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A clinical study of risk factors, aetiology and management of spontaneous pneumothorax

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Abstract---Materials & Methods: A hospital based prospective study of 50 consecutive cases presenting to MGM Medical College, Hospital diagnosed as Spontaneous Pneumothorax from the time period of 2014 December to 2016 November who met the inclusion and exclusion criteria. Results: In the total of 50 cases of SP studied, 35 (70% of total cases) of them were found to have underlying lung pathology and diagnosed as SSP while only 15 (30% of total cases) had no demonstrable lung pathology and diagnosed as PSP. Among the total cases of 50 studied the highest number of cases were in the age group of 50-60 years (28% of total cases), followed by the age group of 20-30 years (22% of total cases). Males were more commonly affected comprising 40 of the total 50 cases studied (82% of total cases) while females comprised of the rest 9 cases (18% of total cases). Male: Female Ratio for SP was 5:1, for PSP 9:1 and for SSP 4. 5:1. COPD was found to be the leading cause of SSP responsible for 21 of the 35 cases of SSP (60% of the total cases), followed by TB accounting for only 10 cases (28. 57% of the total cases). ILD seen in 2. 85%, LCH seen in 2. 85%, Lung Malignancy seen in 2. 85% and HIV associated pulmonary Tuberculosis was seen in 2. 85% of the cases studied. All cases were managed accordingly with Tube Thoracostomy alone done in 43 cases (86% of total) while Tube Thoracostomy with Talc Pleurodesis performed in 4 cases (8% of the total). Aspiration was sufficient for the management of 3 cases of SP (6% of the total). Conclusion: Spontaneous pneumothorax is more common in the male gender. Smoking history and taller height are significant risk factors for the development of PSP. The commonest etiological factor of SP is COPD. Majority of the cases are managed effectively by the tube Thoracostomy.

Keywords---Spontaneous Pneumothorax; Epidemiology; Tube thoracostomy.

Introduction

Pneumothoraces can be divided into Spontaneous Pneumothorax and Traumatic Pneumothorax. Spontaneous Pneumothorax is sub classified as either Primary spontaneous Pneumothorax or Secondary spontaneous Pneumothorax.

Primary Spontaneous Pneumothorax occurs without a precipitating event in a person with no clinical evidence of lung disease. Many of these individuals have occult lung disease with sub pleural blebs on computed tomography (CT) scans. In contrast, secondary spontaneous Pneumothorax occurs as a complication of underlying lung disease, most often Tuberculosis(T. B). ¹

The most common mode of presentation of spontaneous Pneumothorax is sharp unilateral chest pain which is continuous and exacerbated by deep inspiration and postural change. The patient may also present with dyspnoea or sometimes both. The possibility of Pneumothorax should be considered in any patient with COPD who has increasing shortness of breath, particularly if chest pain is also present. ^{2, 3, 4, 5, 6}

Most of the pneumothoraces can be diagnosed accurately with physical examination and chest radiograph, though occasionally a chest CT might be required.

The management of Pneumothorax varies widely from Observation, simple aspiration, Tube thoracostomy with or without instillation of a sclerosing agent to more interventional procedures such as parietal pleurectomy, pleural abrasion at thoracoscopy, Video Assisted Thoracoscopic procedures and thoracotomy. There is considerable variation in individual management of spontaneous Pneumothorax, thoracic surgeons on the whole tending to resort to more active measures than physicians.

Aims & objectives

- To study the risk factors for Spontaneous Pneumothorax.
- To study the various aetiology of Spontaneous Pneumothorax
- To study the various modalities adapted for the management of spontaneous Pneumothorax.

Method

Fifty consecutive patients who presented to us in the O. P. D of MGM Medical College Aurangabad from the time period of 2014 December to November 2016 with symptoms and signs suggestive of spontaneous pneumothorax who met the inclusion criteria were selected for the study.

