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Original Research Article

Is the recurrence of primary spontaneous pneumothorax predictable?

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ABSTRACT

Background: Recurrence of Primary Spontaneous Pneumothorax (PSP) constitutes a serious challenge for both physicians and patients.
Methods: A retrospective study was conducted in 115 patients who had chest tubes at their first onset of PSP. Considering the development of recurrence, two groups were composed and comparatively examined in terms of age, body mass index, smoking status, side and size of initial pneumothorax, presence of bulla and duration of chest tube drainage at the first episode.
Results: Among 115 patients with PSP, 24 cases developed recurrence. Male gender was prominently relevant to develop recurrent PSP (p=0.034) whereas remaining inspected parameters revealed no significant relationship with a relapse. Interval between first onset and recurrence of PSP was calculated as 9.2 months. Interestingly, most of the patients developed recurrence in low-temperature months.
Conclusions: Recurrence of PSP is substantially unpredictable. Therefore, close follow-up of cases in the following year of their first episode and also informing the patients about probability of a relapse and measures to consider under this circumstance is of great importance.

Keywords: Chest tube, Follow-up, Prediction, Recurrence, Spontaneous pneumothorax, Surgery

INTRODUCTION

Spontaneous pneumothorax that occurs in patients without any apparent pre-existing lung disease is termed Primary Spontaneous Pneumothorax (PSP). Tall and thin body habitus, male gender and smoking are frequently encountered clinical features while subpleural blebs and bullae appear to play a role in the pathogenesis of PSP at a rate up to 80%.[1,2]

Regarding the size of pneumothorax and the clinical presentation of the patients, various treatment modalities including observation, aspiration, chest tube insertion, chemical pleurodesis or surgery can be applied both at the time of the first episode and recurrence.[2] Recurrence rate of PSP is accepted to be ranging over 30% after the first episode.[3] Factors usually announced to be in relation to recurrent pneumothorax are advanced age, smoking, previous treatment modality of pneumothorax and the presence of bullous lesions of the lung parenchyma.[2-4] Recent studies in the literature evaluating the factors related to relapse of PSP more generally focus on surgical outcomes and techniques following the first episode. Therefore, aim of this study was to analyze the patients with recurrence in a multifactorial approach.

METHODS

A single center retrospective study was performed by reviewing the databank's records of the interval between January 2013 and January 2017 following approval of Faculty's Ethics Committee.

Inclusion criteria

- Patients who had only chest tubes at their first episode of PSP were included in the study. The same thoracic surgeon applied all the observative and surgical procedures using the identical chest tubes while the radiologic evaluation and measurements were carried out by the one and same radiologist.

Exclusion criteria

- Secondary spontaneous or traumatic pneumothorax, lack of evaluation with Computed Tomography (CT) at first application and any surgical intervention other than tube thoracostomy at the first episode in order to obtain a homogeneous cohort.

Whole group of patients was divided into two series with regard to development of recurrence. Thereafter, both of the groups were examined in terms of age, Body Mass Index (BMI), smoking status, side and size of pneumothorax, presence of bulla and duration of chest tube drainage at the first episode. Furthermore, elapsed time until relapse and month of the year when recurrence occurred was recorded for every patient who developed relapse.

Existence of bulla was identified by measuring its diameter over 1 cm whereas size of the pneumothorax was calculated with computer-aided volumetry and recorded as percentage and divided into two groups by size: below or over the percentage of 50% to provide a valid statistical analysis. Moreover, status of smoking was accepted affirmative for the cases who sustained their habit afterwards the first episode of pneumothorax. Routine follow-up of the patients was designed as one week followed by one, three, six, nine and twelve-month intervals after the first onset of PSP and carried out by physical examination and chest X-rays.

Statistical analysis

The results obtained in this study were analyzed with IBM SPSS Statistics 22. Compliance of variables with normal distribution was inspected with Shapiro Wilks test. To evaluate the data of the study, definitive statistical methods (average, standard derivation, frequency) were applied as well as Mann Whitney U test was used to compare quantitative data between two groups. Qualitative data was evaluated with Continuity (Yates) Correction Chi-Square Test. Differences were considered to be statistically significant for p-values <0.05.

