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Etiology-Based Differences in Clinical Presentation and Management of Pneumothorax: A Retrospective Study

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Abstract:

Objective: Pneumothorax is a common thoracic emergency that may present as primary spontaneous, secondary spontaneous, or traumatic pneumothorax. This study aimed to compare the clinical characteristics, treatment approaches, and outcomes of different pneumothorax subtypes.

Methods: This retrospective single-center study included adult patients diagnosed with pneumothorax between March 2024 and March 2025. Patients with incomplete records, repeated admissions, or pregnancy were excluded. Demographic characteristics, clinical presentation, treatment modalities, comorbidities, complications, and laboratory findings were analyzed. Patients were classified as primary spontaneous pneumothorax (PSP), secondary spontaneous pneumothorax (SSP), or traumatic pneumothorax. Statistical significance was defined as $P<0.05$.

Results: A total of 154 patients were included: 44 (28.6%) with PSP, 35 (22.7%) with SSP, and 75 (48.7%) with traumatic pneumothorax. Patients with SSP were significantly older than those with PSP (66.5 vs. 41.2 years, $P<0.001$). Male predominance was observed in all groups (81.8%, 91.4%, and 82.7%, respectively). Dyspnea was more frequent in SSP (88.6%, $P=0.029$), whereas chest pain was most common in traumatic pneumothorax (94.7%, $P=0.023$). COPD was strongly associated with SSP (88.6%, $P<0.001$). Chest tube insertion was the most common treatment modality (72.7%, 80.0%, and 70.7% in PSP, SSP, and traumatic pneumothorax, respectively). Rib fractures (53.3%, $P<0.001$) and hemothorax (18.7%, $P=0.001$) were more frequent in traumatic pneumothorax.

Conclusion: PSP predominantly affected younger patients, whereas SSP was strongly associated with advanced age and COPD. Traumatic pneumothorax was frequently accompanied by rib fractures and hemothorax. These findings support an etiology-based approach to pneumothorax management and may contribute to more individualized treatment strategies.

Keywords: Pneumothorax, Thoracoscopy, Thoracostomy, Chest Tube

Pleural diseases are common health problems in the general population, and this term encompasses a wide variety of different conditions requiring specific treatment [1-3]. Pleural effusion and pneumothorax are the most common manifestations of pleural diseases, and their incidence is increasing [2, 4]. Pneumothorax is defined as the partial or complete collapse of the lung due to the

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accumulation of air in the pleural cavity. It is a serious thoracic emergency that may occur spontaneously or as a result of trauma and can lead to severe respiratory failure if not treated properly [5, 6]. Based on etiology, pneumothorax is generally classified into primary spontaneous pneumothorax (PSP), secondary spontaneous pneumothorax (SSP), and traumatic pneumothorax [5-7].

PSP usually occurs in individuals without underlying lung disease and is most commonly observed in young, tall, and thin men. The underlying mechanism is typically associated with the rupture of subpleural blebs or bullae located at the lung apex [8, 9]. In contrast, SSP develops in patients with preexisting lung disorders such as chronic obstructive pulmonary disease (COPD), tuberculosis sequelae, interstitial lung disease, or malignancy. These patients generally present with more severe clinical symptoms due to reduced pulmonary reserve [6, 10].

Traumatic pneumothorax occurs as a result of blunt or penetrating thoracic trauma and is frequently accompanied by additional thoracic injuries, including hemothorax and rib fractures [11]. In clinical practice, it is important to differentiate between spontaneous and traumatic pneumothorax because management strategies and clinical outcomes can vary considerably depending on the underlying etiology.

Patients with pneumothorax most commonly present with sudden onset chest pain and dyspnea. The diagnosis is usually made through clinical evaluation and imaging methods such as chest X-ray and computed tomography [12]. The management of pneumothorax depends on several factors, including the type of pneumothorax, the size of the pleural air collection, and the clinical stability of the patient. Treatment options range from observation and oxygen therapy to simple aspiration, chest tube drainage, and surgical interventions [13, 14].

While chest tube drainage remains a cornerstone of treatment in many cases of pneumothorax, particularly in moderate or large pneumothorax cases, minimally invasive surgical techniques such as video-assisted thoracoscopic surgery (VATS) may be required in recurrent cases or persistent air leaks [15, 16]. Recent studies have also suggested that conservative or ambulatory management strategies may be appropriate for selected patients with PSP [17, 18].