Each of these cases were admitted and studied according to the case Proforma which included detailed history taking, thorough clinical examination and investigations. Investigations included routine blood investigations and specific

investigations such as Chest X-ray, Sputum for AFB, Sputum culture and microscopy. CT scan and USG Thorax was done whenever found necessary. The final management used for each case was then recorded, analyzed and tabulated.

Inclusion criteria

- All patients with spontaneous pneumothorax with or without complications.
- Patients willing for investigation and treatment.

Exclusion criteria

- Patients age-14 years and below.
- Pregnant females

Results & observations

Total number of cases studied-50 cases.

Table1
Showing Age Distribution

Age Group (years)	Total Number of Cases		Percentage
	PSP	SSP	
14 – 20	2	3	10
20 – 30	6	5	22
30 – 40	1	2	6
40 – 50	1	7	16
50 – 60	3	11	28
60-70	2	7	18
TOTAL	15	35	100

The age distribution of the patients in our study showed a biphasic pattern with the first peak occurring between 20 and 30 years of age and these cond peak occurring between 50 and 60 years of age. Most of the patients with PSP presented in the 20 - 30 year age group (3rd decade) while most of the patients with SSP presented in the 50 - 60 year age group (6th decade). This shows that patients with PSP are significantly younger compared to patients with SSP. The first peak in the 3rd decade of life contributed to 22% of the total cases while these cond peak in the 6thdecade of life contributed to 28% of the total cases.

Table 2
Showing sex distribution

Sex	Number of Cases		Percentage
	PSP	SSP	
Males	12	29	82
Females	3	6	18
TOTAL	15	35	100

The Sex Distribution of the patients in our study indicates that SP is more common among men with a Male: Female ratio of 5:1. This Male preponderance in PSP was the ratio is 4:1 compared to SSP were the ratio is 5:1. Males contribute to 82% of cases with females accounting to only 18% of cases.

Table 3
Showing Risk Factor Analysis for Height, Weight and B. M. I.

Risk Factor Analysis for Height, Weight and B. M. I.				
	PSP	SSP	P Value	95% Confidence Interval(CI)
	N = 15	N =35		
Height (in cms)				
Range	156-180	146-166	0. 0011	-13. 21063 to -3. 52937
Mean	167. 93	155. 97		
Standard deviation	6. 31	4. 46		
Standard error	1. 9	1. 34		
Weight (in kgs)				
Range	50-71	30-66	0. 004	4. 5976 to 14. 7224
Mean	59. 26	49. 6		
Standard deviation	6. 13	8. 86		
Standard error	1. 84	2. 67		
B. M. I (kg/m²)				
Range	19. 1-23. 1	13. 7-28. 6	0. 013	1. 4666 to 5. 6334
Mean	20. 95	17. 4		
Standard deviation	1. 38	3. 89		
Standard error	0. 42	1. 17		

The Risk Factor Analysis for Height, Weight and B. M. I shows that patients affected with PSP are significantly taller with a mean height of 167. 93 cm as compared to patients with SSP who had a mean height of 155. 97cm with p value< 0. 0011(95% CI: -13. 21063 to-3. 52937) . However patients with SSP have a lower mean weight (49. 6 kg vs. 59. 26 kg) and B. M. I (17. 4 vs. 20. 95) compared to patients with PSP and the difference is statistically significant. This indicates from the above study that height is a significant risk factor for developing PSP as compared to weight and BMI.

