Original Article

Risk factors and age-specific monthly patterns of primary spontaneous pneumothorax: a multicenter study

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Background: Primary spontaneous pneumothorax (PSP) is characterized by sudden lung collapse without external injury or underlying lung disease. However, detailed research on its causes and recurrence patterns is lacking, prompting investigating monthly epidemiology and factors influencing recurrence. Therefore, we aimed to assess the monthly trends in PSP occurrence and identify factors contributing to its recurrence, with a focus on teenagers due to the high incidence rates in this population, while also examining risk factors across other age groups.

Methods: We conducted a multicenter retrospective study involving 4,231 cases of PSP from five hospitals in Korea. Patients aged 10–39 years were included, wherein monthly incidence patterns were assessed. Statistical analyses using physical parameters and laboratory data were performed to determine factors influencing recurrence.

Results: Our analysis revealed that July was the most common diagnosis month in teenagers, followed by October and March. This month-based pattern differed from that observed in the other age groups. Multivariate analysis revealed body mass index (BMI) at initial diagnosis to be a significant risk factor for first recurrence in male patients aged 16–19 years [hazard ratio (HR), 0.98; 95% confidence interval (CI): 0.97–0.99; P=0.001] and in male patients older than 20 years (HR, 0.99; 95% CI: 0.98–0.99; P<0.001). In male patients aged ≥20 years, the monocyte-lymphocyte ratio (MLR) at initial diagnosis was also a significant factor for first recurrence (HR, 1.20; 95% CI: 1.10–1.32; P<0.001). In female patients aged ≥20 years, MLR at the time of the first pneumothorax was significantly associated with recurrence (HR, 1.41; 95% CI: 1.07–1.87; P=0.01).

Conclusions: Our study provided valuable insights into the month-based epidemiology of PSP in Korea, highlighting differences in incidence patterns among teenagers compared with those in the other age groups. Moreover, the reported link between BMI, inflammation, and pneumothorax recurrence might be a basis for future prospective studies aimed to prevent and treat pneumothorax.

Keywords: Pneumothorax; adolescents; recurrence

Submitted Nov 11, 2024. Accepted for publication Feb 18, 2025. Published online Mar 19, 2025.
doi: 10.21037/jtd-2024-1957
View this article at: https://dx.doi.org/10.21037/jtd-2024-1957

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Introduction

Background

Primary spontaneous pneumothorax (PSP) is characterized by the sudden collapse of the lung without external damage in individuals without underlying lung disease. It occurs when air enters the pleural space, leading to partial or complete lung collapse and causing sharp chest pain and breathlessness. Despite its potential severity, research on PSP occurrence and recurrence is limited, partly due to its low prevalence. Existing studies indicate varying incidence rates among female, 1.2 to 6 per 100,000, and male patients, 7.4 to 18.0 per 100,000 (1).

Highlight box

Key findings

- Distinct monthly dynamics in primary spontaneous pneumothorax (PSP) incidence between individuals aged ≥20 years and those in their teens were found. We identified body mass index (BMI) and monocyte-lymphocyte ratio (MLR) as risk factors for PSP recurrence: BMI was a male sex-specific factor, whereas MLR applied to both sexes in patients aged more than 20 years.

What is known and what is new?

- Research on the occurrence and recurrence of PSP is limited, lacking comprehensive evaluations of PSP epidemiology and risk factors. Prior studies have established an association between BMI and PSP development, recognizing low BMI as a significant risk factor for recurrence. Additionally, although inflammatory status may play a role, studies investigating its relationship with PSP recurrence remain scarce.
- Our study highlighted that PSP incidence was mainly observed in patients in their late teenage years, with distinct differences in incidence and recurrence patterns compared with other age groups. Additionally, we found that BMI was significantly associated with PSP recurrence, consistent with prior findings indicating that low BMI increased recurrence risk. Notably, we observed that PSP could also occur in patients with normal BMI, suggesting that dynamic changes in body shape, such as rapid height growth followed by volume increase, might play a crucial role in PSP. Furthermore, we identified MLR as a novel and significant risk factor for PSP recurrence, emphasizing the role of systemic inflammation.

What is the implication, and what should change now?

- We observed distinct incidence patterns among teenagers compared with those in other age groups, warranting further investigation.
- Our findings linking BMI and inflammation status to pneumothorax recurrence offer valuable groundwork for future prospective studies aimed to establish preventive and effective treatment strategies.