RESULTS

Among all of 115 patients consisting of 87 males and 28 females, 20.9% of the cases (n=24) developed recurrence. Whole group of patients had a mean age of 29.28±12.37 ranging between 11 and 72 years. Fifty three percent of the cases (n=61) were aged 25 years and younger whereas rest of the patients (n=54) were older than 25 years. Average of BMI was 22.57±3.18 kg/m^2 varying from 16.8 to 29.5 kg/m^2. For the recurrence developing group, mean elapsed time until relapse was calculated as 6.54±2.08 months (range 1-11 months). Sixty-three patients (54.8%) had right and 71 patients had (45.2%) left-sided PSP. Bulla was diagnosed in 61.7% (n=71) of the cases. Moreover, 61.7% of the patients sustained their smoking habit unremittingly between the first episode and the recurrence of PSP. Size of initial pneumothorax was below 50% in 87(75.7%) and over 51% in 28(24.3%) cases, respectively. Mean duration of drainage for the first-episode PSP was calculated as 2 days ranging between 1 and 5 days. General clinical and demographic features of the patients are listed below (Table 1).

Table 1: General features of the patients.

Parameters	Min-Max		Avg±SD (Median)
Age (years)	11-72		29.28±12.37 (25)
BMI (kg/m^2)	16.8-29.5		22.57±3.18 (22.7)
Duration of drainage (days)	1-5		2.42±0.79 (2)
Time until recurrence (months)(n=24)	1-11		6.54±2.08 (7)
	n		**%**
Group of age	25 and younger /over25	61/ 54	53.0/ 47.0
Gender	Male/ Female	87/ 28	75.7/ 24.3
Recurrence	Yes/ No	24/ 91	20.9/ 79.1
Side	Right/ Left	63/ 52	54.8/ 45.2
Presence of Bulla	Yes/ No	71/ 44	61.7/ 38.3
Smoking	Yes/ No	58/ 57	50.4/ 49.6
Percentage of initial PSP	0-50/ 51-100	87/ 28	75.7/ 24.3

Concerning the status of recurrence development, there were no statistically significant differences in terms of age, BMI, duration of drainage, side, presence of bulla, smoking status and percentage of initial pneumothorax

(p>0.05). However, percentage of male individuals in the whole cohort of patients and the recurrence developing group is 75.7% and 70.8%, respectively. Findings show that male gender is prominently relevant to develop recurrent PSP (p=0.034). Moreover, average of interval between first onset and recurrence of PSP was calculated as 9.2 months for whole group of cases. Comparative analysis of patients (Table 2).

Table 2: Evaluation of the cases regarding the status of recurrence.

Parameters		Recurring(n=24)	Not Recurring (n=91)	Z/χ^2	p
Age (Years)	Avg±SD (Median)	27.71±12.93(25.5)	29.69±12.26 (24)	[1]-0.679	0.497
Gender	Male/Female	17(70.8%)/7(29.2%)	70(76.9%)/21(23.1%)	[2]0.354	0.034
Group of age	25 and younger/ Over 25	12(50%)/12(50%)	49(53.8%)/42(46.2%)	[2]0.011	0.916
BMI (kg/m^2)	Avg±SD (Median)	2.29±0.91(2)	2.45±0.76(2)	[1]-0.602	0.547
Duration of drainage (Days)	Avg±SD (Median)	22.16±2.67(21.4)	22.68±3.31(22.8)	[1]-0.955	0.339
Side	Right / Left	14(58.3%)/10(41.7%)	49(53.8%)/42(46.2%)	[2]0.026	0.871
Presence of Bulla	Yes / No	17(70.8%)/ 7(29.2%)	54(59.3%)/ 37(40.7%)	[2]0.631	0.427
Smoking	Yes / No	10(41.7%)/14(58.3%)	48(52.7%)/ 43(47.3%)	[2]0.541	0.462
Percentage of initial PSP (%)	0-50 / 51-100	20(83.3%)/4(16.7%)	67(73.6%)/ 24(26.4%)	[2]0.516	0.473

1Z: Mann Whitney U Test χ2: Continuity (Yates) Correction Chi-Square Test

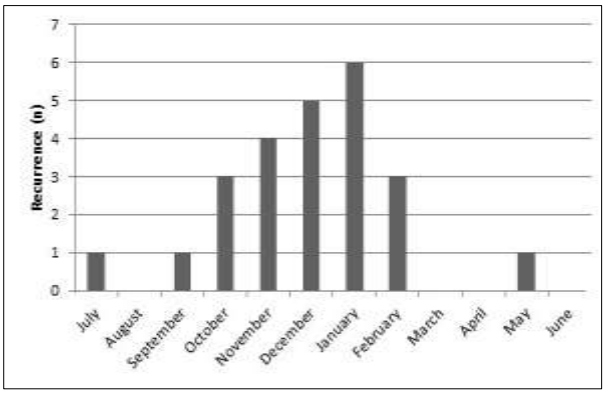

Figure 1: Annual distribution of cases with recurrence.