Despite advances in diagnostic and therapeutic strategies, pneumothorax continues to represent a significant clinical problem worldwide. Although the clinical characteristics and management of primary spontaneous, secondary spontaneous, and traumatic pneumothorax have been extensively described, studies directly comparing these entities within the same patient population remain limited. Since the underlying etiology may influence clinical presentation, comorbidities, treatment decisions, and outcomes, a better understanding of these differences is essential for optimizing patient management. Therefore, the present study aimed to evaluate the demographic characteristics, clinical features, treatment approaches, and outcomes of patients diagnosed with pneumothorax and to compare these parameters among patients with primary spontaneous, secondary spontaneous, and traumatic pneumothorax.

METHODS

Study Design and Patient Selection

This retrospective single-center study was conducted at Giresun Training and Research Hospital and included patients who were admitted with a diagnosis of pneumothorax between March 2024 and March 2025. Medical records of all eligible patients were retrospectively reviewed. The diagnosis of pneumothorax was based on clinical findings and radiological imaging methods, including chest X-ray and thoracic computed tomography.

Patients aged 18 years and older diagnosed with pneumothorax during the study period were evaluated. Only patients with complete medical records, including demographic characteristics, smoking history, presentation type, diagnostic findings, and treatment details, were included in the study. Patients under 18 years of age, those with incomplete clinical or radiological records, pregnant patients, and patients with repeated hospitalizations of the same patient were excluded. In cases of multiple hospitalizations of the same patient, only the first hospitalization was considered for analysis.

Initially, the study planned to include 197 patients diagnosed with pneumothorax. However, forty-three patients were excluded due to several reasons: three patients were under 18 years of age, eighteen patients had incomplete medical records, and twenty-two

patients had multiple records. As a result, 154 patients diagnosed with pneumothorax were included in the study. The patient selection process is summarized in Figure 1. Patients were classified into three groups according to the etiology of pneumothorax: PSP, secondary spontaneous pneumothorax, and traumatic pneumothorax. PSP was defined as pneumothorax occurring in patients without any known underlying lung disease, whereas SSP was defined as pneumothorax occurring in patients with underlying pulmonary pathology. Traumatic pneumothorax included pneumothorax cases associated with blunt or penetrating thoracic trauma as well as iatrogenic causes.

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval for the study was obtained from the Ethics Committee of Giresun Training and Research Hospital (Decision no: BAEK 2025-318/15).

Data Collection

Demographic, clinical, radiological, laboratory, and treatment-related data were obtained from the hospital electronic medical record system. The collected data included age, sex, smoking status, presenting symptoms such as dyspnea, chest pain, palpitations, and cough, pneumothorax type, pneumothorax size (minimal, partial, or subtotal), and laterality (right, left, or bilateral). In addition, treatment methods including oxygen therapy, simple aspiration, chest tube drainage, pleurodesis, thoracoscopy, VATS, and decortication were recorded. Complications and associated conditions such as hemothorax, pneumomediastinum, subcutaneous emphysema, pleural effusion, and flair chest were also evaluated.

Comorbid diseases including COPD, pneumonia, tuberculosis sequelae, hypertension, diabetes mellitus, coronary artery disease, and malignancy were recorded. Laboratory parameters obtained at admission included hemoglobin, hematocrit, white blood cell count, platelet count, neutrophil count, lymphocyte count, eosinophil count, basophil count, monocyte count, and C-reactive protein (CRP) levels. The primary aim of this study was to evaluate the demographic characteristics, clinical features, treatment approaches, and outcomes of patients diagnosed with pneumothorax. In addition, comparisons were made between primary spontaneous, secondary spontaneous, and traumatic pneumothorax groups in terms of clinical presentation, treatment methods, complications, and mortality.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics software (IBM Corp., Armonk, NY,