Rationale and knowledge gap

The recurrent nature of PSP poses significant health risks and underscores the need for comprehensive research into its underlying causes and mechanisms (2). Although previous literature provides insights into recurrence rates and potential risk factors, a comprehensive analysis is lacking (3-8). Addressing this gap is crucial for identifying modifiable risk factors and developing targeted interventions to mitigate recurrence rates.

Objective

Therefore, this study aimed to explore the epidemiology of pneumothorax in Korea, including monthly incidence patterns by age group and investigate hemodynamic indicators affecting recurrence. These findings may help identify specific environmental and physiological factors contributing to PSP. We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-2024-1957/rc).

Methods

Patient selection

We conducted a retrospective analysis of data from five university hospitals affiliated to The Catholic University of Korea (Seoul St. Mary's Hospital, St. Vincent's Hospital, Incheon St. Mary's Hospital, Bucheon St. Mary's Hospital, and Uijeongbu St. Mary's Hospital) covering the period from January 2013 to May 2023. Among 12,828 patients diagnosed with pneumothorax, 4,231 met the inclusion criteria. Patients under 10 or over 39 years of age; those with missing clinical data; and those with traumatic or secondary spontaneous pneumothorax (SSP) were excluded from the study. Subgroup analyses were performed based on age (teenagers and ≥20 years) and sex (*Figure 1*).

Variables definitions

Pneumothorax classification included spontaneous pneumothorax (SP) and traumatic pneumothorax, with SP further categorized into PSP and SSP related to underlying lung disease (9). Patients under 40 years old without secondary pneumothorax were included in the study.

To assess month-based occurrence patterns, we captured the month of the first emergency department visit or hospitalization with a diagnosis of pneumothorax. Month-

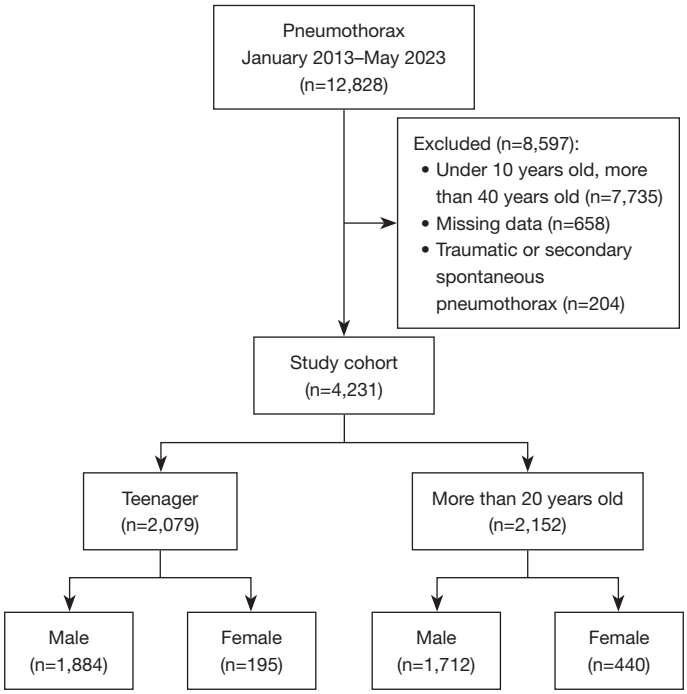


Figure 1 Flow diagram of patient inclusion in the study.

based patterns were also analyzed for the time of first recurrence, defined as an emergency department visit or hospitalization for the same diagnosis.

Height and weight data within one year of diagnosis were used to calculate body mass index (BMI), categorized according to World Health Organization criteria. Lean body type was defined as BMI <18.5 kg/m^2.

Laboratory data included complete blood count, hemoglobin, hematocrit, platelet, and white blood cell counts. The percentage of each inflammatory cell (neutrophil, lymphocyte, monocytes, eosinophils, and basophils) was also analyzed. The levels of albumin, aspartate transaminase, and alanine transferase, indicative of the nutritional status, were also analyzed. Creatine phosphokinase levels were used as an indicator of muscle damage or stress.

Statistical analysis

Continuous variables were analyzed using the independent *t*-test, while categorical variables were examined using the Chi-squared and Fisher's exact tests. Descriptive statistics are represented as means and standard deviations for continuous variables and frequencies and percentages for categorical variables. The Shapiro-Wilk test assessed the normality of each parameter's distribution. Logistic regression analysis was performed to identify factors contributing to recurrence, including age, sex, smoking status, BMI, and laboratory results (white blood cell, hemoglobin, hematocrit, platelet). Statistical analyses were performed using R (v4.2.2; R Core Team 2022, Vienna, Austria), with a package including moon Book. A P value <0.05 indicated statistical significance.

