

Adolescent Primary Spontaneous Pneumothorax: A Hospital's Experience

YW HUI, KW CHAN, CK CHUNG, S KO, LS LAM, KL WU, SC YOUNG

Abstract

Objective: To study the demographic and clinical characteristics of adolescent primary spontaneous pneumothorax (PSP). **Methods:** Adolescent patients (age 10-18 years) with first presentation of PSP were recruited in this retrospective cohort study. Four categories of data, including demography, clinical symptoms at presentation, disease progress and recurrence were retrieved from the hospital records. **Results:** Ninety episodes of PSP in 63 patients (55 males and 8 females) were identified. The mean (SD) height, weight and body mass index percentiles were 60.2% (27.9%), 35.0% (21.1%) and 29.9% (21.8%) respectively. The commonest symptoms at presentation were chest pain or discomfort (90.5%) and shortness of breath (42.9%); none of them had cardiopulmonary compromise. Nineteen patients were treated conservatively whereas 29 and 15 patients were treated by tube thoracostomy and surgery respectively. There were totally 22 (34.9%) patients who suffered from recurrence, and the recurrence rates for the conservative, tube thoracostomy and surgery treatment groups were 26.3% (5/19), 52.7% (15/29) and 13.3% (2/15) respectively. Fifteen (68%) of the 22 recurrences occurred within 3 months after the first presentation. **Conclusion:** Adolescent PSP occurs mainly in tall thin boys of late teenage group and all of them are clinically stable. Conservative treatment can be considered for small PSP of size less than 30%. Tube thoracostomy should be considered in large PSP or failed conservative treatment. For patients treated with tube thoracostomy, persistent leakage (longer than 7 days) warrants surgical treatment.

Key words

Adolescent; Primary spontaneous pneumothorax; Recurrence

Introduction

Pneumothorax is an abnormal collection of air in the pleural space and can be classified into 3 categories: spontaneous, traumatic and iatrogenic. Spontaneous pneumothorax is further classified into primary and secondary.

Department of Paediatrics & Adolescent Medicine, Princess Margaret Hospital, Lai Chi Kok, Kowloon, Hong Kong, China

YW HUI (許焯和) MBBS, FHKAM(Paed),
MSc(Epidemiology & Biostatistics)
KW CHAN (陳麒尹) MBBS
CK CHUNG (鍾振堅) MBBS
S KO (高晟) MBBS
LS LAM (林麗珊) MBBS
KL WU (胡國樑) MBBS
SC YOUNG (楊淑清) MBBS

Correspondence to: Dr YW HUI

Received May 26, 2005

Primary spontaneous pneumothorax (PSP) is defined as pneumothorax occurring in otherwise healthy people with no apparent clinical lung diseases being found.¹ Clusters of cases of PSP were found in many families, so some cases were postulated as autosomal dominantly inherited with variable penetrance and expression.²⁻⁴ Specific HLA typing was also suspected but no definite correlation was so far identified.⁵ PSP is rarely encountered in young children, and mostly found in adolescents and young adults. Since there are only a few epidemiology studies focusing on adolescents, the clinical characteristics and outcomes of PSP in adolescents are not fully understood.⁶⁻⁹

Our department treats patients up to 18 years of age and hence all adolescents suffering from PSP will be admitted to our department. We assess the size of pneumothorax subjectively and categorise qualitatively into small and large size; initial treatment for small size PSP is conservative with oxygen therapy and/or simple aspiration, whereas for large size PSP tube thoracostomy is the treatment of choice.

The chest drain is connected to an underwater seal system with a suction pressure 15-20 cmH₂O which will be stopped if no bubbling for 24 hours. Daily chest radiograph (CXR) is taken to monitor the progress, and the drain will be removed if no re-accumulation of air occurs after stopping suction for 24 hours. When leakage persists for a duration of more than 7 days, surgical treatment will be considered. Besides, other indications for surgical treatment are contralateral pneumothorax in different occasions, and frequent recurrent pneumothorax.

In order to have more understandings of this disease entity in adolescents, we carried out a retrospective review. The objective of the review was to study the demographic and clinical characteristics of adolescent PSP including symptoms of presentation, outcome and recurrence.

Methods and Statistics

It was a retrospective cohort study reviewing the hospital records of all the adolescent patients admitted for PSP during the period from 1 January 1997 to 31 August 2003. The study was carried out by a group of interns of the Department of Paediatrics and Adolescent Medicine of Princess Margaret Hospital, Hong Kong SAR.