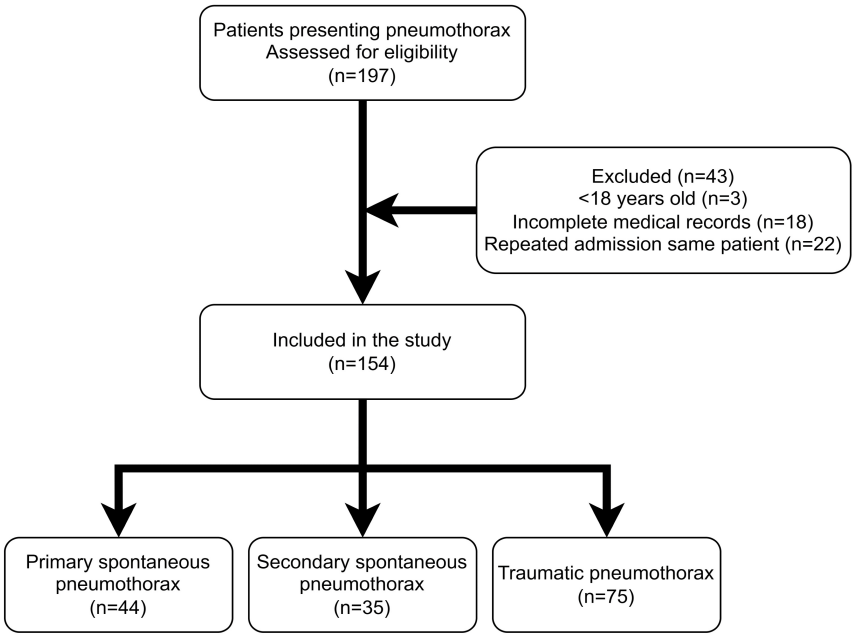

FIGURE 1. Flow diagram of patient selection and classification of pneumothorax subtypes.

USA). Continuous variables were expressed as mean ± standard deviation or median (interquartile range), as appropriate, while categorical variables were presented as frequencies and percentages. Group comparisons were performed using the chi-square test or Fisher's exact test for categorical variables and one-way analysis of variance (ANOVA) or the Kruskal–Wallis test for continuous variables, according to data distribution. When overall group differences were statistically significant, post hoc pairwise comparisons were performed to identify the source of the difference. Tukey's test was applied following significant ANOVA results, whereas Bonferroni-adjusted pairwise comparisons were used following significant Kruskal–Wallis test results. Significant pairwise differences are indicated in the tables using superscript letters. A two-sided P value <0.05 was considered statistically significant.

RESULTS

A total of 154 patients diagnosed with pneumothorax were included in the study. Among these patients, 44 (28.6%) were classified as PSP, 35 (22.7%) as secondary spontaneous pneumothorax, and 75 (48.7%) as traumatic pneumothorax. The mean age differed significantly between the groups, with patients in the SSP group being significantly older than those in the PSP group (66.5 vs. 41.2 years, P<0.001). The mean age of patients with traumatic pneumothorax was 60.6 years (Table 1).

Male patients constituted the majority in all groups. In the PPS group, thirty-six (81.8%) patients were male, while in the SSP group 32 (91.4%) patients were male and in the traumatic pneumothorax group 62 (82.7%) patients were male. There was no statistically significant difference between the groups in terms of sex distribution (P=0.426). Similarly, smoking status did not differ significantly among the groups (P=0.095) (Table 1).

In terms of presenting symptoms, dyspnea was significantly more frequent in the secondary pneumothorax group compared with the other groups (P=0.029). Dyspnea was present in 63.6% of patients with PSP, 88.6% of patients with SSP, and 66.7% of those with traumatic pneumothorax. Chest pain was the most common symptom overall and was observed in 79.5% of primary pneumothorax patients, 80% of secondary pneumothorax patients, and 94.7% of traumatic pneumothorax patients, with a statistically significant difference between the groups (P=0.023). Palpitations were also significantly more common in the secondary pneumothorax group (P=0.016), whereas cough did not show a significant difference among the groups (P=0.844) (Table 1).

Comorbid diseases differed between groups. copd was strongly associated with SSP (P<0.001), being present in 88.6% of patients in this group. Tuberculosis sequelae were also significantly more common in patients with SSP (P=0.017). Extrathoracic malignancies were more frequently observed in the SSP group (P=0.036), whereas hypertension, diabetes mellitus, coronary artery disease, pneumonia, and lung cancer did not differ significantly between the groups (Table 1).

