risk faktörleri, insidansı, Wells ve Geneva skorları, tanı ve tedavi yöntemlerini araştırmayı planladık.

**Yöntemler:** Ocak 2010 – Şubat 2012 tarihleri arasında Erciyes Üniversitesi Tıp Fakültesi Acil Servisinde PTE tanısı konulan 112 hastanın dosyaları geriye dönük olarak incelendi. Veriler SPSS 17.0 programı ile değerlendirildi.

**Bulgular:** Hastaların yaş ortalaması 65,02 ± 16,23 yıl idi. Hastaların 41'i (%36,6) erkek, 71'i (%63,4) kadın idi. Hastaların acil servise başvuru şikayetlerinde en sık nefes darlığı (%81,3) idi. Hastaların risk faktörlerinde immobilizasyon (%35,7), geçirilmiş cerrahi hikayesi (%19,6) mevcut idi. Hastaların troponin ortalaması 0,13 ± 0,48 ng/L ve d-dimer ortalaması 8779,92 ± 12698,12 µg/L idi. Hastaların Geneva Skorlamasında; 4 hastanın (%3,6) skoru düşük, 88 hastanın (%78,6) skoru orta ve 20 hastanın (%17,9) skoru yüksek iken Wells Klinik Olasılık Skorlamasında; 1 hastanın (%0,9) skoru düşük olasılıklı, 74 hastanın (%66,1) skoru orta olasılıklı ve 37 hastanın (%33) skoru yüksek olasılıklı idi. Hastaların tedavilerinde; heparin infüzyonu (% 36,6), enoxaparin (%59,8) ve tPA (%3,6) kullanıldı.

**Sonuç:** Pulmoner tromboemboli tanı ve tedavi araçların gelişmesine rağmen tanı koymakta zorlanan bir hastalık olmaya devam etmektedir. Tanı için ilk adım risk faktörleri olan hastalarda şüphelenmekle başlamaktadır.

**Anahtar kelimeler:** Pulmoner tromboemboli, tanı, tedavi, demografik özellikler

<sup>1</sup> Adnan Menderes University Faculty of Medicine, Department of Emergency Medicine, Aydın, Turkey

<sup>2</sup> Yozgat State Hospital, Department of Emergency Medicine, Yozgat, Turkey

<sup>3</sup> Dışkapı Yıldırım Beyazıt Training and Research Hospital, Department of Emergency Medicine, Ankara, Turkey

<sup>4</sup> Erciyes University Faculty of Medicine, Department of Emergency Medicine, Kayseri, Turkey

**Correspondence:** Ali Duman,

Adnan Menderes University Faculty of Medicine, Dept. Emergency Medicine, Aydın, Turkey Email: aliduman3489@hotmail.com

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## INTRODUCTION

Pulmonary thromboembolism (PTE) is a common disease with high mortality and difficult diagnosis [1]. Pulmonary thromboembolism is; obstruction of pulmonary artery and / or branches with thrombus that is transmitted by systemic veins or non-thrombus materials (air, oil, tumor cells, amniotic fluid, septic material etc.) [2]. The annual number of new cases are reported as, 100.000 for France, 65.000 for England and 60.000 for Italy [3]. The incidence in our country cannot be calculated because there is no adequate and regular data [4]. In our country, mortality of PTE is 386 people/year according to Ministry of Health data. In fact, the expected number of mortality rate is around 3.000/ year [5]. When the mortality rate of untreated cases is 25-30%, it reduces to 2-8% in treated cases [6]. For the diagnosis of pulmonary thromboembolism three scoring systems were developed. Wells and colleagues were developed a prospective scoring system, which consists of seven parameters in order to use in bedside and to evaluate the clinical likelihood quickly. Another alternative scoring system is Geneva scoring system which consists of seven parameters including radiographic information. Finally, revised Geneva scoring system which consists of eight parameters that does not require gas exchange and radiographic information was approved and published. These scoring systems provide standardization to the clinician's assessment and decision method [7].