Period analysis revealed that most of the patients developed recurrence in the autumn and winter months: 3 in October 4 in November 5 in December 6 in January and 3 in February, respectively (Figure 1).

All of the cases who developed recurrence underwent thoracoscopic bullectomy or wedge resection both combined with partial pleurectomy. Of these patients, 2(8.3%) developed prolonged air leakage which required autologous blood patch whereas 1(4.2%) encountered local wound complication. Follow-up of the recurrence developing patients revealed neither postoperative complication nor relapse.

DISCUSSION

In this retrospective study of 115 patients, the only significant factor predicting the recurrence of PSP was male gender. Age, BMI, duration of drainage following first episode, side, presence of bulla, smoking status and percentage of initial pneumothorax comprised no significant difference in the recurrence rates. Moreover, it is an obvious finding that the patients developed recurrence in the autumn and winter months more frequently. Recurrence after a first episode of PSP ranges from 16 to 52%.[5] Recurrence rate of 20.9% for series is within expected frequency represented in current literature. Progressively increasing incidence of subsequent recurrences, as high as 62% for a second recurrence and 83% for a third, constitutes a significant challenge for both patients and physicians.[5,6] Factors predicting a recurrence have been investigated by several recent studies but mostly reviewing the cases with regards to surgical outcomes.

PSP has been advocated to be developing in young males with tall and thin habitus.[1-3,5] Moreover, bullous parenchymal lesions and smoking are frequently considered as risk factors for first episode of PSP.[5-9] These arguments only apply to the findings in this study in terms of gender and presence of bulla. Recent studies mostly have not identified a discrimination regarding the factors associated with the development of first episode and recurrence of spontaneous pneumothorax.[2-4,5-7] Moreover, most of these studies included heterogeneous groups of patients with primary or secondary pneumothoraxes treated by observation and surgical interventions. A study by Sadikot et al, announced an increased rate of recurrence for female gender, greater height and continuation of smoking while Choi and associates reported that presence of bullous lung lesions detected after an initial episode of PSP was related to the development of an ipsilateral recurrence.[10,11] On the other

hand, a recent study by Ouanes-Besbes et al, indicated that the number, size or distribution of the dystrophic lesions of the lung parenchyma did not establish a link to the recurrence of pneumothorax.[12] Data included in this study reveals that male gender is the only predisposing factor for relapse. However, taking note of a higher incidence of first-episode PSP in male patients, more frequent recurrence for male gender should not arouse astonishment. As it is seen, contradicting conclusions of previous studies, including authors, invalidate the probability of reaching a definite and final judgement over the factors related to the development of recurrent pneumothorax.

Reviewing the frequency analysis of recurrence demonstrates a quantitative increase of cases in cold weather conditions, which is quite likely related with ascending rates of atmospheric pressure. By an increase in temperature, heating air expands and rises up causing the gases dilute which will result as a drop-in air pressure. Conversely, gas molecules of the cooling air tighten, become heavier and collapse toward the Earth surface forming a high-pressure area.[13] Herein, hypothesizing that increasing air pressure reflecting on the thoracic cavity makes bullous formations of the lung parenchyma vulnerable to rupture shall not be illogical.

CONCLUSION

Confirming an accurate path for predicting the recurrence of PSP is improbable. Close follow-up in the following year of the first episode is essential regarding that recurrence of PSP mostly occurs within the first nine months after initial pneumothorax. Likewise, the patients should be informed in detail about the possibility and signs of a recurrence and also precautions they should take under these circumstances. Investigating the relation between cold weather conditions and the recurrence in multi-centered large case series shall also be considered for further studies. Thoracoscopy is a reliable and a less invasive surgical intervention to approach a recurrent pneumothorax regarding its low complication and high success rates.

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