Retrospective Evaluation of Patients Who Admitted to the Emergency Department Due to Pneumothorax

Pnömotoraks Nedeni ile Acil Servise Başvuran Hastaların Retrospektif Olarak Değerlendirilmesi

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ABSTRACT

Introduction: Spontaneous pneumothorax is a severe life-threatening situation, especially in the elderly and individuals with comorbid diseases.

Objective: In this research, we aimed to elucidate the demographic and clinical characteristics of spontaneous pneumothorax cases in a retrospective manner.

Method: Patients (n=325) diagnosed with pneumothorax at our institution's Emergency Medicine Clinic were included in this retrospective analysis. The patient data were obtained from patient files and data in the hospital automation system. The patients' admission complaints, comorbidities, laboratory findings, imaging results, treatment methods, and hospitalization or discharge were recorded.

Results: Within the scope of the study, 325 patients aged between 1 and 90 were included in the evaluation. Patients were divided into two groups according to age: <40 years (n=163) and ≥40 years (n=162). A statistically significant difference was observed in the distribution of malignancy, diabetes mellitus (DM), hypertension (HT), chronic obstructive pulmonary disease (COPD), chronic kidney failure (CKF), primary spontaneous pneumothorax (PSP), secondary spontaneous pneumothorax (SSP), traumatic pneumothorax, falls, rib fracture, thoracotomy and outcomes (p< 0.05). While mortality was observed in a total of 25 patients, a statistically significant difference was found in the ≥40-years-old patient group (n=21) compared to the <40-years-old patient group (n=4). The diagnosis of PSP was statistically significantly higher in the <40 age group (n=119) than in the ≥40 age group (n=79). It was observed that the hemoglobin, lymphocyte count, and estimated glomerular filtration rate (eGFR) in patients younger than 40 were higher than in patients older than 40.

Conclusion: As a result, spontaneous pneumothorax is a clinical entity that is treated according to age, clinical condition, and underlying causes, is often benign when seen in young people, and is life-threatening if not urgently intervened in elderly patients with limited pulmonary reserve. Mortality and morbidity can be prevented with timely diagnosis and appropriate treatment.

Keyswords: Spontaneous Pneumothorax, Thoracotomy, Video-Assisted ThoracicSurgery (VATS), Chronic Obstructive Pulmonary Disease (COPD), Mortality.

ÖZET

Giriş: Spontan pnömotoraks özellikle yaşlılarda ve eşlik eden hastalığı olan bireylerde yaşamı tehdit eden ciddi bir durumdur.

Amaç: Bu çalışmaya spontan pnömotoraks olgularının demografik ve klinik özelliklerini retrospektif olarak aydınlatmayı amaçladık.

Yöntem: Bu retrospektif analize kurumumuz Acil Tıp Kliniğinde pnömotoraks tanısı alan hastalar (n=325) dahil edildi. Hasta verileri hasta dosyalarından ve hastane otomasyon sistemindeki verilerden elde edildi. Hastaların başvuru şikayetleri, ek hastalıkları, laboratuvar bulguları, görüntüleme sonuçları, tedavi yöntemleri, yatış veya taburculuk durumları kaydedildi.

Bulgular: Araştırma kapsamında yaşları 1 ile 90 arasında değişen 325 hasta değerlendirmeye alındı. Hastalar yaşlarına göre <40 yaş (n=163) ve ≥40 yaş (n=162) olmak üzere iki gruba ayrıldı. Malignite, diyabetes mellitus (DM), hipertansiyon (HT), kronik obstrüktif akciğer hastalığı (KOAH), kronik böbrek yetmezliği (KBY), primer spontan pnömotoraks (PSP), sekonder spontan pnömotoraks (SSP), travmatik pnömotoraks, düşme, kaburga kırığı, torakotomi ve sonlanımlarının dağılımında istatistiksel olarak anlamlı farklılık gözlendi (p< 0,05). Toplam 25 hastada mortalite gözlenirken, ≥40 yaş hasta grubunda (n=21) <40 yaş hasta grubuna (n=4) göre istatistiksel olarak anlamlı fark bulundu. Spontan pnömotoraks tanısı <40 yaş grubunda (n=119), ≥40 yaş grubuna (n=79) göre istatistiksel olarak anlamlı derecede yüksekti. 40 yaş altı hastalarda hemoglobin, lenfosit sayısı ve tahmini glomerüler filtrasyon hızının (eGFR) 40 yaş üstü hastalara göre daha yüksek olduğu görüldü.