Anticoagulant therapy which started with suspected pulmonary thromboembolism requires exclusion or the verification of the diagnosis as soon as possible because of high risk of bleeding. Only 25% of patients with suspicion of PTE can be diagnosed directly with objective tests (spiral computed tomography , Doppler ultrasound) [8]. Nonspecific, clinical findings is often made the diagnosis impossible. The main objective of noninvasive diagnostic strategies is to reduce invasive and expensive procedure requirement such as pulmonary angiography in patients with suspected PTE as much as possible. For this purpose various diagnostic algorithms such as D-dimer, lower limb compression ultrasonography, serial venous ultrasonography, ventilation / perfusion scintigraphy and spiral computed tomography angiography are manufactured in the empirical clinical assessment [9].

In this study, we aimed to investigate the demographic characteristics, risk factors, incidence, Wells and Geneva score, diagnosis, and treatment methods of the patients who has got diagnosis of PTE in our emergency department retrospectively.

## METHODS

This study was performed in 112 patients who had diagnosis of pulmonary thromboembolism at the Emergency Department of Erciyes University with the permission of Ethics Committee of Erciyes University Medical Faculty (2012/240) between January 2010 - February 2012. Patient files were reviewed retrospectively. Patients' demographic characteristics, risk factors, Wells and Geneva scores, diagnosis, and treatment methods were collected and recorded to the study forms.

### Exclusion criteria

Patients younger than 18 years old. Patients with renal insufficiency or any renal disease which diminishes renal clearance. Patients with diagnosis of congestive heart failure Patients with diagnosis of liver failure.

### Statistical analysis

SPSS 17.0 statistical program was used to evaluate the data. Percentage, mean, standard deviation, median, 25-75 percentile values, maximum and minimum values were given (used) as descriptive statistics. Shapiro Wilk Normality test was used to evaluate the normal distribution of the data. Independent two sample test was used for the comparison of the two groups for normally distributed age variable and Mann Whitney U test for the analysis of the non-normally distributed all other variables.

## RESULTS

Hundred-twelve patients who had diagnosis of PTE in the Erciyes University Medical Faculty Emergency Department between January 2010 and February 2012 were included in the study. The mean age of the patients who were included in the study was  $65.02 \pm 16.23$ . Forty-one (36.6%) of the patients were male and 71 (63.4%) were female. Present complaints of the patients presenting to emergency department were; 91 (81.3%) dyspnea, 61 (54.5%) chest pain, 12 (10.7%) hemoptysis, 15 (13.4%) syncope, 27 (24.1%) palpitations, 26 (23.2%) cough, 18 (16.1%) sputum. According to patients' vital signs; 7 (6.3%) hypotensive, 11 (9.8%) hypertensive and 94 (83.9%) patients were normotensive. When 56 (50%) of the patients had higher respiratory rate ( $\geq 16$  minute), 56 (50%) patients had normal respiratory rate (12-16/minute). The heart rate was higher ( $\geq 100$ /minute) in 49 (43.8%) of the patients and normal (60-100/minute) was in 63 (56.3%). The fever

of the 18 (16.1%) patients was high ( $\geq 37.5^{\circ}\text{C}$ ) and the fewer of the 94 (83.9%) patients were normal ( $36\text{-}37.5^{\circ}\text{C}$ ).

The average heart rate, fewer and respiratory rate of the patients were consequently;  $102.94 \pm 22.39/\text{min}$ ,  $36.64 \pm 0.65^{\circ}\text{C}$   $22.14 \pm 3.08/\text{min}$ . When the patients' medical history was examined, it has found that; 4 (3.6%) patients had cerebrovascular disease, 21 (18.8%) patients had chronic obstructive pulmonary disease, 15 (13.4%) patients had coronary artery disease, 32 (28.6%) patients had hypertension and 8 (7.1%) patients, had diabetes mellitus.

