Assessment of spontaneous pneumothorax in adults in a tertiary care hospital

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ABSTRACT

Context: Pneumothorax continues to be a major cause of morbidity and mortality among respiratory patients, but there is a paucity of data regarding etiology, clinical profile, management, and outcome of spontaneous pneumothorax (SP), from this part of the world. Aims: To assess the patients of spontaneous pneumothorax in adults with special reference to the etiology, clinical presentation, management, and outcome of SP. Settings and Design: Prospective, observational study conducted in a tertiary care institution over a period of one year. Materials and Methods: All adult patients of SP attending the department of pulmonary medicine in a tertiary hospital were studied and detailed clinical, radiological, and management data were recorded and analyzed. Results: Sixty consecutive patients, who satisfied the inclusion criteria were included in the study. Among them 10 had primary spontaneous pneumothorax (PSP) and 50 had secondary spontaneous pneumothorax (SSP). The overall male to female ratio was 4:1. The mean age of the PSP patients was 26.3 ± 2.19 years, whereas, that of the SSP patients was 53.42 ± 2.07 years (P < 0.0001). Seventy percent of the patients were smokers. The most common clinical manifestation of PSP was chest pain (80%) in contrast to dyspnea in SSP (96%). The most common cause of SSP (42%) was found to be chronic obstructive pulmonary disease (COPD) followed by pulmonary tuberculosis (30%). The cases were managed with intercostal tube drainage (85%), simple aspiration (8.33%), and observation (6.67%). Full expansion of the lung was noted in 91.67% of the cases. Conclusion: Spontaneous pneumothorax was more common in men. SSP was far more common in this study, and the predominant underlying cause of SSP was COPD, which surpassed tuberculosis as the leading cause of SSP. This is in contrast to the results from previous studies done in our country. Intercostal tube drainage was the mainstay of treatment and the response was good.

KEY WORDS: Intercostal tube drainage, primary spontaneous pneumothorax, secondary spontaneous pneumothorax, spontaneous pneumothorax

INTRODUCTION

Pneumothorax is defined as the presence of air in the pleural space. The general consensus is that Primary spontaneous pneumothorax (PSP) results from a rupture of the subpleural blebs that are usually located in the apices of the lung.¹ Tuberculosis has remained the dominant cause of secondary spontaneous pneumothorax (SSP) in all earlier studies on adults from India.² Agnihotri et al.³ in their study in Jaipur, India, have found pulmonary tuberculosis to be the most common cause of pneumothorax (57.5% of spontaneous pneumothorax (SP)), and Gupta et al.⁴ during their study in Chandigarh, India, have found that tuberculosis (41.7% of SSP and 33% of SP) is the most common etiology behind of SSP. On the other hand, studies from developed countries show different etiological pictures. In a recent series from Spain, COPD has been the
The patient's age, smoking history, breathlessness, underlying lung disease, and size of pneumothorax were the determining factors to decide the management strategy. Those with a PSP size not >2 cm and/or with breathlessness underwent observation. Those having a size >2 cm and/or breathlessness underwent needle aspiration of air with a 16-18G needle. If there was no improvement, then the patients were managed with intercostal tube drainage. Patients of SSP with size <1 cm and no breathlessness underwent conservative management with high-flow oxygen and observation. Needle aspiration was tried in patients having a pneumothorax between 1 and 2 cm in size. Intercostal tube drainage was performed if the initial pneumothorax size was >2 cm with/without breathlessness and in those not improved by needle aspiration. The intercostal tube was removed after 24 hours of complete expansion of the lung. Chemical pleurodesis with 10% Povidone-Iodine solution was reserved for patients who underwent management with intercostal tube drainage and had a past history of pneumothorax. Referral for surgical intervention was done for those patients, whose lungs did not expand after 14 days of intercostal tube drainage.