Ethical statement

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Review Board of The Catholic University of Korea (No. KC23WIDI0546), and individual consent for this retrospective analysis was waived.

Results

Patient characteristics

Among the 4,231 patients, 3,596 (85.0%) were male and 635 (15.0%) were female patients, with a male-to-female ratio of 5.7:1. Of the male patients, 1,884 (52.4%) were teenagers and 1,712 (47.6%) were over 20 years of

Table 1 Baseline characteristics of patients with PSP (n=4,231)

Characteristics	Male (n=3,596)	Female (n=635)	P value
Age (years)	22.0±6.7	25.3±7.8	<0.001
<20	1,884 (52.4)	195 (30.7)	
≥20	1,712 (47.6)	440 (69.3)	
Weight (kg)	61.5±11.2	51.7±9.9	<0.001
Height (cm)	174.9±7.8	162.3±7.5	<0.001
BMI (kg/m^2)			0.005
<18.5	1,203 (33.5)	256 (40.3)	
≥18.5, <23	1,848 (51.4)	302 (47.6)	
≥23, <25	317 (8.8)	47 (7.4)	
≥25, <30	195 (5.4)	22 (3.5)	
≥30	33 (0.9)	8 (1.3)	
Smoking history			0.001
Ex/current smoker	903 (25.1)	53 (8.3)	
Never smoker	1,491 (41.5)	354 (55.7)	
Missing data	1,202 (33.4)	228 (35.9)	
White blood cell (×10^9/L)	8.1±3.0	8.0±6.4	0.63
Neutrophils (%)	63.0±12.5	63.1±13.0	0.81
Lymphocytes (%)	26.0±10.9	26.7±11.1	0.10
Monocytes (%)	8.1±2.7	7.3±2.7	<0.001
Eosinophils (%)	2.6±2.4	2.2±2.2	0.001
Basophils (%)	0.4±0.3	0.4±0.3	0.59
NLR	3.5±3.4	3.8±6.2	0.23
MLR	0.4±0.3	0.3±0.2	<0.001
Hemoglobin (g/dL)	14.4±1.5	12.3±1.5	<0.001
Hematocrit (%)	42.5±4.2	37.0±4.2	<0.001
Platelet (×10^9/L)	242.7±72.8	258.2±80.2	<0.001
CPK (U/L)	262.0±981.6	262.0±981.6	0.11
Albumin (g/dL)	4.3±0.5	4.1±0.6	<0.001
AST (U/L)	28.2±121.2	36.0±204.4	0.36
ALT (U/L)	23.0±57.9	24.3±93.4	0.73
Recurrence	1,591 (44.2)	254 (40.0)	0.052

Values are presented as number (%) or mean ± standard deviation. AST, aspartate transaminase; ALT, alanine transferase; BMI, body mass index; CPK, creatine phosphokinase; MLR, monocyte-lymphocyte ratio; NLR, neutrophil-lymphocyte ratio; PSP, primary spontaneous pneumothorax.