Sonuç: Sonuç olarak spontan pnömotoraks yaşa, klinik duruma ve altta yatan nedenlere göre tedavi edilen, gençlerde görüldüğünde sıklıkla benign seyreden, akciğer kısıtlılığı olan yaşlı hastalarda acil müdahale edilmediği takdirde yaşamı tehdit eden bir klinik tablodur. Zamanında tanı ve uygun tedavi ile mortalite ve morbidite önlenebilir.

Anahtar Kelimeler: Spontan Pnömotoraks, Torakotomi, Video Yardımlı Göğüs Cerrahisi (VATS), Kronik Obstrüktif Akciğer Hastalığı (KOAH), Mortalite.

INTRODUCTION

Spontaneous pneumothorax is the accumulation of air in the pleural space without trauma and subsequent lung collapse. The occurrence of this condition in a healthy individual is referred to as primary spontaneous pneumothorax (PSP). If there is an underlying lung disease, it is referred to as secondary spontaneous pneumothorax (SSP). Risk factors for spontaneous pneumothorax include male gender, smoking, tall height, low body weight, and underlying lung disease. Increased neutrophil and macrophage activation in lung tissue damages elastic fibers, and bullous lesions may develop. An imbalance between protease-antiprotease and oxidant-antioxidant systems may play a role in the etiology. Sudden shortness of breath, accompanying chest pain, palpitations, and productive cough complaints may be observed. Physical examination is diagnostic (1). Management of spontaneous pneumothorax patients includes close observation, oxygen therapy, a conservative approach, aspiration, percutaneous catheter drainage, tube thoracostomy, video thoracoscopic surgery, and axillary or lateral thoracotomy treatments (2).

Patients usually have pleuritic-type chest pain or acute dyspnea on the same side. Chest pain may be very superficial or sharp. Even if pneumothorax is not treated, the pain subsides within 24 hours (3). Physical examination is normal in small pneumothoraces below 15%. Large spontaneous pneumothorax causes a decrease in vital capacity and a decrease in the alveolar-arterial oxygen gradient. Although hypoxia occurs, hypercapnia does not develop because lung function tests are generally normal. Tachycardia is the most common physical examination finding. In large pneumothorax, that side of the chest does not participate in breathing, hyperresonance is detected on percussion, and breath sounds are decreased or absent. A heart rate above 135/min, hypotension, or cyanosis should suggest tension pneumothorax (4).

In a meta-analysis of 11 series including patients who were only monitored due to PSP and treated with needle aspiration or tube thoracostomy, the recurrence rate was reported to be between 6-52%. Most recurrences occur between the first 6-24 months. This possibility is higher in cases with radiological pulmonary fibrosis, smoking habit, asthenic type, and pneumothorax occurring at a young age (5).

Pulmonary tuberculosis once again emerges as an essential factor in SSP. In a study conducted in Spain, tuberculosis was reported to be 23% of the causes of SSP (6). Pneumocystis carinia pneumonia, which develops in HIV (+) patients, is reported as one of the most common causes of pneumothorax in various countries and is associated with high mortality. Pneumothorax is reported at a rate of 25% in eosinophilic granuloma cases and 80% in lymphangiomyomatosis cases. SSP is common in older ages with the increasing frequency of chronic obstructive pulmonary disease. These patients have shortness of breath due to the underlying lung disease, even if the pneumothorax is not severe. Patients usually have pain on the same side. Hypoxia, hypercapnia, and hypotension may occur. The probability of recurrence in SSP is between 39-47% (7).

Within the scope of this research, we aimed to elucidate the demographic and clinical characteristics of spontaneous pneumothorax cases in a retrospective manner.

METHOD

Patients (n=325) diagnosed with pneumothorax at Sakarya Training and Research Hospital Emergency Medicine Clinic between January 2020 and December 2021 were included in this retrospective analysis. The patient data were obtained from patient files and data in the hospital automation system. The patients' admission complaints, comorbidities, laboratory findings, imaging results, treatment methods, and hospitalization or discharge were recorded.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Ethics committee approval was granted from our institution on 31/01/2023 with protocol number E-71522473-050.01.04-216240-27. As this was retrospective research, no informed consent was obtained from participants.