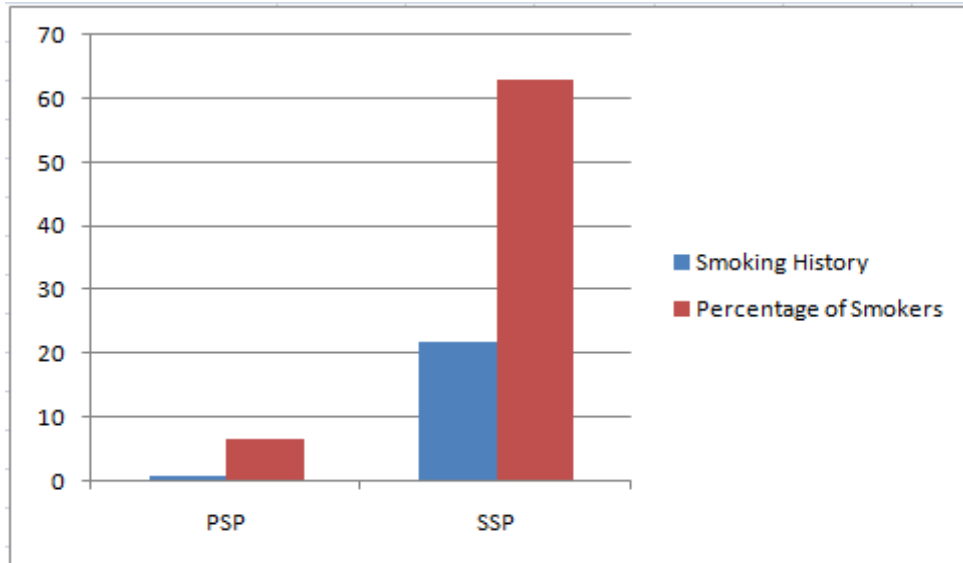


Figure1: Showing Risk Factor Analysis for Smoking

The risk factor analysis for Smoking in our study indicates that smoking is a significant risk factor for the development of spontaneous pneumothorax, especially more so for secondary spontaneous pneumothorax. A history of smoking was present in 46% of the cases presenting with spontaneous pneumothorax. Of the cases diagnosed with PSP 62. 86% of them gave a positive history of smoking while the percentage of smokers in PSP was only 6. 67% of cases