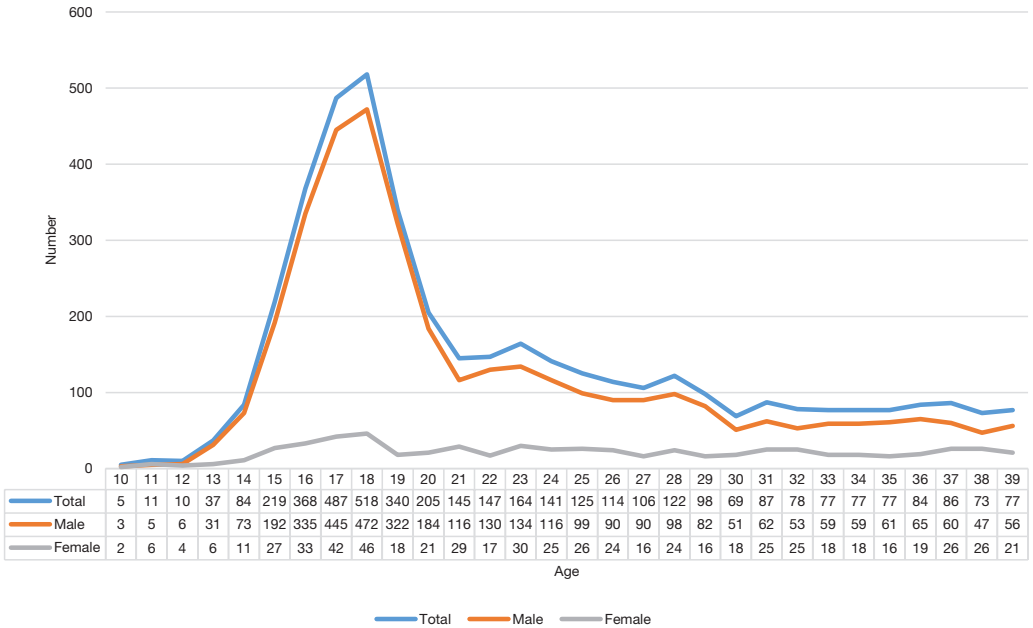
age. Among female patients, 195 (30.0%) were teenagers and 440 (70.0%) were over 20 years of age. Additionally, 1,203 (33.5%) male and 256 (40.3%) female patients had a BMI <18.5 kg/m^2. The number of recurrences was 1,591 and 254 in male and female participants, with recurrence rates of 44.2% and 40.0%, respectively; the differences in these rates were marginally significant (P=0.052) (*Table 1*). The peak age at first diagnosis was 18 years (12.24%), followed by 17 years (11.51%), 16 years (8.70%), and 19 years (8.04%) (*Figures 2,3*). Subgroup analysis in patients aged 16–19 years revealed less tobacco use, and highly lean body compared with the general population. The recurrence rate in the age group of 16–19 years was comparable between the sexes at 778 (49.4%) male and 66 (47.5%) female cases (*Table 2*).

Monthly prevalence

July (n=209, 10.05%) was the most common diagnosis month in teenagers, followed by October (n=195, 9.38%) and March (n=193, 9.28%). The lowest incidence month was February (n=132, 6.35%). There was a statistically significant difference in occurrence between each month (P=0.001). Although the timing of first pneumothorax diagnosis did not differ by month, November (n=199, 9.25%) and August (n=160, 7.43%) were the most and least common diagnosis months in patients aged ≥20 years (P=0.64) (*Figure 4A,4B*). Regarding the timing of first recurrence, teens showed higher rates during March–April (n=199, 19.15%) and July–August (n=195, 18.76%) (P=0.17), whereas patients aged ≥20 years reported a recurrence peak in March (n=81, 10.05%) (P=0.55) (*Figure 5A,5B*).

Risk factors for PSP first recurrence

Using multivariate analysis, BMI at initial diagnosis was a significant risk factor for first recurrence in male patients aged 16–19 years [hazard ratio (HR), 0.98; 95% confidence interval (CI): 0.97–0.99; P=0.001] (*Table 3*) and in those aged ≥20 years (HR, 0.99; 95% CI: 0.98–0.99; P<0.001). In male patients aged ≥20 years, monocyte-lymphocyte ratio (MLR) at initial diagnosis was also a significant factor for first pneumothorax recurrence (HR, 1.20; 95% CI: 1.10–1.32; P<0.001) (*Table 4*). In female patients aged ≥20 years, MLR was significantly linked to first pneumothorax recurrence (HR, 1.41; 95% CI: 1.07–1.87; P=0.01), whereas BMI was not associated with it (*Table 4*).



Age	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Total	5	11	10	37	84	219	368	487	518	340	205	145	147	164	141	125	114	106	122	98	69	87	78	77	77	77	84	86	73	77
Male	3	5	6	31	73	192	335	445	472	322	184	116	130	134	116	99	90	90	98	82	51	62	53	59	59	61	65	60	47	56
Female	2	6	4	6	11	27	33	42	46	18	21	29	17	30	25	26	24	16	24	16	18	25	25	18	18	16	19	26	26	21

Figure 2 Distribution of patients first diagnosed with PSP by sex and age (years). PSP, primary spontaneous pneumothorax.

