Original Article

Clinical Profile of Spontaneous Pneumothorax in Adults: A Retrospective Study

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Abstract

Background. Pneumothorax is an important cause of morbidity and mortality, but limited data are available regarding the aetiology, clinical profile, management and outcome of spontaneous pneumothorax from India in recent times.

Methods. This was a retrospective observational study conducted at a Government chest hospital which included patients with the diagnosis of spontaneous pneumothorax seen over a period of one year. Demographic, clinical, radiological and treatment data were collected from hospital records and analysed.

Results. Of the 86 patients studied (male:female = 4:1), two had primary spontaneous pneumothorax (PSP) and 84 had secondary spontaneous pneumothorax (SSP). The annual incidence of spontaneous pneumothorax was calculated to be 1590 per 100,000 hospital admissions. Annual incidence figures for PSP and SSP were 37 and 1553 per 100,000, respectively. The most common cause of SSP was found to be pulmonary tuberculosis (TB) followed by chronic obstructive pulmonary disease (COPD) and pneumonia.

Conclusions. Our observations suggest that pneumothorax is more common among men. Secondary spontaneous pneumothorax is more common than PSP and the most common cause of SSP was pulmonary TB followed by COPD.
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Key words: Primary spontaneous pneumothorax, Secondary spontaneous pneumothorax, Tube thoracostomy, Brochopleural fistula.

Introduction

Pneumothorax is defined as the presence of air within the pleural cavity. Pneumothorax occurring in the absence of trauma is classified as spontaneous pneumothorax. When pneumothorax develops following penetrating, non-penetrating or barometric trauma to the chest is classified as traumatic pneumothorax. Spontaneous pneumothorax is further classified into primary spontaneous pneumothorax (PSP) occurring in otherwise healthy individuals and secondary spontaneous pneumothorax (SSP), which occurs in patients with an underlying lung disease.[1]

The aetiology and clinical spectrum of pneumothorax have undergone a marked change in the recent years, after increased incidence of pulmonary tuberculosis (TB) and acquired immunodeficiency syndrome (AIDS).[2] There are limited data related to disease burden, epidemiology and clinical profile of spontaneous pneumothorax from South India. This study aimed at describing the demographic characteristics, aetiology, clinical profile, treatment and outcome of patients admitted with spontaneous pneumothorax.

Material and Methods

This was a retrospective, observational study carried out at Government Chest Hospital, Andhra Medical College, Visakhapatnam. Clinical data of patients who were admitted with spontaneous pneumothorax during a period of one year, from April 2014 to March 2015 were collected from the hospital records and entered in to a structured proforma. The data recorded included demographic details (age, gender, residence, occupation, smoking habits, exposure to biomass fuel), co-morbidities, anthropometric details [height, weight, body mass index (BMI)], clinical presentation, physical examination findings, and details of relevant investigations like chest radiograph, computed tomogrpahy (CT), sputum, pleural fluid [Gram staining, bacterial culture and sensitivity testing, staining for acid-fast bacilli (AFB)], human immunodeficiency virus (HIV) testing, fibreoptic bronchoscopy (bronchial washings, bronchoalveolar lavage fluid), and treatment and outcome details.

The patients were classified as having PSP if routine clinical and radiographic evaluation, as well as results of relevant additional investigations, failed to reveal

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any underlying pulmonary disease that could explain the occurrence of pneumothorax. All patients, in whom an underlying pulmonary disorder that could be linked to pneumothorax was detected were classified as having SSP.[1] Quantification of the pneumothorax was done based on British Thoracic Society (BTS) guidelines[3] for the management of spontaneous pneumothorax. When the rim of air between the pleura and the chest wall at the level of the hilum was less than 2 cm, the pneumothorax was defined as small. Pneumothorax was defined as large when the rim was 2 cm or more.[3] All patients with SSP were managed with tube thoracostomy and specific treatment appropriate for the underlying condition. Patients with PSP was treated with simple needle aspiration, and if this failed, tube thoracostomy was resorted to.

All data were entered in Microsoft Excel and descriptive analysis was carried out using percentages, mean and standard deviation. Meaningful comparison between PSP and SSP groups could not be done as the PSP group contained only two patients.