**RESULTS**

During the period of one year, 60 consecutive patients of both sexes, having clinical and radiological features suggestive of SP, were enrolled in this study. Ten patients (16.67%) had PSP and 50 patients (83.33%) had SSP. Overall, the mean age of the patient was 48.9 ± 2.19 years (mean ± SEM). Patients with PSP were significantly younger as compared to patients with SSP (mean age of presentation 26.30 ± 2.19 years in PSP vs. 53.42 ± 2.07 years in SSP, P < 0.00001). The distribution of age in patients of SP showed a biphasic pattern, with the first peak occurring between 20 and 30 years of age, which was predominantly contributed by PSP, while the second peak occurred in patients above 50 years of age and was mainly contributed by SSP [Figure 1]. PSP cases were more common in the below-40-year age group, whereas, SSP was common in the age group above 40 years. The male gender was predominant, with an overall male to female ratio of 4:1. Ipsilateral chest pain (80%) was the most common symptom in PSP followed by dyspnea (50%) and cough (30%). In cases of SSP, the most common complaint was dyspnea (94%) followed by ipsilateral chest pain (42%), cough (36%), fever (20%), and hemoptysis (2%).
49 (81.67%) cases of SP. Most of the patients of SP attended the hospital for consultation after one to six days of their initial symptoms and the duration was the same for both PSP and SSP. Patients who had a confirmed prior admission for SP were considered to have recurrent disease. By this means, the recurrence rate in cases of PSP was 10% and in SSP it was 14%. The overall recurrence rate was 13.33% in SP. Ipsilateral recurrence (11.67%) was more common than contralateral recurrence (1.67%). Pre-existing chronic obstructive pulmonary disease (COPD) was confirmed in 16 patients and asthma in three patients. Eleven patients had a past history of tuberculosis (nine cases of pulmonary tuberculosis and two cases of tubercular pleural effusion). There was no family history of SP. Seventy percent of the patients of SP (42 out of 60) were smokers, of whom six (60%) had PSP and 36 (72%) had SSP. Patients with PSP were taller than those with SSP. The mean height of the SP patients was 162.48 ± 0.94 cm, while those of PSP and SSP were 165.60 ± 2.22 cm and 161.86 ± 1.02 cm, respectively. On physical examination the most common signs were tachypnea (43.33%) and tachycardia (30%). SP occurred in either hemithorax, with almost near equal frequency (left 30 and right 29). Underlying pulmonary diseases were identified in 50 patients (83.33%) and they were classified as SSP; and in the remaining 10 cases (16.67%) there were no underlying pulmonary diseases, and hence, they were classified as PSP. HRCT of the thorax revealed an apical bleb and/or emphysematous changes in six (60%) cases of PSP. The etiology of the SSP cases were identified as COPD (42%), pulmonary tuberculosis and its sequelae (30%), asthma (8%), pneumonia (6%), bronchiectasis (6%), lung carcinoma (4%), diffuse parenchymal lung disease (DPLD) (2%), and bullous lung disease (2%) [Figure 2]. Among 15 patients of pulmonary tuberculosis or its sequelae, 11 patients had a past history of tuberculosis and the remaining patients were sputum smear acid-fast bacilli (AFB)-positive by Ziehl–Neelsen staining. All these patients were having radiological signs of pulmonary tuberculosis or its sequelae. Radiologically, the upper zone involvement and cavitation lesions were the most commonly observed findings. Among the three patients diagnosed with pneumonia, one had aspiration pneumonia of the right lower lobe, one had Klebsiella pneumonia of right upper lobe, and one had bilateral staphylococcal pneumonia. Two patients had underlying lung malignancy in the form of a hilar mass and a right upper lobe mass. One patient of DPLD was diagnosed by HRCT thorax. Among the 60 patients of SP one patient (1.67%) was managed with observation only without any oxygen supplementation and three cases (5%) were observed with only high-flow oxygen. Supplemental oxygen was given to 59 (98.33%) patients. Five (8.33%) cases were successfully managed with simple needle aspiration and the remaining 51 (85%) patients required intercostal chest tube drainage. Twenty percent of PSP and 6% of SSP patients were managed with needle aspiration of air and the lungs expanded without any complication. Intercostal chest tube drainage was done in PSP and SSP patients when success was not achieved by needle aspiration or there was persistent breathlessness and in large (more than 2 cm) pneumothoraces. In our study 70% of PSP and 88% of SSP (overall 85% of SP) were managed by a chest tube drain. Ten percent of the SP patients had undergone chemical pleurodesis [Table 1]. The mean duration between chest drain insertion and removal was 6.63 ± 0.41 days in SP patients. Surgical emphysema (19.61%) was the most common complication of intercostal tube drainage followed by bronchopleural fistula (9.8%), pyopneumothorax (1.96%), and re-expansion pulmonary edema (1.96%) [Figure 3]. There was no complication in closed needle aspiration. Lung expansion was observed in 55 (91.67%) out of 60 SP patients. The remaining five patients (8.33%), with persistent air leak, were referred to the thoracic surgeon for intervention.

**DISCUSSION**

Spontaneous pneumothorax with underlying lung disease is categorized as SSP and it is considered to be a more serious disorder, as the patients have a premorbid cardiopulmonary compromise for the underlying lung diseases. PSP occurs in young patients without any apparent lung disease. According to Ferraro and colleagues, PSP is found in 80% of the cases of SP and only 20% have an underlying pulmonary disease. Sousa et al. has found an underlying pulmonary disease in 36.4% of the cases (SSP). The reported incidence of PSP among all patients presenting with SP have been widely

**Table 1: Different strategies for management of spontaneous pneumothorax**

| Type of management          | SP (n=60) (%) | PSP (n=10) (%) | SSP (n=50) (%) |
|-----------------------------|--------------|---------------|---------------|
| Only observation            | 1 (1.67)     | 1 (10)        | Nil           |
| Observation with oxygen     | 5 (8.33)     | Nil           | 3 (6)         |
| Closed needle aspiration    | 2 (20)       | 3 (6)         | 19 (38)       |
| Chest drain                 | 7 (70)       | 44 (88)       |               |
| Chemical pleurodesis        | 6 (10)       | 1 (10)        | 5 (10)        |