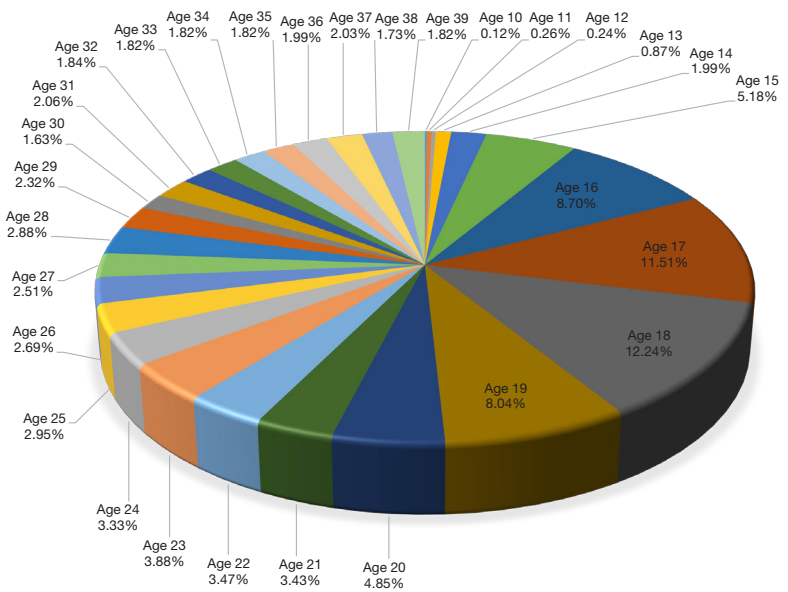


Figure 3 Proportion of patients first diagnosed with PSP by age group (years). PSP, primary spontaneous pneumothorax.

Discussion

Key findings

Our study, encompassing a substantial patient cohort, underscores the concentration of PSP incidence among late teens in Korea. Notably, this study provided a deeper analysis of age at onset compared with previous studies (2,10,11), showing different monthly dynamics in the incidence of PSP among individuals aged 20 years and older versus teens. However, no statistically significant differences were identified, providing nuanced directions for future investigation. Additionally, we identified BMI and MLR as

Table 2 Baseline characteristics of patients aged 16–19 years with PSP (n=1,713)

Characteristics	Male (n=1,574)	Female (n=139)	P value
Age (years)			0.20
16	335 (21.3)	33 (23.7)	
17	445 (28.3)	42 (30.2)	
18	472 (30.0)	46 (33.1)	
19	322 (20.5)	18 (12.9)	
Weight (kg)	58.5±9.7	49.4±7.7	<0.001
Height (cm)	175.0±8.1	163.1±7.0	<0.001
BMI (kg/m^2)			0.10
<18.5	707 (44.9)	78 (56.1)	
≥18.5, <23	775 (49.2)	56 (40.3)	
≥23, <25	59 (3.7)	3 (2.2)	
≥25, <30	27 (1.7)	1 (0.7)	
≥30	6 (0.4)	1 (0.7)	
Smoking history			0.001
Ex/current smoker	197 (12.5)	3 (2.2)	
Never smoker	800 (50.8)	83 (59.7)	
Missing data	577 (36.7)	53 (38.1)	
White blood cell (×10^9/L)	8.1±3.0	8.8±10.5	0.47
Neutrophils (%)	63.6±12.5	64.0±12.9	0.68
Lymphocytes (%)	25.6±10.8	26.2±11.4	0.56
Monocytes (%)	8.1±2.6	7.3±2.8	0.004
Eosinophils (%)	2.4±2.3	1.9±1.7	0.002
Basophils (%)	0.3±0.3	0.3±0.2	0.24
NLR	3.5±3.2	4.2±7.9	0.35
MLR	0.4±0.2	0.3±0.2	0.052
Hemoglobin (g/dL)	14.6±1.3	12.5±1.4	<0.001
Hematocrit (%)	43.0±3.6	37.8±3.7	<0.001
Platelet (×10^9/L)	235.4±55.1	243.7±72.7	0.21
CPK (U/L)	234.6±631.7	142.9±296.5	0.005
Albumin (g/dL)	4.4±0.5	4.3±0.6	0.009
AST (U/L)	25.7±130.0	36.1±93.8	0.25
ALT (U/L)	18.3±27.4	30.2±107.8	0.22
Recurrence	778 (49.4)	66 (47.5)	0.72

Values are presented as numbers (%) or mean ± standard deviation, unless otherwise indicated. AST, aspartate transaminase; ALT, alanine transferase; BMI, body mass index; CPK, creatine phosphokinase; MLR, monocyte-lymphocyte ratio; NLR, neutrophil-lymphocyte ratio; PSP, primary spontaneous pneumothorax.

risk factors for PSP recurrence: BMI was a male sex-specific factor, whereas MLR applied to both sexes.