Evaluation of pneumothorax characteristics revealed no significant differences in pneumothorax size among the groups (P=0.720). Most cases were unilateral, occurring in 97.7% of PSP patients, 100% of SSP patients, and 98.7% of traumatic pneumothorax patients (P=0.675). Right-sided pneumothorax was observed in 63.6% of PSP patients, 51.4% of SSP, and 60% of traumatic pneumothorax patients, without a significant difference between the groups (P=0.535). Similarly, left-sided pneumothorax distribution did not differ significantly between groups (P=0.659). Rib fractures were significantly more common in the traumatic pneumothorax group (P<0.001) (Table 2).

Regarding treatment modalities, oxygen therapy was administered to the majority of patients in all groups, with rates of 93.2% in the PSP group, 94.3% in the SSP group, and 86.7% in the traumatic pneumothorax group (P=0.337). Simple aspiration was rarely performed and was used in only 2.7% of cases overall (P=0.986). Chest tube drainage was the most frequently applied treatment modality and was performed in 72.7% of PSP patients, 80% of SSP patients, and 70.7% of traumatic pneumothorax patients, without a statistically significant difference between the groups (P=0.584). Pleurodesis was performed only in the SSP group (8.6%) and showed a statistically significant difference between the groups (P=0.006). Thoracoscopy and VATS were performed significantly more frequently in patients with spontaneous pneumothorax compared with

TABLE 1. Comparison of Demographic Characteristics, Clinical Presentation, Comorbidities, Prognosis, Seasonality, and Length of Hospital Stay Among Patients with Primary, Secondary, and Other Pneumothorax

	Primary pneumothorax	Secondary pneumothorax	Traumatic pneumothorax	P-value
Age (years)	41.2 (35.1-47.2)	66.5 (60.8-72.2)	60.6 (56.4-64.8)	**<0.001**[ab]
Gender				
Female	8 (18.2)	3 (8.6)	13 (17.3)	0.426
Male	36 (81.8)	32 (91.4)	62 (82.7)	
Symptoms				
Dyspnea	28 (63.6)	31 (88.6)	50 (66.7)	**0.029**[ac]
Chest pain	35 (79.5)	28.0 (80)	71 (94.7)	**0.023**[b]
Palpitations	2 (4.5)	8 (22.9)	19 (25.3)	**0.016**[ab]
Cough	4 (9.1)	4 (11.4)	6 (8.0)	0.844
Smoking status				
Never smoked	10.0 (22.7)	2 (5.7)	22 (29.3)	0.095
Former smoker	23 (52.3)	21 (60.0)	34 (45.3)	
Current smoker	11 (25.0)	12 (34.3)	19 (25.3)	
Comorbidity				
COPD	1 (2.3)	31 (88.6)	8 (10.7)	**<0.001**[ac]
Pneumonia	1 (2.3)	5 (14.3)	4 (5.3)	0.084
Sequelae of tuberculosis	2.0 (4.5)	5 (14.3)	1 (1.3)	**0.017**[c]
Hypertension	6 (13.6)	12 (34.3)	19 (25.3)	0.096
Diabetes mellitus	1 (2.3)	1 (2.9)	6 (8.0)	0.309
Coronary artery disease	2 (4.5)	7 (20.0)	14 (18.7)	0.072
Lung cancer	1 (2.3)	2 (5.7)	6 (8.0)	0.437
Extrapulmonary malignancy	2 (4.5)	7 (20.0)	5 (6.7)	**0.036**[a]
Prognosis				
Survive	43 (97.7)	32 (91.4)	65 (86.7)	0.127
Exitus	1 (2.3)	3 (8.6)	10 (13.3)	
Season				
Spring	11 (25.0)	8 (22.9)	18 (24.0)	0.104
Summer	13 (29.5)	8 (22.9)	21 (28.0)	
Autumn	9 (20.5)	4 (11.4)	23 (30.7)	
Winter	11.0 (25.0)	15 (42.9)	13 (17.3)	
Length of hospital stay	3.1 (1.4-4.8)	3.9 (1.9-5.8)	4.1 (2.3-5.9)	0.536

Data are shown as mean (95% confidence interval) or n (%) where appropriate. COPD, chronic obstructive pulmonary disease.
Superscript letters indicate pairwise comparisons for statistically significant post hoc differences: a, primary versus secondary pneumothorax; b, primary versus traumatic pneumothorax; c, secondary versus traumatic pneumothorax.
Statistically significant P-values are shown in bold.