When we evaluate the patients in terms of PTE risk factors, we have found that; 10 (8.9%) patients had deep vein thrombosis, 22 (19.6%) patients had previous surgical history, 5 (5.4%) patients had malignancy, 1 (0.9%) patient had blood clotting disorder, 5 (4.5%) patients had oral contraceptive using history, 28 (25%) patients had smoking history, 40 (35.7%) patients had immobilization, 2 (1.8%) patients had history of trauma, 4 (3.6%) patients had pregnancy, 18 (16.1%) patients had PTE history, and 37 (33%) patients had difference in diameter of the lower extremity. In terms of electrocardiograms of the patients; 78 (69.6%) patients had tachycardia, 49 (43.8%) patients had S1Q3T3 pattern, 26 (23.6%) patients had T-wave inversion and 16 (13.6%) patients had atrial fibrillation.

When assessing patients' blood gases; 7 (6.3%) patients had low pH ( $\leq 7.35$ ), 31 (27.7%) patients had high pH ( $\geq 7.45$ ) and 74 (66.1%) patients had normal pH (7.35-7.45). Partial  $\text{O}_2$  pressure ( $\text{pO}_2$ ) of the 90 (80.4%) patients were low ( $\leq 80$  mmHg), 19 (17%) patients'  $\text{pO}_2$  were normal (80-100 mmHg) and 3 (2.7%) patients'  $\text{pO}_2$  were high ( $\geq 100$  mmHg). Partial carbon dioxide pressure ( $\text{pCO}_2$ ) of the 81 (72.3%) patients were low ( $\leq 23$  mmol/L), 23 (20.3%) patients were normal (23-30 mmol/L) and 8 (7.1%) patients were high ( $\geq 30$  mmol/L). Oxygen saturation of 63 (56.3%) of the patients were low ( $\leq 93\%$ ), while 49 (43.7%) patients' saturation were normal (93-100%). Troponin and D-dimer levels of the 80 patients were evaluated and they were determined respectively;  $0.13 \pm 0.48$  ng/L and  $12,698 \pm 8779$   $\mu\text{g}/\text{L}$  as average. Echocardiography was performed to 86 (76.8%) patients and while Echocardiography normal in 30 (34.8%) patients, in 56 (65.1%) patients were identified right ventricular dilatation on the Echocardiography. Lower extremity venous Doppler was performed in 51 (45.5%) patients, doppler of 22 (43.1%) patients were normal and in 29 (56.8%) patients were detected deep venous thrombosis. Ventilation / perfusion scintigraphy was

performed on 11 (9.8%) patients. It was identified as low probability in one patient (9%), intermediate probability in 2 (18.1%) patients and high probability in 8 (72.7%) patients. Results of the spiral computed tomography were; the main pulmonary artery embolism in 57 (50.9%) patients, segmental embolism in 50 (44.6%) patients, subsegmental embolism in 44 (39.3%) patients.

Geneva Scoring of the patients were; 4 (3.6%) patients had low score, 88 (78.6%) patients had medium score and 20 (17.9%) patients had significantly high score (Table 1). Wells Clinical Probability Scoring of the patients were; 1 (0.9%) patient had low probability, 74 (66.1%) patients had intermediate probability score, and 37 (33%) patients had high probability score (Table 1).

Sixty-seven (59.8%) of the patients were hospitalized in chest disease department, 35 (31.3%) of them in the intensive care unit of chest diseases, one (0.9%) patient cardiology department, 2 (1.8%) of them in the medical intensive care unit. One patient (0.9%) were referred to the other center, one patient (0.9%) was discharged voluntarily and 5 (4.5%) patients were discharged to regular treatment. In the treatment, heparin infusion was administered to 41 (36.6%) patients, enoxaparin sodium was administered to 67 (59.8%) patients and tPA was administered to 4 (3.6%) patients. Thirty (26.8%) patients in the first 24 hours' time Coumadin therapy was added.