Results

Of the 86 patients included in the study, two (2.3%) had PSP while 84 (97.7%) had SSP. Based on the total number of admissions to our hospital during the study period, the annual incidence of spontaneous pneumothorax was calculated as 1590 cases per 100,000 hospital admissions. Annual incidence figures for PSP and SSP were similarly calculated as 37 cases and 1553 cases per 100,000 hospital admissions, respectively. The mean age of the patients studied was 41.8±16.2 years (range 15-80 years). Majority of the patients included in the study were males (male:female = 4:1). Patients with PSP were younger compared to those with SSP (mean age 17±1.4 *versus* 42.4±15.3 years); both the PSP patients were males. Fifty-four patients (64%) were smokers (mean pack years was 6 [range 1.5-8.0]). One of the two patients with PSP was a smoker. Among SSP patients, 54 of the 84 (64.3%; 48 males and 6 females) patients were smokers. Fifteen of the 20 (75%) SSP cases secondary to chronic obstructive pulmonary disease (COPD) were smokers and 31 of the 42 (73.8%) SSP cases due to pulmonary tuberculosis (TB) were smokers. Only two female patients with SSP secondary to COPD who were non-smokers had exposure to firewood smoke. Patients with PSP were taller than those with SSP. However, the weight was lower in SSP group compared to PSP group. The body mass index (BMI) was similar in both the groups (Table 1).

Dyspnoea was the most common symptom seen in 90% patients followed by pleuritic chest pain (86%). In addition, 64% patients presented with cough and expectoration, fever 52%. Haemoptysis was evident in 10% of the cases. Patients with PSP presented to hospital earlier (within one week) as compared to SSP who presented to the hospital later than a week. None of the patients gave a family history of pneumothorax. The pneumothorax was left-sided in 47 (54.7%) patients and 38 (44.2%) had right-sided pneumothorax; one patient presented with simultaneous bilateral pneumothorax. Sputum AFB was positive in 21 patients (6 new cases and 15 previously treated patients). In patients with active pulmonary TB, imaging findings on chest radiograph and high resolution CT (HRCT) included consolidation with hilar adenopathy, air-space nodules, thick walled cavities with pericavitary consolidation, centrilobular nodules with tree-in-bud pattern, loculated hydropneumothorax with parenchymal air-space opacities. In patients with old healed TB, salient imaging findings included thin walled cavities, traction bronchiectasis and pleural thickening. Aetiological causes of spontaneous pneumothorax are shown in figure 1. The most common aetiology for SSP was identified as TB in 42 patients (50%), followed by COPD in 20 patients (23.8%) (Figure 2) among others.

Table 1. Anthropometric data

Variable	Spontaneous Pneumothorax	Primary Spontaneous Pneumothorax	Secondary Spontaneous Pneumothorax
Height (cm)			
Mean	160.8	178	160.4
Range	145–180	176–180	145–170
Weight (kg)			
Mean	57.3	65	57.3
Range	35–74	64–66	35–74
Body mass index (kg/m²)			
Mean	22.4	20.5	22.5
Range	16.9–27.3	20.7–20.4	16.9–27.3

Malignancy was the aetiological cause in two cases. The SSP in one patient was due to bronchogenic carcinoma and the other patient with carcinoma oesophagus presented with simultaneous bilateral pneumothorax. One patient was diagnosed to have pulmonary Langerhans' cell histiocytosis (PLCH) (Figure 3). In patients with bacterial pneumonia with

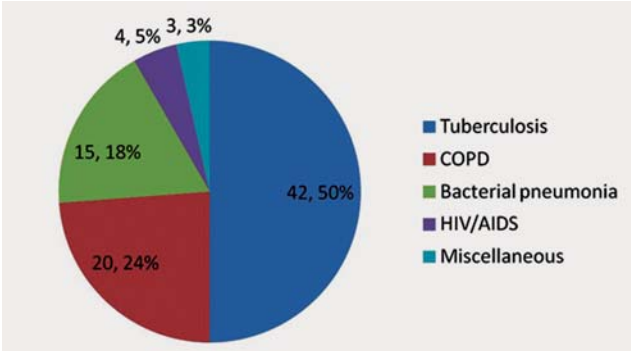

Figure 1. Aeiological causes of secondary spontaneous pneumothorax. COPD=Chronic obstructive pulmonary disease; HIV=Human immuno-deficiency virus; AIDS=Acquired immunodeficiency syndrome.

pyopneumothorax the organisms isolated from pus were *Staphylococcus aureus* and *Klebsiella pneumoniae*.