Statistical Analysis

Patient data collected within the scope of the study were analyzed with the IBM Statistical Package for the Social Sciences (SPSS) for Windows 26.0 (IBM Corp., Armonk, NY) package program. Frequency and percentage for categorical data and continuous data were given as descriptive values. For comparisons between groups, the "Mann Whitney U Test" was used for two groups, and the "Pearson Chi-Square Test" was used to compare categorical variables. The results were considered statistically significant when the p-value was less than 0.05.

RESULTS

Table 1. Distribution of Demographic and Clinical Characteristics of Patients

Variables	Total (n=325)	<40 Age (n=163)	≥40 Age (n=162)	p-value
	n (%) or Median (IQR)	n (%) or Median (IQR)	n (%) or Median (IQR)	
Age (year)	39.00 (32.00)	25.00 (10.00)	57.00 (20.75)	**<0.001**
Comorbidity				
Malignancy	20 (6.2)	5 (3.1)	15 (9.3)	**0.02**
DM	40 (12.3)	4 (2.5)	30 (22.2)	**<0.001**
HT	50 (15.4)	5 (3.1)	45 (27.8)	**<0.001**
COPD	45 (13.8)	3 (1.8)	42 (25.9)	**<0.001**
Palsy	6 (1.8)	2 (1.2)	4 (2.5)	0.448
CKF	42 (12.9)	5 (3.1)	37 (22.8)	**<0.001**
Type of Pneumothorax				
PSP	198 (60.9)	119 (73)	79 (48.8)	**<0.001**
SSP	7 (2.2)	0 (0)	7 (4.3)	**0.007**
Traumatic pneumothorax	120 (36.9)	42 (25.8)	78 (48.1)	**<0.001**
Type of Trauma				
Falls	74 (22.8)	18 (11)	56 (34.6)	**<0.001**
Traffic accident	29 (8.9)	15 (9.2)	14 (8.6)	0.859
Penetrating injuries	7 (2.2)	3 (1.8)	4 (2.5)	0.723
Blunt injuries	3 (0.9)	2 (1.2)	1 (0.6)	1.000
Clinical Finding				
Sternum fracture	7 (2.2)	2 (1.2)	5 (3.1)	0.283
Rib fracture	92 (28.3)	30 (18.4)	62 (38.3)	**<0.001**
Pneumothorax				
Left	151 (46.5)	82 (50.3)	69 (42.6)	0.163
Right	184 (56.6)	87 (53.4)	97 (59.9)	0.237
Bilateral	10 (3.1)	6 (3.7)	4 (2.5)	0.750
Hemothorax	53 (16.3)	23 (14.1)	30 (18.5)	0.282
Pneumomediastinum	9 (2.8)	5 (3.1)	4 (2.5)	1.000
Type of Treatment				
Thorax tube	272 (83.7)	132 (81)	140 (86.4)	0.185
Thoracotomy	26 (8)	19 (11.7)	7 (4.3)	**0.015**
Refusal of treatment	7 (2.2)	2 (1.2)	5 (3.1)	0.283
Hospitalization Period (day)	6.00 (5.00)	6.00 (6.00)	6.00 (5.00)	0.112
Outcome				
Intensive care	95 (29.2)	30 (18.4)	65 (40.1)	**<0.001**
Death	25 (7.7)	4 (2.5)	21 (13)	**<0.001**
Discharge	292 (89.8)	156 (95.7)	136 (84)	**<0.001**

IQR: Interquartile range; DM: Diabetes mellitus; HT: Hypertension; COPD: Chronic obstructive pulmonary disease; CKD: Chronic kidney disease; PSP: Primary spontaneous pneumothorax; SSP: Secondary spontaneous pneumothorax.

Within the scope of the study, 325 patients aged between 1 and 90 were included in the evaluation. Patients were divided into two groups according to age: <40 years (n=163) and ≥40 years (n=162). The distribution of demographic and clinical findings of the patients according to their age groups is denoted in Table 1. A statistically significant difference was observed in the distribution of malignancy, diabetes mellitus (DM), hypertension (HT), chronic obstructive pulmonary disease (COPD), chronic kidney failure (CKF), PSP, SSP, traumatic pneumothorax, falls, rib fracture, thoracotomy and outcomes (p< 0.05). While there was no statistical difference between the two age groups in terms of tube thoracostomy application, it was determined that thoracotomy application was statistically more common in the < 40-years-old patient group (n=19) than in the ≥ 40-years-old patient group (n=7). While death was observed in a total of 25 patients, a statistically significant difference was found in the ≥40-years-old patient group (n=21) compared to the <40-years-old patient group (n=4). The diagnosis of PSP was statistically significantly higher in the <40 age group (n=119) than in the ≥40 age group (n=79). The diagnosis of traumatic pneumothorax is statistically significantly higher in the ≥40 age group than in the <40 age group (n=78, n=42, respectively).