**Table 1.** Probability distributions according to Geneva and Well's clinical probability scoring systems

	High		Moderate		Low	
	n	%	n	%	n	%
Geneva Scoring System	20	17,9	88	78,6	4	3,6
Wells Clinical Probability Scoring	37	33	74	66,1	1	0,9

## DISCUSSION

According to the data of United States average annual incidence of PTE is about 1/1000 and increases with age. After 80 years-old it increases about 10 times in comparison to age 45 to 50 (10). In the study of Lee et al. it was identified that the mean age of 808 patients,  $58.3 \pm 16.3$ , 40.7% males and 59.3% of women [11]. In the study of Stein and colleagues it has found that; the incidence of PTE increases with age-related and more common in women over 50 year-old [8]. In the study of Naka-

mura and colleagues it has found that; the majority were women of 133 patients and the mean age was  $61 \pm 17$  year [12]. In this study, the mean age of the patients was  $65.02 \pm 16.23$  and the majority of patients was composed of female in harmony with literature. When 50% or more of the pulmonary vascular bed obstructed, the sudden onset of dyspnea, hypotension and/or shock develops. Obstruction is often bilateral. Cyanosis, apathy, oliguria, mental confusion, severe tachypnea, tachycardia and hypotension (systolic blood pressure  $<90$  mmHg) can be seen. Pulmonary second sound rough, S3 gallop, venous distension, along the left edge of the sternum pansystolic murmur of tricuspid regurgitation may be heard [8]. In 90% of cases, as a result of clinical symptoms like dyspnea, chest pain, and syncope is suspected PTE. In some series, dyspnea, tachypnea, or chest pain has been reported in more than 90% of patients with PTE [13]. In the study of Lee and colleagues with 808 patients, they have determined that the most common symptoms were, respectively; dyspnea (78.6%), chest pain (26.9%) and cough (13.1%) and the most frequent clinical symptoms respectively; tachypnea (% 45.3), tachycardia (29.8%), lower extremity edema (13%), fever (9%) (11). In our study, consistent with the literature, the first complaint was shortness of breath (81%). Tachycardia was present in 43.8% and tachypnea was present in 50% of the patients.

Factors that lead to intravascular coagulation were described by Virchow in 1856. They are 1. Vascular endothelial damage, 2. Hypercoagulability, 3. Stasis. In the 75% of PTE patients one of these three factors is determined as acquired and / or hereditary [14]. In the study of Nakamura et al they have defined the risk factors. These are; long term immobilization (62%), stroke (28%), cancer (24%), the venous catheter (20%), obesity (17%), heart failure (16%), respiratory failure (10%) and only a few coagulopathy [12]. Lee et al in their study described the most common risk factors of PTE as; long-term immobilization (22.9%), deep venous thrombosis (22.0%), recently surgery (19.2%), and cancer (15.8%). Most commonly surgery that is associated with pulmonary thromboembolism is orthopedic surgery (36.8%), and it is followed by general surgery (25.2%) and neurosurgery (14.2%) operations [11]. In our study immobilization took the first place with respect to the risk factors. Only 8.9% of the patients had a history of deep vein thrombosis, but as a result of the doppler ultrasound deep vein thrombosis was detected in 25.9% of patients. Thus, deep vein thrombosis took in second place. The new opera-

tion history also was third. These results were consistent with the literature.

In the diagnosis of pulmonary thromboembolism; on the electrocardiography, inverted T waves in leads V1-V4 or QR pattern in lead V1, classic S1Q3T3 pattern and incomplete or complete right bundle branch block may be useful [15]. Lee et al have identified, normal sinus rhythm in 36% of patients, sinus tachycardia in 25.7%, ST-T wave changes in 16.2%, and right bundle branch block in 4.5% on the ECG's of the patients in their study [11]. In the study of Guzel and colleagues they could only get at two patients' records. In only one of these two patients were identified S1Q3T3 findings [16]. In our study sinus tachycardia took the first place with respect to on the electrocardiography of the patients. Hypoxemia and respiratory alkalosis are frequently observed blood gas parameters in patients with acute PTE. In the most of the patients initially hypoxemia, hypocapnia and respiratory alkalosis were determined [15]. In our study, in harmony with the literature, mostly arterial hypoxemia, hypocapnia and alkalosis have been identified.