The records were traced by the Clinical Data Analysis and Reporting System (CDARS) of the Hospital Authority, Hong Kong, with the codes (512.0) spontaneous tension pneumothorax and (512.8) other spontaneous pneumothorax. All hospital records were read thoroughly by the authors and eligible subjects were recruited based on the following inclusion criteria: (1) adolescents, defined as age between 10 to 18 years and (2) primary spontaneous pneumothorax, defined as pneumothorax occurring in otherwise healthy people with no apparent clinical lung diseases being found.¹ Pneumothoraces other than PSP were excluded.

Four categories of data, including demography, clinical symptoms at presentation, disease progress and recurrence were retrieved from each record. The demographic data included sex, age, height, weight and body mass index. The height, weight and body mass index percentiles were obtained by plotting on the corresponding growth percentile charts. The clinical features were family history, smoking history, site and size of pneumothorax, symptoms at presentation such as chest pain or discomfort, shortness of breath, cyanosis and desaturation; the body temperature, respiratory and heart rates and blood pressure were also included. In order to have a quantitative documentation of the size of pneumothorax, the CXR at presentation of each patient was reviewed and the size of pneumothorax was calculated by the authors based on the method of average interpleural distances advocated by Collins.¹⁰ The information of clinical outcomes were duration of leakage, methods of treatment and recurrence. At the end, all patients were interviewed by phone to update their recurrence status because they might have recurrences which were not treated in our hospital. Data were recorded on an Excel spreadsheet and were then analyzed with SPSS 11.0. Descriptive analysis was performed on demographic data, clinical symptoms and disease progress. For comparative analysis, student t-test was used for continuous data with normal distribution.

Results

Ninety episodes of PSP in 63 patients were identified during the period between 1 January 1997 and 31 August 2003. All patients were successfully contacted to update their recurrence status. The duration of follow-up ranged from 0.4 to 6.9 years. Of these, two (3%) were followed up for less than 6 months, three (4.8%) from 6 to 12 months and 48 (75%) more than 2 years. The demographic data were tabulated in Table 1. They were predominantly males

Table 1 Demographic data, height and weight measurement of all patients suffering from primary spontaneous pneumothorax

Demographic information		Compare with the population mean (50%)		
		Mean difference	95% CI of difference	p-value
Total number of patients	63			
Mean age, years (SD)	16.5 (1.3)			
Male sex (%)	55.0 (87.3)			
Mean length of stay, days (SD)	10.5 (9.8)			
Mean height percentile, % (SD)	60.1 (27.9)	10.1	1.9 – 18.3	p<0.05
Mean weight percentile, % (SD)	35.4 (21.1)	-14.7	-20.9 – -8.4	p<0.0005
Mean body mass index percentile, % (SD)	29.9 (21.8)	-20.1	-26.6 – -13.6	p<0.0005

(male to female ratio 6.9:1) with a mean age of 16.5 years (SD 1.3 years). The length of stay ranged from 1 to 55 days. Two patients were hospitalised for 1 day, and both of them suffered from mild pneumothorax of size less than 10%. The height percentile was significantly higher than average ($p < 0.05$), whereas the weight percentile and body mass index percentile were significantly lower than average ($p < 0.0005$). Hence these patients were relatively tall and thin when compared with the population.

For the clinical symptoms, most of them ($n = 57, 90.5\%$) complained of chest discomfort or pain, but only 27 (42.9%) subjectively had shortness of breath (Table 2), and 18 of them (66.7%) belonged to the group of pneumothorax size greater than 30% ($p < 0.005$, OR 4.5, 95% CI 1.5-13.2). None of them had cyanosis or desaturation. Left side pneumothorax was more common ($n = 46, 73\%$), and the sizes of pneumothorax ranged from 7% to 100% with the mean (SD) 31.5% (22%). Only 2 patients demonstrated mild fever, temperature 37.6°C and 37.8°C respectively. The blood pressure and pulse rate were stable in all of the patients.