TABLE 2. Comparison of Pneumothorax Characteristics, Treatment Approaches, and Associated Pathologies Among Patients with Primary, Secondary, and Traumatic Pneumothorax

	Primary pneumothorax	Secondary pneumothorax	Traumatic pneumothorax	P-value
Type of pneumothorax				
Minimal	12 (27.3)	7 (20.0)	20 (26.7)	0.720
Partial	4 (9.1)	5 (14.3)	12 (16.0)	
Subtotal	10 (22.7)	5 (14.3)	16 (21.3)	
Total	18 (40.9)	18 (51.4)	27 (36.0)	
Location of pneumothorax				
Unilateral	43 (97.7)	35 (100)	74 (98.7)	0.675
Bilateral	1 (2.3)	0 (0)	1 (1.3)	
Right-sided	28 (63.6)	18 (51.4)	45 (60.0)	0.535
Left-sided	17 (38.6)	17 (48.6)	31 (41.3)	0.659
Treatment approach				
Oxygen therapy	41 (93.2)	33 (94.3)	65 (86.7)	0.337
Chest tube insertion	32 (72.7)	28 (80.0)	53 (70.7)	0.584
VATS	8 (18.2)	5 (14.3)	1 (1.3)	**0.004**[ab]
Decortication	3.0 (6.8)	4 (11.4)	0 (0)	**0.019**[c]
Intubation	0 (0)	4.0 (11.4)	10 (13.3)	**0.044b**
Associated pathology				
Rib fracture	0 (0)	1 (2.9)	40 (53.3)	**<0.001**[ab]
Hemothorax	1 (2.3)	0 (0)	14 (18.7)	**0.001**[ab]
Pneumomediastinum	2 (4.5)	2 (5.7)	6 (8.0)	0.744
Pleural effusion	2 (4.5)	9 (25.7)	16 (21.3)	**0.023**[ab]
Subcutaneous emphysema	1 (2.3)	9 (25.7)	9.0 (12.0)	**0.007**[a]

Data are shown as n (%). VATS, video-assisted thoracoscopic surgery.

Superscript letters indicate statistically significant pairwise post hoc comparisons: a, primary versus secondary pneumothorax; b, primary versus traumatic pneumothorax; c, secondary versus traumatic pneumothorax

Statistically significant P-values are shown in bold.

traumatic pneumothorax (P=0.048 and P=0.004, respectively). Decortication procedures also differed significantly between groups (P=0.019). Endotracheal intubation was significantly more common in the secondary and traumatic pneumothorax groups (P=0.044) (Table 2).

Complication analysis demonstrated that hemothorax occurred significantly more frequently in patients with traumatic pneumothorax (P=0.001). Pleural effusion and subcutaneous emphysema were significantly more common in the secondary pneumothorax group (P=0.023 and P=0.007, respectively). No significant differences were observed between the groups in terms of pneumomediastinum or flail chest (Table 2).

Analysis of laboratory parameters revealed significant differences between the groups. Hemoglobin and hematocrit levels were significantly lower in patients with traumatic pneumothorax (P<0.001 and P=0.001, respectively). Lymphocyte counts were significantly lower in the SSP group (P=0.001). Significant differences were also found in eosinophil (P=0.001) and basophil (P=0.033) counts. However, white blood cell count, platelet count,

TABLE 3. Comparison of Hematological Parameters and C-Reactive Protein Levels Among Patients with Primary, Secondary, and Traumatic Pneumothorax