The rates of PSP and thoracotomy in patients younger than 40 years of age were higher than in patients older than 40 years, the rates of patients older than 40 years were higher than those of patients younger than 40 years in other significant variables.

The distribution of laboratory measurements of the patients according to age groups is indicated in Table 2. When the table was examined, a statistically significant difference was found between the two groups in all laboratory measurements except international normalized ratio (INR) and platelet (PLT) measurements (p <0.05).

Table 2. Distribution of Laboratory Findings of Patients

Laboratory Parameters	Total (n=325)	<40 Age (n=163)	≥40 Age (n=162)	p-value
	Median (IQR)	Median (IQR)	Median (IQR)	
Wbc ($10^3/\mu L$)	10.40 (5.69)	**9.70 (5.51)**	**11.23 (5.86)**	**0.008**
Hemoglobin (mg/dL)	14.00 (2.30)	**14.40 (1.82)**	**13.40 (2.10)**	**<0.001**
Neutrophil ($10^3/\mu L$)	7.14 (5.65)	**6.05 (4.60)**	**7.81 (5.41)**	**<0.001**
Lymphocyte ($10^3/\mu L$)	2.05 (1.43)	**2.08 (1.41)**	**1.85 (1.50)**	**0.020**
Platelet ($10^3/\mu L$)	223.00 (75.00)	219.00 (70.50)	228.00 (85.25)	0.899
PLR	107.69 (78.72)	**104.38 (71.87)**	**112.03 (104.66)**	**0.036**
NLR	3.22 (4.83)	**2.73 (3.69)**	**4.18 (6.37)**	**<0.001**
Crp (mg/L)	7.55 (29.54)	**2.60 (6.48)**	**18.64 (52.49)**	**<0.001**
Troponin (ng/L)	2.00 (10.50)	**0.95 (2.85)**	**5.90 (17.74)**	**<0.001**
INR	1.17 (0.16)	1.15 (0.16)	1.18 (0.17)	0.426
eGFR (mL/min/1.73m^2)	114.00 (33.11)	**125.27 (17.37)**	**98.09 (28.41)**	**<0.001**
Lactate (mmol/L)	1.80 (1.10)	**1.50 (0.90)**	**1.90 (1.29)**	**0.004**

IQR: Interquartile range; Wbc: White blood cell; PLR: Platelet-to-lymphocyte ratio; NLR: Neutrophil-to-lymphocyte ratio; Crp: C-reactive protein; INR: International normalized ratio; eGFR: Estimated glomerular filtration rate.

A statistically significant difference was detected between the two patient groups in terms of laboratory parameters such as hemoglobin, leukocyte, lymphocyte, C-reactive protein, platelet/lymphocyte ratio (PLR), troponin, neutrophil/lymphocyte ratio (NLR), estimated glomerular filtration rate (eGFR), lactate, and neutrophil count. While it was observed that the hemoglobin, lymphocyte count, and eGFR in patients younger than 40 were higher than in patients older than 40, in other significant variables, the measurements of patients older than 40 were higher than in patients younger than 40.

DISCUSSION

The incidence of spontaneous pneumothorax is reported as 7.4-28/100.000 per year for men and 1.2-6/100.000 per year for women. The majority of cases consist of PSP cases. Only about 10% are SSP cases. The most common cause of SSP development is COPD. While the recurrence rate is given as 31% for PSP, it is reported as 43% for SSP (8). The development of severe expiratory obstruction in patients and the rupture of a subpleural bulla are considered possible etiologies. The disease manifests itself with symptoms ranging from mild decrease in breath sounds to severe respiratory failure. While PSP is more common in young people, SSP is seen in middle-aged and elderly patients (9). In our study, the diagnosis of PSP was statistically significantly higher in the <40 age group (n=119) than in the ≥40

age group (n=79). The diagnosis of traumatic pneumothorax is statistically significantly higher in the ≥40 age group than in the <40 age group (n=78, n=42, respectively).