SP: Spontaneous pneumothorax, PSP: Primary spontaneous pneumothorax, SSP: Secondary spontaneous pneumothorax
variable in the few studies from India, and range from 12.5% in a study from Jaipur,[3] 20% in Chandigarh,[4] and 25% in Rohtak,[11] to 64% in Srinagar.[12] In the present study, an underlying etiology has been found in 50 patients (83.33%) and only 10 patients (16.67%) are in the group of PSP. The high relative incidence of SSP may partly be related to the fact that most patients of PSP are managed at the primary and secondary healthcare hospitals, whereas, patients of SP, who have associated comorbidities are referred to tertiary care hospitals like ours. The male to female ratio ranges from 5:1 to 8:1.[13] Sousa et al.[10] found a male to female ratio of 3.7:1. Among the Indian studies, Gupta et al.[4] has found a male to female ratio of 5:1. Our study has a male preponderance, with a male to female ratio of 3:1. Above studies is similar to the previous studies. The higher incidence in men is attributed to the higher rates of smoking, body habitus, and different mechanical properties of the lungs.[16] The two age peaks (PSP between 20 and 30 years and SSP above 50 years) in our study are similar to studies from the western world, although in our study the second age peak occurred in the 50 years and above age group, as compared to the 60-65-year range reported in the western studies.[15] The likely explanation for the slightly earlier occurrence of the second peak is that a considerable number of cases of SSP in this study are secondary to tuberculosis, in contrast to the studies from the western region. Smoking is a recognized risk factor for SP and has been estimated to increase the risk 22-fold in men and nine-fold in women.[16] Sousa et al.[10] have found that 60.6% of the patients have a current or past history of tobacco use. Gupta et al.[4] have found that nearly half of the patients have smoked tobacco. In our study 42 (70%) patients of SP have had either a past or present history of smoking and among them six have PSP and 36 have SSP. This may be related to the small number of patients with PSP and a large number of COPD patients in the SSP group. In our study, patients with PSP are relatively taller (mean height 165.60 ± 2.22 cm), which is a well-known observation.[17] Dyspnea was the most common symptom in SP in our study, but chest pain was the most common symptom of PSP (80% in PSP vs. 42% in SSP) and dyspnea was the most common manifestation of SSP (50% in PSP vs. 94% in SSP). Ahangar et al.[13] found that chest pain was the most common symptom of PSP and dyspnea was the most common manifestation of SSP. Contrary to most of the previous literature[17] our study showed that SP occurred with almost equal frequency with a slight preponderance to the left side. Blebs and bullae were the most common findings (70%) on the computed tomography (CT) scan and these were bilateral in most cases. These findings were similar to those found in the study by Granke et al.[18] COPD has now emerged as the leading cause

Figure 2: Bar diagram showing that COPD was the leading cause of SSP followed by tuberculosis

Figure 3: Bar diagram showing complication during management with intercostal chest tube drainage
of SSP, from the west, but tuberculosis has remained the dominant cause of SSP in all studies in adults in India.\[2-4,12\] Agnihotri et al.\[3\] in their study in Jaipur, India, before 1987, found pulmonary tuberculosis to be the most common cause of pneumothorax (57.5% of SP) and Gupta et al.\[4\] during their study in Chandigarh, India from 2001 to 2002 showed tuberculosis (41.7% of SSP, 33.3% of SP) to be the most common etiology of SSP. In our study we found tuberculosis to be the etiology in 30% of SSP (25% of SP), but COPD (42% of SSP) was the leading underlying pulmonary disorder in SSP. A possible explanation for this major change in etiology may be the fact that most of the previously mentioned studies were done before the massive expansion of the RNTCP and DOTS strategy and the increasing number of case findings and effective chemotherapy has reduced the tuberculosis burden to some extent.\[10\] Tuberculosis as a cause of SP was already on a declining trend from studies before 1987 to 2001 (57.5% of SP to 33.3% to SP).\[2-4\] The other possible explanation may be the increasing COPD burden in India,\[20\] air pollution, and large number of smokers in our study. Simple needle aspiration is indicated for large size (>2 cm) PSP with breathlessness, and medium size (1-2 cm) for without breathlessness.\[21\] Twenty percent of our PSP and 6% of the SSP (total 8.33% of SP) patients were managed with needle aspiration. In our study 70% of the PSP and 68% of the SSP (85% of SP) were managed with a chest tube drain. Our study showed overuse of chest tube drain rather than simple aspiration, mostly in PSP patients, as most of the patients were symptomatic, with a large size pneumothorax. In our study subcutaneous emphysema was observed in 19.61% of the cases, which was comparable with other studies.\[10\]

Therefore, the conclusions that can be drawn from our study are that SSP is far more common than PSP and the predominant underlying cause of SSP is COPD. This is in contrast to the previous studies done in India. Intercostal tube drainage is the mainstay of the treatment and the overall response has been good. There is a paucity of data from the eastern part of India regarding the etiology, clinical profile, and management of SP. Most of the studies from the other parts of India are not very recent. In view of the reduction of the tuberculosis burden in India, after introduction of the DOTS strategy, and a steady rise in the COPD cases, the etiology, clinical profile, and management of SP in contrast to the previous studies may be different in other parts of India also, and this needs further evaluation.

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