D-dimer test has high sensitivity, but specificity is low. In the cases of surgery, trauma, renal disease, malignancies, serious infections, SLE, pregnancy, etc. it could be positive [17]. Charles V. and colleagues in their study of 543 patients, quantitative D-dimer test has been performed and they have found high levels in 477 (87%) patients, as, the average value of  $7162 \pm 14\ 241$  ng / mL [18]. Our results are consistent with the literature. Troponin is a cardiac muscle specific enzyme. Right ventricular dilatation as a result of acute right heart failure due to massive PTE increases the need for oxygen of the right ventricle. Troponin release of these areas increases. Elevated serum troponin level shows right ventricle dysfunction [19]. In the study of Charles V. et al with 1880 patients, they have found that; there were elevated levels of serum troponin in 1,287 (68%) patients [18]. Our study was consistent with the literature.

Right ventricular dilatation, septal wall paradoxical motion and left deviation, right ventricular dysfunction, moderate or severe hypokinesia, mobile thrombus in right atria and ventricle, pulmonary hypertension, patent foramen ovale might be observed in pulmonary thromboembolism by echocardiography [20]. Charles V. Et al in their study of 1880 patients, they were performed transthoracic echocardiography in 430 (23%) patients with the PTE disease and diagnosed right ventricular hypokinesia in 218 patients [18]. Lee et al in their study

have detected pulmonary hypertension in 51.6% of the patients and right ventricular hypokinesia in 36.6% of the patients by echocardiography [11]. Our study was consistent with the literature.

Scintigraphy has been used less frequently, especially after multidetector computed tomography angiography has been started to use. In the diagnosis of pulmonary artery perfusion defects, perfusion scintigraphy is a sensitive but nonspecific detection method [21]. If the number of detector increases ( $\geq 4$ ) it also increases the detection sensitivity of spiral [8]. Lee et al in their study had identified frequently thrombus localities as; the right main pulmonary artery (39.5%), right lobar pulmonary arteries (27.8%), the main left pulmonary artery (24.6%), and left lobar pulmonary arteries (24%) on computed tomography [11]. In our study, spiral computed tomography results were; the main pulmonary artery embolism in 57 (50.9%) patients, segmental emboli in 50 (44.6%) patients and subsegmental emboli in 44 (39.3%) patients.

It is useful in diagnosis and treatment of patients with suspected PTE to classify the patients according to symptoms, findings, and clinical risk factors as low, medium and high probability. For this purpose the two scoring systems are widely used. The first of these scoring systems is Wells scoring system and it is also known as, "Canadian scoring system". The second scoring system is the modified Geneva scoring system [22]. In the study of Charles et al. of 1880 patients, have been identified 44 (25%) patients had low, 111 (65%) patients had moderate and 18 (10%) patients had high probability PTE with based on Wells scoring system [18]. In our study it was calculated that, 66.1% of patients with moderate probability, 33% of patients in the high probability and one (0.9%) patient with low probability.

In patients with moderate and high suspicion of Pulmonary thromboembolism, immediately low molecular weight heparin or unfractionated heparine anticoagulation therapy should be initiated until the high risk of bleeding excluded [23]. Lee and colleagues in their study to the 86.8% of the patients began heparin therapy 78.6% unfractionated heparine and 21.4% low molecular weight heparin. Patients' 12.3% received thrombolytic therapy. 67.5% of these patients were treated with urokinase and 32.5% recombinant tissue plasminogen activator. Inferior vena cava filter was implanted to the 11.1% of the patients. The embolectomy was applied to 3.2% of the patients [11]. In terms of treatment methods our study was consistent with other studies.

In spite of improvements in diagnosis and treatment methods, pulmonary embolism diagnosis is still a problem. The first step to diagnosis in patients with risk factors begin to suspect. We think that; PTE must be emphasized in the educative procedures of Emergency Department, and selected scoring systems should be used in practice.

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