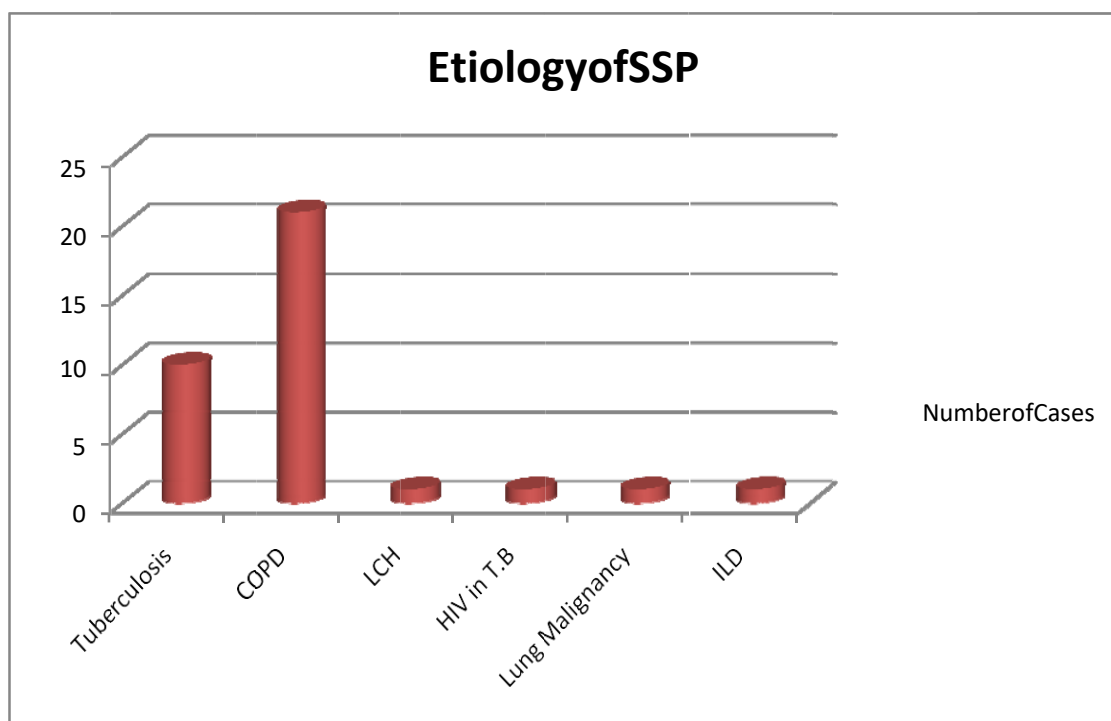


Figure 2: showing etiology of SSP

The commonest etiology for SSP in our study was found to be COPD accounting to 60% of the cases, followed by Pulmonary Tuberculosis accounting for 28. 57%, LCH (Langerhans Cell Histocytosis) accounting for 2. 85%, ILD accounting for 2. 85%, Lung Malignancy accounting for 2. 85%, . HIV associated Pulmonary infections was seen in 2. 85% of the cases studied.

Table 4
Showing Mode of Management of SP

Mode of Management of SP		
Procedure	Number of Cases	Percentage
Aspiration	3	6
Tube Thoracostomy	43	86
T tube thoracotomy with talc pleurodesis	4	8
TOTAL CASES	50	100

In the present study majority of the patients were managed with Tube Thoracostomy alone in up to 86% of cases, while Tube Thoracostomy with Talc Pleurodesis was attempted in 8% of the cases. The rest were managed by simple aspiration (6% of the cases).

Discussion

Incidence of SP

Although the entity of pneumothorax has been well recognized since the beginning of 19th century, very few studies are available regarding its epidemiology, particularly from India. The most widely quoted study on the incidence of SP was conducted in Olmsted County, Minnesota⁷. 141 cases were spontaneous in onset of which 77 were primary and 64 secondary to an underlying pulmonary disease⁷. The reported incidence of PSP among all patients presenting with SP have been widely variable in the few studies available from India, and has ranged from 12.5% in a study from Jaipur⁸ to 25% from Rohtak⁹ and 64% from Srinagar¹⁰. In the present study, the underlying aetiology could be found in 35 patients (70%), leaving only 15 (30%) in the PSP group as compared with Rohtak⁹. This high relative incidence of SSP could partly be related to the fact that most patients of PSP are managed at the primary and secondary healthcare hospitals, while several patients of SSP, who have associated comorbidities, are referred to tertiary care hospitals.

Age incidence

In the study conducted by Gupta D et al¹¹ on the incidence of Spontaneous Pneumothorax in England, they found that the age distribution for Pneumothorax showed a biphasic distribution. The highest rates for men were in the 3rd decade and 8th decade age groups. The first peak for women was at a later age than men at 30 - 34 years and 2nd peak at 70 - 74 years. The biphasic distribution corresponds to primary and secondary spontaneous pneumothorax. The age distribution in the present study also shows a similar biphasic pattern of distribution. The 1st peak occurring in the age group of 3rd decade and the 2nd peak occurring in the age group of 6th decade. Classically, these two age peaks correspond to PSP and SSP respectively, where PSP is predominantly a disease of younger men. In our study, the second age peak occurred a little earlier 6th decade as compared to the 7th decade range reported in the other Western studies^{7, 11}.

Sex incidence

The studies conducted on the incidence of spontaneous pneumothorax in Olmsted County, Minnesota⁷ shows that the ratio of male to female incidence was 6.2:1 for PSP and 3.2:1 for SSP. In another study conducted by Gupta D et al¹¹ on the epidemiology of SP in England they found the M: F ratio was 2.7:1.

The sex incidence in the present study showed a male preponderance with a male: female ratio of 4.5:1. The results obtained in the present study are comparable to the other studies. This higher incidence in men has been attributed to higher smoking rates in men, body habitus and different mechanical properties of the lungs.¹²

Risk factor analysis for height, weight and b. M. I

In a study conducted by Withers et al he found that those with pneumothoraces were 2 in. taller and 25lb lighter than the average military recruit¹³.

In study conducted by Dheeraj Gupta et al¹⁴ they found that men affected by PSP had mean height of 171 cms. Weight and B. M. I were however lower in patients with SSP.

