

Management of Primary Spontaneous Pneumothorax: A Single-center Experience

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Abstract

Background: The prevalence of primary spontaneous pneumothorax is high in the Arab region. There is a lack of studies from the Eastern Province of Saudi Arabia highlighting the associated risk factors and demonstrating the effectiveness of surgical management.

Objectives: To identify risk factors associated with primary spontaneous pneumothorax and to correlate the effectiveness of surgical management with the rate of disease recurrence.

Subjects and Methods: This retrospective chart review included adult patients who presented with primary spontaneous pneumothorax and were managed at King Fahd Hospital of the University, Al-Khobar, Saudi Arabia, from January 1, 2005, to December 31, 2014. The results are presented as arithmetic mean for quantitative data, and chi-square test was used for statistical analysis. $P \leq 0.05$ was considered statistically significant.

Results: In total, 151 patients with primary spontaneous pneumothorax were included, with the majority being male (98.7%) and Saudis (88.7%). The mean age was 24 ± 6 years (range: 13–49 years), mean height 171 ± 8 cm (range: 144–193 cm) and mean body mass index 19.2 ± 3.8 kg/m² (range: 13.3–39.0 kg/m²). About 62% of the patients were smokers. Ten patients had an ipsilateral recurrence of primary spontaneous pneumothorax after the first episode was successfully managed. Surgical exploration after the first episode itself was found to significantly reduce the recurrence rate. The study found that in the management of these patients, there was a shift from conventional open thoracotomy to the minimally invasive video-assisted thoracoscopic surgery method.

Conclusions: The risk factors for primary spontaneous pneumothorax in this study were consistent with the current literature. Surgical exploration after the first episode of primary spontaneous pneumothorax significantly reduces the recurrence rate and there is a paradigm shift toward a less invasive surgical approach in managing these patients.

Keywords: Primary spontaneous pneumothorax, recurrence, risk factors, video-assisted thoracoscopic surgery

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INTRODUCTION

Pneumothorax is an accumulation of air in the pleural space and can be classified as spontaneous and traumatic. Spontaneous pneumothorax is subclassified into primary, when there is no apparent underlying lung disorder, and secondary, when there is an underlying lung disease.^[1] The pathogenesis of primary spontaneous pneumothorax (PSP) remains unclear. However, factors such as cigarette smoking and bronchial abnormalities can result in distal airway inflammation or obstruction, which could possibly cause PSP. This may lead to the formation of subpleural bleb, rupture of which can cause PSP.^[2]

In Western countries, PSP is considered a significant clinical problem, with an annual incidence of 18–28/100,000 males and 1.2–6/100,000 females.^[3] Among Arabs, the trends are similar, with an annual incidence of 8.8/100,000 males and 0.3/100,000 females.^[4] Although the prevalence of PSP in the region is high, there are lack of studies from the Eastern Province of Saudi Arabia on the same. This study aimed to identify the risk factors associated with PSP and correlate the effectiveness of surgical management with the rate of disease recurrence.

SUBJECTS AND METHODS

This retrospective study was conducted at King Fahd Hospital of the University (KFHU), Al-Khobar, Kingdom of Saudi Arabia. The study included all adult patients who were admitted with PSP over a period of 10 years from January 1, 2005, to December 31, 2014. Patients with secondary or traumatic pneumothorax were excluded from this study.

Diagnosis of PSP was confirmed by reviewing the patients' history and the chest X-ray on admission. Data regarding the patient's age, gender, marital status, smoking history, side of lung in which PSP occurred, surgical management and recurrence rate were collected and analyzed using Statistical Package for the Social Sciences (SPSS) version 20 (IBM Corp., Armonk, NY, USA).

Surgical management of the patients was either by chest tube drainage until full inflation of the lung or through exploration of the lung by thoracotomy, axillary thoracotomy or video-assisted thoracoscopic surgery (VATS). Whenever lung blebs or bullae were identified, they were resected with a stapler. Then, pleurodesis was performed mechanically or with talc powder, based on the preference of the surgeon. Recurrence was diagnosed when a patient presented with

a second attack of ipsilateral spontaneous pneumothorax after the first attack had been treated.