	Primary pneumothorax	Secondary pneumothorax	Traumatic pneumothorax	P-value
Hemoglobin (g/dL)	13.9 (13.2-14.6)	13.1 (12.5-13.8)	12.2 (11.6-12.8)	**<0.001[b]**
Hematocrit (%)	41.2 (39.1-43.4)	40.6 (38.7-42.5)	37.3 (35.8-38.9)	**0.001[b]**
White blood cell (×10³/µL)	11.46 (9.61-13.30)	11.65 (9.78-13.51)	11.81 (10.19-13.42)	0.934
Platelet (×10³/µL)	259 (240-279)	294 (252-337)	257 (231-282)	0.218
RDW (%)	43.0 (41.0-45.1)	45.5 (43.7-47.3)	44.7 (43.6-45.9)	0.148
Neutrophil (×10³/µL)	7.81 (6.62–9.00)	9.04 (7.19-10.88)	8.88 (7.88-9.88)	0.399
Lymphocyte (×10³/µL)	2.35 (1.58-3.12)	1.72 (1.29-2.15)	1.52 (1.27-1.77)	**0.001[b]**
Eosinophil (×10³/µL)	0.26 (0.13-0.39)	0.31 (0.01-0.60)	0.12 (0.06-0.17)	**0.001[bc]**
Basophil (×10³/µL)	0.04 (0.03-0.05)	0.03 (0.03-0.04)	0.03 (0.02-0.03)	**0.033[b]**
Monocyte (×10³/µL)	0.59 (0.50-0.67)	0.55 (0.46-0.65)	0.65 (0.59-0.72)	0.099
C-reactive protein (mg/L)	23.47 (7.59-39.34)	33.31 (11.35-55.27)	31.29 (17.84-44.74)	0.055

Data are shown as mean (95% confidence interval). RDW, red cell distribution width.

Superscript letters indicate statistically significant pairwise post hoc comparisons: a, primary versus secondary pneumothorax; b, primary versus traumatic pneumothorax; c, secondary versus traumatic pneumothorax.

Statistically significant P-values are shown in bold.

neutrophil count, monocyte count, and CRP levels did not differ significantly between the groups (Table 3). The mean length of hospital stay did not differ significantly between the groups (P=0.536). Mortality occurred in 1 (2.3%) patient in the PSP group, 3 patients (8.6%) in the SSP group, and 10 (13.3%) patients in the traumatic pneumothorax group; however, this difference was not statistically significant (P=0.127). Additionally, no significant difference was observed in the seasonal distribution of pneumothorax cases among the groups (P=0.104) (Table 3).

DISCUSSION

Pneumothorax is a common thoracic emergency that can occur spontaneously or as a result of trauma. In this study, we evaluated and compared the clinical characteristics, treatment approaches, and outcomes of patients with primary spontaneous, secondary spontaneous, and traumatic pneumothorax. Our findings reveal that these groups differ in several clinically significant aspects.

Patients with SSP were significantly older than those with PSP. This finding is consistent with the literature, as PSP is generally observed in younger individuals without underlying lung disease, while SSP is more common in older patients with chronic pulmonary conditions such as COPD [6, 9, 10]. The higher age observed in the SSP group is likely related to the increased prevalence of chronic lung diseases among older adults.

A higher incidence of pneumothorax was observed in men for all types of pneumothoraxes. This is consistent with previous studies reporting a higher incidence of pneumothorax in men, particularly in cases of PSP [8, 18]. This difference has been attributed to both biological factors and lifestyle-related factors, including smoking.

Although there was no significant difference in smoking rates between the groups in our study, smoking exposure was common in patients with spontaneous pneumothorax. It is well known that smoking contributes to inflammation and structural changes in lung tissue, promotes bleb and bulla formation, and increases the risk of pneumothorax [9, 19].

Clinically, chest pain was the most common symptom, while dyspnea was observed more frequently in patients with secondary spontaneous pneumothorax.

This finding is consistent with previous studies showing that chest pain and dyspnea are the most frequent symptoms of pneumothorax [10]. The higher prevalence of dyspnea in SSP patients may reflect reduced pulmonary reserve associated with underlying chronic lung disease, making these patients more susceptible to symptomatic respiratory compromise even in the presence of relatively small pneumothorax.

Most cases of pneumothorax were unilateral, with a slight predominance on the right side. This observation is consistent with previous reports indicating that spontaneous pneumothorax most often affects a single hemithorax [20].

Chest tube drainage was the most frequently used treatment method in all groups. This finding is consistent with current guidelines recommending tube thoracostomy as the primary treatment for moderate to large pneumothorax [13, 14]. Although, conservative management may be favorable in selected patients with small and clinically stable PSP [17].

Surgical procedures, especially VATS, have become more common in patients with spontaneous pneumothorax, mostly in cases of recurrent or persistent air leak. Previous studies have shown VATS to be an effective and minimally invasive option that significantly diminishes recurrence rates [21, 22].