All patients with SSP were managed with tube thoracostomy and appropriate specific treatment. One patient with PSP was treated with simple needle aspiration and had a successful outcome. The second patient with PSP required tube thoracostomy following failure of needle aspiration. Two patients developed re-expansion pulmonary oedema within an hour following intercostal tube (ICT) placement and managed successfully with oxygen and diuretics. Surgical emphysema occurred in 10 patients. In 58 cases (67.4%) there was complete expansion of lung and pleurodesis was done with doxycycline/ minocycline/10% povidone iodine. In 25 cases (29%) lung failed to expand completely. In PSP patients lung expanded in 48 hours and ICT was removed after three days. In patients with COPD, the mean duration for lung expansion was 7.9±1.8 (range 5-11) days. In patients with TB, the mean duration of tube thoracostomy was 17.3±13 (range 7-90) days. In patients with pneumonia, the mean duration of tube thoracostomy was 10.3±2.8 (range 5-16) days.

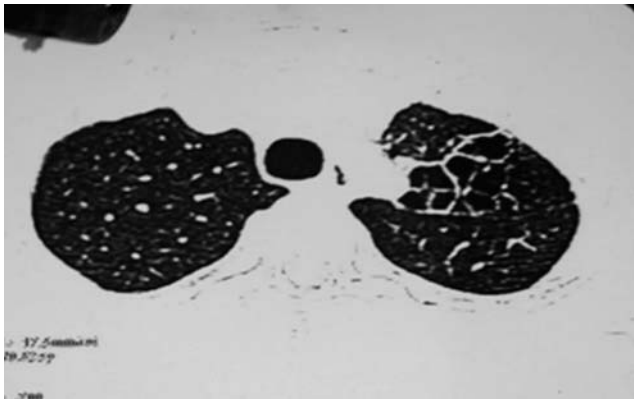

Figure 2. HRCT chest (axial section) showing emphysematous bulla in the left upper lobe in a patient with secondary spontaneous pneumothorax due to chronic obstructive pulmonary disease.

Figure 3. HRCT chest (axial section) showing multiple cysts, nodules and left-sided pneumothorax due to PLCH.

PLCH=Pulmonary Langerhans' cell histiocytosis

The average length of hospital stay was 13.9±9.4 (range 5-90) days. Three (3.5%) patients died during hospital stay, one patient due to diabetic ketoacidosis with uncontrolled sepsis and the other two cases (pulmonary langerhans' cell histiocytosis and carcinoma oesophagus) died due to respiratory failure. Patients in whom the lung did not expand (n=25) were referred to cardiothroacic surgery for bronchopleural fistula (BPF) / oesophago-pleural fistula closure (n=10) and decortication/adhesionolysis (n=15).

Discussion

Although pneumothorax is a commonly encountered respiratory emergency, few studies are available regarding epidemiology and clinical profile particularly from India. In a population-based study conducted among residents of Olmested county, Minnesota,[4] the incidence of PSP was 7.4 per 100,000 per year among men and 1.2 per 100,000 per year among women, while the incidence of SSP was 6.3 per 100,000 per year and 2 per 100,000 per year for men and women, respectively. In a large national database from the United Kingdom,[5] the overall person consulting rate for pneumothorax in general practice was 24 per 100,000 per each year for males and 9.8 per 100,000 per each year for females.[5] Hospital admissions for pneumothorax as a primary diagnosis was 16.7 per 100,000 per year and 5.8 per 100,000 per year for males and females, respectively. In a study from India,[6] pneumothorax was seen in 99.9 per year per 100,000 hospital admissions. In the present study, the incidence of spontaneous pneumothorax was calculated to be 1590 per year per 100,000 hospital admissions. This figure is higher because ours is not a population-based study and also because ours is a tertiary care chest speciality hospital and the denominator comprises of patients with chest diseases only.