The results are presented as arithmetic mean for quantitative data, and chi-square test was used for statistical analysis. $P \leq 0.05$ was considered significant in all statistical analyses.

Ethical approval for this study (IRB-2015-01-075) was provided by the Institutional Review Board at Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia, on April 19, 2015.

RESULTS

A total of 151 patients with PSP were included in this study. The majority of the patients were male (98.7%), single (82.8%) and Saudis (88.7%). The mean age of the sample was 24 ± 6 years (ranging from 13 to 49 years) and the mean body mass index (BMI) was 19.2 ± 3.8 kg/m² (ranging from 13.3 to 39.0 kg/m²). Smoking history was present in about 62% of the patients. The most common presenting symptoms were chest pain (92.7%) and dyspnea (71.5%). A total of 51% of the patients presented with right-sided PSP and 48.3% with left-sided PSP, while only one patient presented with bilateral PSP [Table 1].

Chest tube was inserted in the majority of the cases (97.4%). After the first episode, about 20% of patients underwent chest tube drainage and 80% underwent surgical exploration through VATS (52.3%), axillary thoracotomy (17.2%) or thoracotomy (10.6%). Resection of identifiable blebs or bullae was carried out in 58.9% of the patients and pleurodesis was performed in 78.1% of the patients [Table 2]. It was found that over the years, there was an increase in the use of VATS and a decrease in the use of open exploration for treating patients with PSP [Figure 1].

Table 1: Characteristics of patients with primary spontaneous pneumothorax (n = 151)

Characteristics	Mean \pm SD or n (%)
Age (years)	24 \pm 6
Gender	
Male	149 (98.7)
Female	2 (1.3)
Nationality	
Saudi	134 (88.7)
Non-Saudi	17 (11.3)
Smoker	93 (61.6)
Mean height (cm)	171.4 \pm 8.1
Mean BMI (kg/m ²)	19.3 \pm 3.8
Side of PSP occurrence	
Right	77 (51.0)
Left	73 (48.3)
Bilateral	1 (0.7)

BMI – Body mass index; SD – Standard deviation; PSP – Primary spontaneous pneumothorax

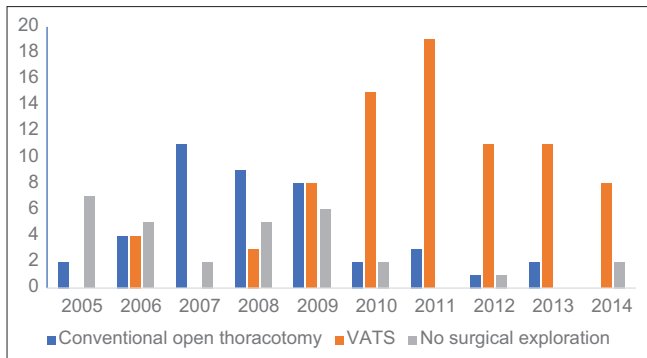


Figure 1: Surgical management of 151 patients with primary spontaneous pneumothorax over the 10 years. VATS – Video-assisted thoracoscopic surgery

However, there was no significant difference between the open conventional thoracotomy (thoracotomy and axillary thoracotomy) and VATS in reducing the recurrence rate in our study ($P = 0.647$). Pleurodesis was done for most patients who underwent surgical exploration; however, it was not found to reduce the recurrence rate ($P = 0.82$) [Table 3].

Ten patients developed ipsilateral recurrence. Of these, the recurrence rate was significantly higher among those who did not undergo surgical exploration after the first episode of PSP. Smoking did not significantly affect the recurrence rate [Table 3].