Strengths and limitations

Our study provides significant insights based on month-based pneumothorax epidemiology analysis in Korea, which has not been extensively explored in prior research. The study has some limitations. First, there might be selection bias inherent in its retrospective design. Although it comprised data from five multicenter studies, the inclusion of only a few regions in Korea limits its ability to represent nationwide trends. Additionally, being retrospective and reliant on a database, the diagnosis used in the search was pneumothorax rather than PSP, potentially introducing misclassifications. Despite exerting efforts to minimize errors by excluding traumatic pneumothorax and SSP through medical record reviews and age restrictions, some misclassifications, such as undiagnosed Birt-Hogg-Dubé syndrome or menstrual-related pneumothorax, might have remained. These conditions are relatively rare and often underreported in medical records, particularly in retrospective studies. However, given their low prevalence and the careful application of inclusion criteria, the impact on our findings is likely minimal. Furthermore, due to the retrospective nature of the study, we were unable to include treatments performed at the time of the initial pneumothorax in the risk factor analysis. Specifically, the presence or absence of surgical intervention is considered an important factor associated with recurrence rates. However, given that current guidelines generally recommend avoiding surgical intervention during the first episode of pneumothorax (except for cases such as tension pneumothorax or in patients with specific occupational requirements) (12); it is likely that very few patients in our cohort underwent surgery during their initial episode. Therefore, we suggest that this limitation had minimal impact on the study's overall findings. Second, this study did not assess subpleural bullae or apex dysplasia, significant factors in juvenile PSP, due to limitations in retrospective medical records. Future prospective studies should address this. Third, potential biases in our study, including age-specific factors influencing recurrence risk, warrant further prospective investigations to better understand these dynamics and validate our findings. Fourth, we found no statistically significant differences in monthly incidence and recurrence pattern by age group. However,

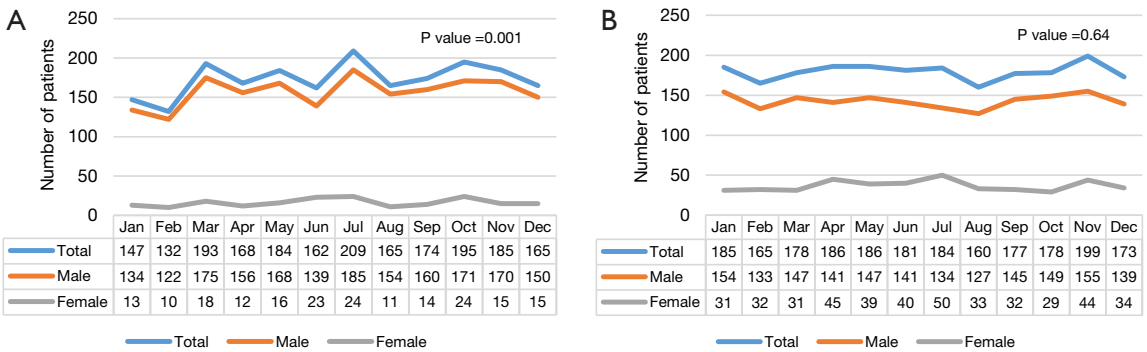


Figure 4 Monthly prevalence of the first diagnosis of PSP in (A) teenage patients and (B) those in their 20–30s. PSP, primary spontaneous pneumothorax.

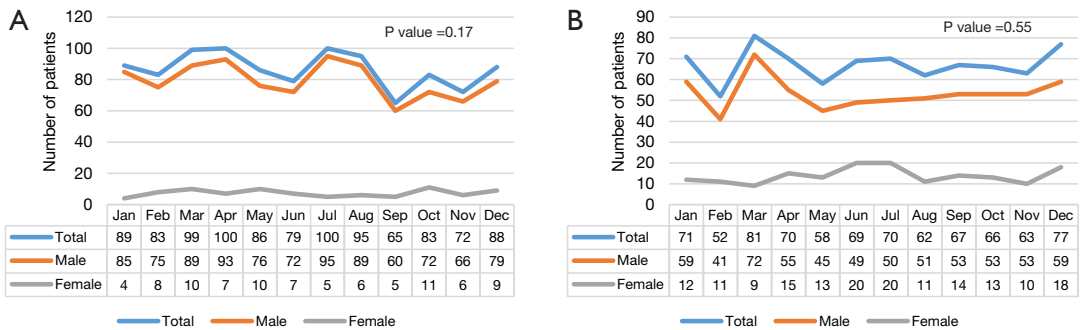


Figure 5 Monthly prevalence of the first recurrence of PSP in (A) teenage patients and (B) those in their 20–30s. PSP, primary spontaneous pneumothorax.