The distribution of the patients in the 3 treatment groups, their outcomes and recurrence rates were shown in Figure 1. Of the 15 surgically treated patients, 14 were found

to have an apical lung cyst. Totally, 22 (34.9%) patients suffered from recurrence, the recurrence rates were 26.3% (5/19), 52.7% (15/29) and 13.3% (2/15) for the conservative, tube thoracostomy and surgical treatment groups respectively. The time intervals between the recurrence and first presentation were illustrated in Figure 2. Fifteen (68%) of the 22 recurrences occurred within 3 months of the first presentation, and all of the

Table 2 Clinical features at presentation of patients suffering from primary spontaneous pneumothorax

	Mean (SD)	n	%
Clinical features at presentation			
Total number of patients		63	
Positive family history		1	1.6
Smoking		12	19.1
Chest pain/discomfort		57	90.5
Shortness of breath		27	42.9
Cyanosis		0	0
Desaturation		0	0
Left side pneumothorax		46	73
Right side pneumothorax		17	27
Body temperature, °C	36.6 (0.8)		
Respiratory rate, bpm	18 (3)		
Heart rate, bpm	88 (18)		
Systolic pressure, mmHg	130 (15)		
Size, %	31 (22)		

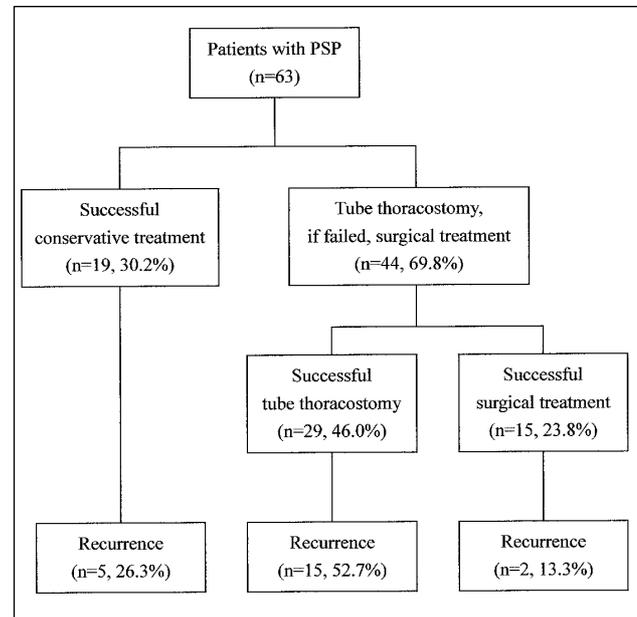


Figure 1 Flow chart showing the number of patients in each treatment groups and their outcomes and recurrence rates.

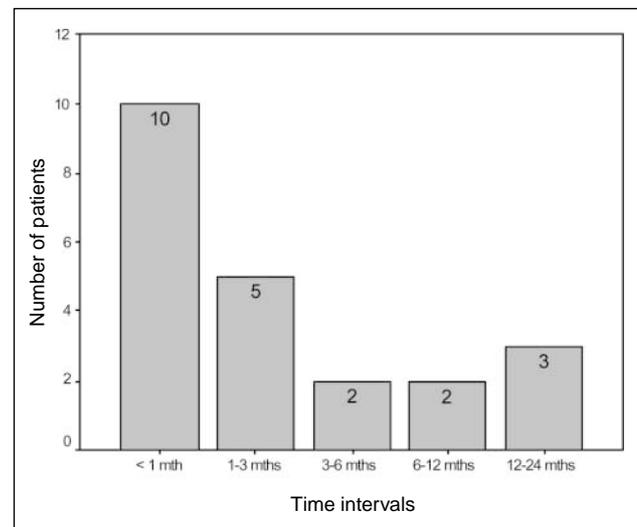


Figure 2 The time intervals of PSP recurrence from the first presentation. The number inside each bar is the number of patients.

recurrences occurred within 24 months. The mean (SD) sizes were 16.4% (6.9%), 35.6% (23.1%) and 43.5% (22.8%) for the conservative, tube thoracostomy and surgical treatment groups respectively. All patients in conservative group were of pneumothorax size less than 30%. For those treated with tube thoracostomy, 18 (62%) had duration of leakage (the lapse of time before air stopped coming out of the chest drain) less than 48 hours (Figure 3), and only 1 (3.4%) had prolonged leakage greater than 7 days.

Discussion

PSP is not a common disease, and has an incidence of 7.4-18 cases per 100,000 population per year among men and 1.2-6 cases per 100,000 population per year among women.¹¹ The incidence is higher in males and the male to female sex ratio ranges from 1.9:1 to 6.2:1.^{8,12-14} The age distribution is from 15-34 years with the peak at 20-24 years.¹² In our series, there were 90 admissions of PSP for the age group from 10 to 18 years within a period of 6 years 8 months. They were mainly tall thin boys (as illustrated by their high height percentile, and low weight and body mass index percentiles) of late adolescent with mean age 16.5. The male to female sex ratio was 6.9:1 which