The reported incidence of PSP among all patients presenting with spontaneous pneumothorax has been widely variable in various studies from India, the reported figure being 12.5%,[7] 17%,[8] 20%,[6] 21%,[9] 25%,[10] and 64%.[11] In the present study, the incidence of PSP was only 2.3%. This relatively high incidence of SSP might be due to treatment difficulties and associated co-morbidities for which several patients with SSP were referred to chest hospital.

Studies from the western world[4,5] and various studies from India[6-11] showed a biphasic distribution with two age-peaks corresponding to PSP and SSP, respectively, where PSP was observed to be predominantly a disease of younger men. In our study, there was no biphasic distribution but patients with PSP were younger when compared to patients with SSP. The gender ratio showed male predominance

(male:female = 4:1). This figure was similar to previously reported observations.[6-11] The higher incidence of pneumothorax in men has been attributed to higher rates of smoking, body habitus and different lung mechanics.[12] Patients with PSP in the present study were taller as has been observed.[12] The higher incidence in tall people is possible due to greater pleural pressure gradient at the lung apex than at the base.[13] Smoking is known to be an important risk factor for the development of PSP, probably due to the formation of blebs contributed by smoking related small airway inflammation.[14] However, in our study, the PSP cases were only two and one among them was a smoker.

In a study from India,[6] dyspnoea (93%) and pleuritic chest pain (83%) were the common presenting symptoms. Similar results were observed in another study.[8] Dyspnoea was the most common symptom in spontaneous pneumothorax in our study (94%). Until the description of PSP,[15] more than 70 years ago, TB was thought to be the leading cause of spontaneous pneumothorax. But, in a later publication from the West[16] and in a series of 505 patients with SSP from Israel, the most common aetiological cause was COPD.[17] However, in most of the Indian studies[6-8,11,18] TB has remained the most common aetiological cause of SSP followed by COPD and pneumonia. Two other Indian studies[9,19] found COPD to be the most common aetiologial cause of SSP followed by pulmonary TB. In our study, TB was the most common aetiological cause for SSP, evident in 50% of cases while COPD and bacterial pneumonia accounted for only 23.8% and 15% cases, respectively.

The therapeutic options range from observation, simple needle aspiration, placement of chest tube, chemical pleurodesis, thoracoscopy, video-assisted thoracoscopic surgery (VATS) and thoracotomy. The chest tube placement is recommended if simple pleural aspiration fails in PSP patients and in all patients with SSP.[20] In our study, all the patients with SSP were managed with intercostal tube drainage and one patient with PSP had to be managed with intercostal tube drainage following failure of simple aspiration. The other patient with PSP was treated successfully with simple aspiration.

In our study in patients with TB, the duration of tube thoracostomy ranged from 7–90 days. Because of extensive destruction, the duration of tube thoracostomy in TB patients has been observed to be longer ranging from 5 days to 6 months.[21] In the present study, lung failed to expand completely in 25 patients. The reasons for failure of the lung to expand include broncho-pleural fistula, dense pleural adhesions and trapped lung. Further, in patients with bronchogenic carcinoma, the lung did not expand due to endobronchial growth and in carcinoma oesophagus, lung expansion did not occur due to oesophago-pleural fistula.

In the present study, cases of traumatic pneumothorax were excluded because ours is a peripheral hospital and cases of chest trauma are not managed by us, but by the department of cardiothoracic surgery. Video-assisted thoracoscopic surgery which is the most appropriate for SSP with persistent air leak in COPD patients, was not done because of lack of availability at our hospital.

Conclusions

Our observations suggest that SSP was more common than PSP. Males were more commonly affected than females. Pulmonary TB was found to be the most common cause of SSP in the present study. Inspite of pneumothorax being a respiratory emergency, prompt diagnosis and drainage intervention with specific treatments made the mortality rates very low (3.48%) in our study.

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