Table 3 Multivariable Cox analysis of the first recurrence of PSP in 16–19 years male patients

Variables	Univariable analysis		Multivariable analysis	
	HR (95% CI)	P value	HR (95% CI)	P value
Age (years)	0.96 (0.93–0.99)	0.01	0.99 (0.99–1.00)	0.002
BMI (kg/m^2)	0.98 (0.97–0.99)	0.002	0.98 (0.97–0.99)	0.001
Smoking history	0.98 (0.90–1.06)	0.64		
WBC (×10^9/L)	1.00 (0.99–1.01)	0.97		
Neutrophil (%)	1.00 (0.98–1.01)	0.64		
Lymphocyte (%)	0.98 (0.98–1.01)	0.38		
Monocyte (%)	0.99 (0.97–1.02)	0.62		
Basophil (%)	0.95 (0.85–1.07)	0.40		
NLR	0.99 (0.98–1.01)	0.53		
MLR	1.04 (0.80–1.36)	0.75		
Hemoglobin (g/dL)	0.98 (0.93–1.05)	0.61		
Hematocrit (%)	1.01 (0.98–1.03)	0.65		
Platelet (×10^9/L)	1.00 (1.00–1.00)	0.09	1.00 (1.00–1.00)	0.06

BMI, body mass index; CI, confidence interval; HR, hazard ratio; MLR, monocyte-lymphocyte ratio; NLR, neutrophil-lymphocyte ratio; PSP, primary spontaneous pneumothorax; WBC, white blood cell.

Table 4 Multivariable Cox analysis of the first recurrence of PSP in patients aged more than 20 years

Variables	Male				Female			
	Univariable analysis		Multivariable analysis		Univariable analysis		Multivariable analysis	
	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value
Age (years)	0.99 (0.99–1.00)	0.004	0.99 (0.99–1.00)	0.003	1.00 (0.99–1.00)	0.41		
BMI (kg/m^2)	0.99 (0.98–0.99)	<0.001	0.99 (0.98–0.99)	<0.001	0.99 (0.98–1.00)	0.14	0.99 (0.98–1.00)	0.10
Smoking history	0.94 (0.89–1.00)	0.05	0.94 (0.89–1.00)	0.04	1.05 (0.89–1.24)	0.53		
WBC (×10^9/L)	1.01 (1.00–1.02)	0.26			1.01 (1.00–1.03)	0.14	1.01 (1.00–1.02)	0.04
Neutrophil (%)	1.00 (0.99–1.01)	0.82			1.00 (0.99–1.02)	0.71		
Lymphocyte (%)	1.00 (0.99–1.01)	0.67			1.01 (0.99–1.02)	0.25		
Monocyte (%)	0.99 (0.97–1.01)	0.17	0.99 (0.98–1.00)	0.01	1.00 (0.96–1.04)	0.91		
Basophil (%)	1.01 (0.91–1.13)	0.78			1.03 (0.85–1.24)	0.76		
NLR	0.99 (0.98–1.01)	0.48			1.00 (0.98–1.02)	0.99		
MLR	1.21 (1.01–1.46)	0.04	1.20 (1.10–1.32)	<0.001	1.46 (0.84–2.52)	0.17	1.41 (1.07–1.87)	0.01
Hemoglobin (g/dL)	1.01 (0.96–1.06)	0.79			0.97 (0.88–1.06)	0.47		
Hematocrit (%)	1.00 (0.98–1.02)	0.92			1.00 (0.97–1.04)	0.80		
Platelet (×10^9/L)	1.00 (1.00–1.00)	0.79			1.00 (1.00–1.00)	0.80		

BMI, body mass index; CI, confidence interval; HR, hazard ratio; MLR, monocyte-lymphocyte ratio; NLR, neutrophil-lymphocyte ratio; PSP, primary spontaneous pneumothorax; WBC, white blood cell.

we suggest that it is significant that the occurrence of pneumothorax requires consideration of various factors. Some laboratory markers were excluded from risk factor analysis due to missing data. Nevertheless, teenagers and other age groups have different characteristics in terms of risk factors as well as epidemiology, suggesting that factors unique to teenagers might be important factors for pneumothorax. Therefore, further studies will be important for characterizing pneumothorax.