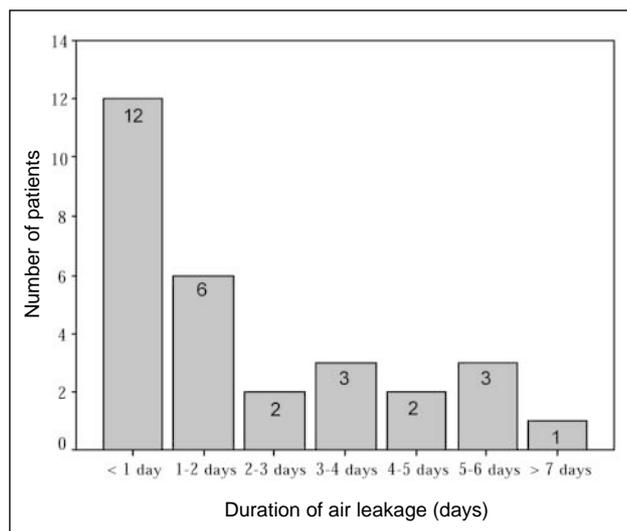


Figure 3 The duration of air leakage from the chest drain in patients being treated with tube thoracostomy. The number inside the each bar represents the number of patients.

was compatible to the previous studies. We also found that left side pneumothorax was more common than the right side.

Clinical symptoms were well summarised by Weissberg for the PSP of the general population including both children and adults.¹⁵ Onset is characterised by sudden pleuritic pain, dyspnoea, and non-productive cough. Cook et al reviewed 15 children with PSP and found the presenting complaints including chest pain (89%), shortness of breath (56%), cough (7%) and respiratory distress (4%).¹⁴ In our patients, we noticed similar presenting symptoms – chest pain or discomfort (90.5%) and shortness of breath (42.9%). All of them were clinically stable without any cardiopulmonary compromise even in those with unilateral completely collapsed lung due to extensive pneumothorax.

PSP can be treated conservatively, by tube thoracostomy or surgery. Several factors are needed to consider for the choice of treatment such as size of pneumothorax, recurrence, bilateral pneumothorax and persistent leakage with tube thoracostomy. The size of pneumothorax can be estimated by Collins' formula.¹⁰ Collins made use of helical CT thorax calculating the extent of pneumothorax on 18 patients of mean age 35 years (range 16-66 years), and constructed a linear regression model relating the interpleural distances and size of pneumothorax. The sample size was small and the model had not been evaluated in other studies. Hence its reliability and applicability has to be questioned. Moreover, the patients were mainly adult and so the model may not be applicable to adolescents. Although this model may not tell the absolute size of pneumothorax, it gives us an idea of the extent of pneumothorax and guides us the decision of initial management. In this study, we found that all the patients successfully treated with conservative method had pneumothorax size less than 30%. Hence, pneumothorax size of 30% could be considered as a cut off point to choose between conservative treatment and tube thoracostomy as the initial management option.

Recurrence is not uncommon for patients with PSP especially being treated with tube thoracostomy. Cook et al reported the recurrence rates for tube thoracostomy and surgical treatment as 57% and 9% respectively.¹⁴ The recurrence rates obtained in our study are similar to Cook's series. We have the following postulation for this phenomenon. For the conservative group, there is only a mild degree of pathological pleural lesion which heals soon

after presentation, so the size of pneumothorax is small, and the leakage stops easily; the chance of recurrence is lower than the tube thoracostomy group. For the groups of tube thoracostomy and surgical treatment, the pathological lesion is more significant. The thoracostomy drainage only treated the leakage but not the pleural pathology, whereas surgery treated the pleural lesion definitely. Hence recurrence is the lowest for surgical group while tube thoracostomy has a recurrence rate as high as 52.7%.

Conclusion

From our study, the following information of the epidemiology and disease progress of adolescent PSP we obtained is similar to other studies. It occurs mainly in tall thin boys of late teenage group and the main clinical symptoms at presentation are chest pain or discomfort and subjective breathing difficulties, but they are never in respiratory distress and do not have any cardiac compromise. We recommend conservative treatment for small PSP (size <30%) if the patient's condition is stable and monitor the patient's vital signs and progress with serial CXR. Tube thoracostomy should be considered in large PSP or failed conservative treatment. For patients being treated with tube thoracostomy, persistent leakage longer than 7 days warrants surgical treatment because the chance of spontaneous sealing is very low. Patients who need tube thoracostomy will have a higher recurrence rate (more than 50%) than either conservative or surgical treatment. Patients who recover from PSP should be warned about the chance of recurrence in the near future especially within the first 3 months.

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