DISCUSSION

According to the American Society of Chest Physicians' recommendation, a patient who is clinically stable with a small pneumothorax (<3 cm apex to copula distance) can be observed for 3–6 h and then discharged if there is no progression of the pneumothorax. However, patients with a large pneumothorax (>3 cm apex to copula distance) should undergo the air drainage procedure, and those with a persistent air leak or a recurrent episode of PSP should undergo surgical exploration.^[5] This study found that surgical exploration after the first episode of PSP itself significantly reduces the rate of recurrence compared with chest tube drainage. This result agrees with studies that recommend surgical exploration after the first episode of PSP,^[6] especially with the presence of a large-size pneumothorax^[7] or a persistent air leak.^[8]

In a study that successfully managed the first episode in patients with a large pneumothorax by aspiration of air using 8.5 F pigtail drain connected to a one-way valve, it was found that the relapse rate was 15.8%.^[9] In our study, of the 30 patients who underwent chest tube drainage, 8 (26.7%) had an ipsilateral recurrence of PSP. Since the rates of recurrence in PSP are high,^[10] undergoing surgical

Table 2: Management of patients with primary spontaneous pneumothorax (n = 151)

Management	n (%)
Type of management	
Surgical exploration	121 (80.1)
Chest tube drainage	30 (19.9)
Approach to surgical exploration	
Thoracotomy	16 (10.6)
Axillary thoracotomy	26 (17.2)
VATS	79 (52.3)
Resection of bullae or blebs	
Done	89 (58.9)
Not done	32 (21.2)
Pleurodesis	
Done	118 (78.1)
Not done	3 (2.0)

VATS – Video-assisted thoracoscopic surgery

Table 3: Characteristics of ten patients with an ipsilateral recurrence of primary spontaneous pneumothorax

Characteristics	Number of patients	P
Management of the first episode of PSP		
Surgical exploration	2	<0.001
Chest tube drainage	8	
Smoking		
Yes	8	0.597
No	2	

Statistical significance at $P < 0.05$. PSP – Primary spontaneous pneumothorax

exploration after the first episode of PSP would reduce the rate of recurrence.

For surgical exploration of patients with PSP, this study found that at KFHU, there is a paradigm shift from open exploration to VATS. This study did not show a significant difference between open conventional thoracotomy and VATS. Nevertheless, several studies support the use of VATS after the first episode of PSP, as it has been shown to be safe with low morbidity, short hospitalization period and good patient satisfaction.^[11,12] Further, using VATS over open thoracotomy for the surgical exploration and resection of blebs or bullae is supported to be a safe procedure.^[13,14] However, a few studies have demonstrated that PSP recurrence rate is higher after VATS than after open thoracotomy.^[15,16] Further, in agreement with the findings of this study, adding pleurodesis to the surgical exploration has been shown to be ineffective in decreasing the recurrence rate of PSP.^[13,17]

In terms of risk factors for developing PSP, the results of this study are consistent with the existing literature. For instance, about two-thirds of the patients in this study were smokers, and smoking has been found to increase the rate of developing PSP by 22 folds in males.^[18] Patients with PSP are also known to have a high prevalence of respiratory bronchiolitis secondary to smoking.^[19,20] Further, thin and

tall males are at a higher risk of developing PSP.^[3,19] The patients in this study had an average height (171.4 cm) but a low BMI (19.3 kg/m²). Most patients develop PSP while they are at rest, with their complaints usually being a sudden local pleuritic chest pain with difficulty in breathing.^[21] Similarly, the majority of the patients in this study had chest pain and dyspnea.

A major limitation of this study is the small sample size and the limited geographic distribution among them.

CONCLUSIONS

This study revealed that surgical exploration after the first episode of PSP itself significantly reduces the recurrence rate as compared with chest tube drainage. Further, this study found that at KFHU, there is a paradigm shift toward a lesser invasive surgery, i.e., VATS, with good outcomes. Large-scale studies should be conducted to validate the generalizability of VATS exploration on decreasing PSP recurrence rates.

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Conflicts of interest

There are no conflicts of interest.

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