As expected, traumatic pneumothorax was strongly associated with additional thoracic injuries such as hemothorax and rib fractures. This finding reflects the underlying mechanism of traumatic chest injury and is consistent with previous reports [11]. The high frequency of associated thoracic injuries highlights the importance of comprehensive trauma assessment and early identification of concomitant injuries in these patients.

Mortality rates were numerically higher in the secondary and traumatic pneumothorax groups, this difference was not statistically significant. However, previous studies have shown that advanced age, comorbidities, and complications are important determinants of mortality, especially in patients with SSP [10].

An important strength of the present study is the direct comparison of primary spontaneous, secondary spontaneous, and traumatic pneumothorax within a single patient cohort. This approach enabled us to identify clinically relevant differences in patient demographics, symptom profiles, comorbidities, treatment strategies, and associated thoracic injuries according to pneumothorax etiology. These findings may help clinicians recognize high-risk patient groups, anticipate potential complications, and tailor management strategies more effectively.

Overall, our findings highlight that pneumothorax is not a single clinical entity but a heterogeneous condition with distinct clinical profiles depending on its etiology. Recognizing these differences is essential for selecting the most appropriate management strategy. An etiology-based approach may facilitate better clinical decision-making, improve patient outcomes, and optimize resource utilization. Future multicenter, prospective studies are needed to further clarify optimal management strategies and long-term outcomes in patients with pneumothorax.

Strengths and Limitations

This study has several limitations. First, due to its retrospective design, the data were obtained from hospital records and may therefore be subject to incomplete documentation, information bias, and potential selection bias. Second, the study was conducted at a single center, and the patient population represents a specific geographic region; therefore, the findings may not be fully generalizable to other institutions or populations. Furthermore, the study period covered only one year, and the relatively small number of patients in some subgroups may have limited the statistical power to detect certain differences between groups. Finally, long-term follow-up data and recurrence rates were not available and therefore could not be evaluated.

Despite these limitations, the study also has several strengths. To our knowledge, few studies have directly compared primary spontaneous, secondary spontaneous, and traumatic pneumothorax within the same cohort. This design enabled a comprehensive evaluation of differences in clinical characteristics, comorbidities, treatment approaches, complications, and outcomes across pneumothorax etiologies. In addition, the inclusion of a broad range of clinical and laboratory variables provides a detailed characterization of the study population. Finally, the study reflects contemporary real-world clinical practice and offers clinically relevant insights that may

support etiology-based management strategies for patients with pneumothorax.

CONCLUSION

In this study, the demographic characteristics, clinical presentations, treatment approaches, and outcomes of patients with pneumothorax were evaluated. Our findings indicate that PSP is predominantly more common in younger patients, while SSP is more frequent in older individuals and is strongly associated with underlying lung diseases, particularly COPD. In cases of traumatic pneumothorax, associated thoracic injuries such as hemothorax and rib fractures were observed more frequently. Tube thoracostomy remained the most commonly used treatment modality across all pneumothorax types, while surgical interventions were mainly reserved for recurrent or complicated cases. These findings highlight the importance of individualized management strategies based on the etiology, comorbidities, and clinical characteristics of patients with pneumothorax.

Ethics Approval and Consent to Participate

This study was approved by the Giresun Training and Research Hospital Ethics Committee (Decision No: BAEK 2025-318/15; date: 14.05.2025). All procedures were conducted in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all participants' parents for the publication of this study.

Clinical Trial Registration

Not Available.

Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contribution

Study Conception: SG; Study Design: SG; Supervision: SG, HBA; Funding: N/A; Materials: N/A; Data Collection and/or Processing: SG, HBA, SÖ; Statistical Analysis and/or Data Interpretation: HBA; Literature Review: SG, SÖ; Manuscript Preparation: SG, HBA; Critical Review: SG.

Conflict of Interest Statement

All authors have completed the ICMJE uniform disclosure form and declare that no potential conflicts of interest, financial or otherwise, exist regarding the research, authorship, or publication of this manuscript.

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Generative Artificial Intelligence Statement

Artificial intelligence–assisted tools were used solely for language editing and clarity improvement. No artificial intelligence tools were used for data analysis, data interpretation, or the generation of scientific conclusions. The authors take full responsibility for the integrity and accuracy of the work.

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