Air leakage lasts longer in patients where lung vascularity is reduced due to chronic disease. The risk of infection and empyema is higher. Surgery is not recommended before treatment of active infection in this group of patients. However, success may not be achieved with observation or aspiration treatments. The first choice should be tube thoracostomy (10). It has been reported that each pneumothorax attack can increase mortality by 4 times in patients with COPD. In our study, while death was observed in a total of 25 patients, a statistically significant difference was found in the ≥40-year-old patient group (n=21) compared to the <40-year-old patient group (n=4).

If pleurodesis is not performed, pneumothorax attacks occur again in 40-50% of patients (11). In our study, a statistically significant difference was observed in the distribution of malignancy, DM, HT, COPD, CKF, PSP, SSP, traumatic pneumothorax, falls, rib fracture, thoracotomy and outcomes (p< 0.05).

Treatment for SSP is more aggressive than for the primary disease. The American College of Chest Physicians guideline recommends applying tube thoracostomy when first encountered and performing pleurodesis to prevent recurrence (12). Many studies have been conducted on the risk factors in spontaneous pneumothorax cases, and many risk factors have been identified. However, it is not possible to predict relapse. Therefore, to minimize the risk of recurrence in patients with SSP, thoracoscopic surgical methods or open surgical intervention are recommended in the first pneumothorax attack if clinically appropriate (13). In previous literature, the relapse rate was 16-52%, depending on the type of treatment after the first attack. Relapses are generally seen between the first 6-24 months, and the relapse rate within the first four years is 54% (14). While it is 20-30% after the attack, it is 50% after the second attack and over 80% after the third attack (2,8). The rate of spontaneous pneumothorax development in the opposite hemithorax is 51.5% (11). Chemical pleurodesis is applied to reduce recurrences after the first attack or when recurrence occurs. However, the recurrence rate in patients who underwent pleurodesis is around 20% (12).

Guo et al. reported that the recurrence rate in cases with SSP was higher than PSP (26-50% versus 12-27%) (15). Smith et al. detected blebs and/or bullae on CT in 56% of the cases with spontaneous pneumothorax, and 44% reported no pathology (16). Ouanes-Besbes et al. detected blebs and/or bullae on CT that could not be seen on direct chest radiography in 72.5% of patients with PSP and showed that most of these lesions were located at the apices and were bilateral in 66% of the cases (17). While there are studies stating that the diameter and location of the bulla do not affect recurrence, there are also studies reporting that detecting pathology on CT is important in predicting recurrence (18, 19).

As a surgical treatment, VATS, limited thoracotomy, or axillary thoracotomy are preferred depending on the surgical conditions and the patient's condition (20). In our study, the rates of PSP and thoracotomy in patients younger than 40 years of age were higher than in patients older than 40 years, the rates of patients older than 40 years were higher than those of patients younger than 40 years in other significant variables. In some publications, it has been reported that VATS was preferred due to the low morbidity, mortality, and recurrence rate after the first attack. In cases where bleb and/or bulla were detected on CT, significant intrathoracic adhesions were observed, making VATS difficult to perform. Freixinet et al. reported that they did not detect any difference between the two methods regarding surgical time, postoperative pain and complications, and hospital stay. They even observed recurrence in two patients who underwent VATS (21). In our analysis, while there was no statistical difference between the two age groups in terms of tube thoracostomy application, it was determined that thoracotomy application was statistically more common in the < 40-year-old patient group than in the ≥ 40-year-old patient group.

The recurrence rate after surgical treatment is 0-6.8% in those who underwent thoracotomy or axillary thoracotomy and 3-13% in those who underwent VATS. The high recurrence rate in VATS was due to less tissue trauma and less formation of pleural adhesions. In cases where video-assisted thoracoscopic surgery was performed, it would be helpful to perform pleural abrasion additionally. Many studies have been conducted on the risk factors in spontaneous pneumothorax, and many risk factors have been identified, but no method has been developed to predict recurrence. To minimize the risk of recurrence,

surgical options other than tube thoracostomy (axillary thoracotomy, VATS, etc.) should be considered at the first pneumothorax attack if the patient's clinical condition is appropriate, considering the risk factors (22).

CONCLUSION

As a result, spontaneous pneumothorax is a clinical entity that is treated according to age, clinical condition, and underlying causes, is often "benign" when seen in young people, and is life-threatening if not urgently intervened in elderly patients with limited pulmonary reserve. Mortality and morbidity can be prevented with timely diagnosis and appropriate treatment. Surgical treatment methods are quite successful in the treatment of recurrent spontaneous pneumothorax.

DESCRIPTIONS

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