Explanation of findings and comparison with results in similar research

The heightened incidence of pneumothorax in late teenage years may stem from apex stress induced by a low thoracic index during post-adolescent adult size attainment, as posited by Casha *et al.* (13). The observed disparity in monthly incidence dynamics, particularly among late teens, may stem from environmental factors. Lee *et al.* suggested that perceived stress could influence pneumothorax incidence, potentially exacerbated by academic pressures during this developmental stage (14). Furthermore, factors such as air pollutants and airborne infections, prevalent in densely populated school environments, may contribute to pneumothorax risk (15). Although previous studies that analyzed monthly incidence rates have shown similar patterns of seasonal frequency of occurrence, they were limited by small sample sizes, which may have obscured some of these patterns (16,17). Therefore, further larger-scale research is essential for clarifying the relationship between environmental factors and pneumothorax.

Prior research has established the association of BMI with pneumothorax development (16,18,19), with low BMI being a recognized risk factor for PSP recurrence (20,21). Our study also shows that the proportion of patients with lean bodies was high in both sexes. Conversely, the proportion of patients with a BMI of 25 or higher in both sexes was approximately 5% (6.4% in men and 4.9% in women), which is quite low compared with this proportion in the Korean population as a whole (33.1% in the under 19 years age group, 31.1% in the 19–29 years age group, and 39.8% in the 30–39 years age group) (22,23), suggesting a significant correlation between body mass and the occurrence of pneumothorax. However, the substantial representation of patients within the 18.5–23 kg/m^2 BMI range, considered normal, implies

that BMI alone might not fully explain pneumothorax occurrence. Dynamic changes in body shape, particularly rapid height growth followed by volume increase, as proposed by Casha *et al.* could contribute to pneumothorax incidence (13). Therefore, a comprehensive analysis of growth patterns over time is warranted to elucidate the association between pneumothorax and BMI.

Risk factor analysis revealed BMI as a significant contributor to recurrence rates in teenage male and in male patients aged ≥20 years, supporting the impact of body mass on PSP recurrence. Additionally, the MLR value at the time of initial diagnosis emerged as a significant factor. Meanwhile, in female patients aged 16–19 years, neither BMI nor MLR was a risk factor. However, the sample size was small, potentially accounting for the undetected effect.

Our study sheds light on the impact of various hematologic markers as risk factors for first recurrence after initial pneumothorax, highlighting the significance of MLR (7). Saricam *et al.* suggested an association between lymphocyte-monocyte ratio and SP recurrence; meanwhile, our study contributes evidence based on a larger sample size and multivariate analysis, encompassing additional relevant laboratory markers (24). The pathophysiology of pneumothorax, traditionally attributed to emphysema-like changes in the visceral pleura, has recently been linked to inflammation-induced diffuse porosity, which could be its key mechanism (8,25). MLR indicates an interaction between innate and adaptive immune reactions (26,27). Increased levels of MLR can heighten systemic inflammation levels and disrupt immune regulation (27,28). Chronic inflammation leads to sustained production of pro-inflammatory cytokines, which recruit more monocytes and inhibit lymphocyte proliferation and function. This imbalance contributes to an increased MLR (29). Previous studies have demonstrated microscopic evidence of respiratory bronchiolitis characterized by accumulation of macrophages differentiating from monocytes in some patients undergoing surgery for PSP, which may suggest that monocytes are associated with pneumothorax (8,25,30).

Implications and actions needed

Our findings support the notion that inflammatory status influences recurrence, with the MLR value serving as a meaningful surrogate marker in this regard. However, potential biases in our study warrant further prospective investigations to validate these findings.

Conclusions

Our findings revealed distinct incidence patterns among teenagers compared with those in other age groups, warranting further investigation. Furthermore, our findings linking BMI and inflammation status to pneumothorax recurrence offer valuable groundwork for future prospective studies aimed to prevent and establish effective treatment strategies.

Acknowledgments

None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-2024-1957/rc

Data Sharing Statement: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-2024-1957/dss

Peer Review File: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-2024-1957/prf

Funding: This study was supported by the Research Fund of Seoul St. Mary's Hospital, The Catholic University of Korea (No. ZC23RAMI0916).

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-2024-1957/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Review Board of The Catholic University of Korea (No. KC23WIDI0546), and individual consent for this retrospective analysis was waived.

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Cite this article as: Yoon SK, Kim HK, Lee J, Kim YD, Cho DG. Risk factors and age-specific monthly patterns of primary spontaneous pneumothorax: a multicenter study. J Thorac Dis 2025;17(3):1131-1141. doi: 10.21037/jtd-2024-1957