In the present study the patients with PSP were relatively taller with a mean height of 167.93cm compared to SSP with a mean height of 155.97 cm. Patients with PSP are relatively taller which is a well-known observation. Because the gradient in pleural pressure is greater from the lung base to the lung apex in taller individuals, the alveoli at the lung apex are subjected to a greater mean distending pressure in taller individuals. Over a long period, this higher distending pressure could lead to the formation of sub pleural blebs in taller individuals who are genetically predisposed to bleb formation.¹⁵ However weight and B. M. I were much lower for patients suffering from SSP. This can be attributed to the nature of chronic illness they suffered from. Risk factor analysis for height, weight & B. M. I are therefore comparable to this study.

Risk factor analysis for smoking

In a study by Cottin V, Streichenberger N, Gamondes JP, et al they found that the pathogenesis of subpleural blebs is probably related to airway inflammation. Respiratory bronchiolitis was found in 70 of 79 patients (89%) who underwent a surgical procedure for recurrence or persistence of primary spontaneous pneumothorax.¹⁶ All the patients in this study were smokers, and cigarette smoking can certainly produce airway inflammation.

When the smoking habits of 505 patients from four separate studies were analyzed,^{17, 18, 19, 20} 461 of the patients (91%) were smokers.

In the present study 62.86 % of the patients affected with SSP had a positive history of smoking as compared to 6.67% of patients affected with PSP.

The occurrence of spontaneous pneumothorax appears to be related to the level of cigarette smoking. Compared with nonsmokers, the relative risk of a pneumothorax in men is seven times higher in light smokers (1-12 cigarettes/day), 21 times higher in moderate smokers (13-22 cigarettes/day), and 102 times higher in heavy smokers (>22 cigarettes/day). For women, the relative risk is 4, 14, and 68 times higher in light, moderate, and heavy smokers than in nonsmokers, respectively.²⁰ Disease of the small airways related to smoking probably contributes to the development of the subpleural blebs.

Etiology of spontaneous pneumothorax

Until the description of PSP by Kjaegard³ more than 70 years ago, tuberculosis was thought to be the leading cause of SP. The scenario has changed over the years, and COPD has now emerged as the leading cause of SSP in the literature from the West. In a recent series of 505 patients from Israel with SSP, the etiologies were as follows: COPD, 348; Tumor, 93; Sarcoidosis, 26; Tuberculosis, 9; other pulmonary infections, 16; and miscellaneous 13.²¹

In the present study the common etiology was found to be COPD accounting to 60% of the cases, followed by Pulmonary Tuberculosis accounting for 28.57%,

ILD seen in 2. 85%, LCH seen in 2. 85%, Lung Malignancy seen in 2. 85% and HIV associated pulmonary Tuberculosis was seen in 2. 85% of the cases studied.

Mode of management of spontaneous pneumothorax

There is evidence of considerable variation in individual management of spontaneous pneumothorax, thoracic surgeons on the whole tending to resort to more active measures than physicians. It should be emphasized that there is a dearth of randomized controlled studies comparing the different treatment modalities.

In the present study all cases of PSP with quantitation of pneumothorax to be moderate was managed effectively by simple aspiration. A total of 3 cases of PSP (6% of the total cases) with moderate quantity pneumothorax were managed with needle aspiration. One multicenter, prospective, randomized study compared manual aspiration versus chest tube drainage for the first episode of primary spontaneous pneumothorax. Sixty patients were randomized and immediate success was obtained in 16 of 27 patients (59. 3%) in the manual aspiration group and 28 of 33 (85%) in the chest tube drainage group.²² Importantly, 13 of the 27 manual aspiration patients did not require hospitalization.²² Devanand et al.²³ performed a meta-analysis of three randomized controlled studies comparing manual aspiration and chest tube drainage and concluded that simple aspiration is advantageous in the initial management of primary spontaneous pneumothorax because of a shorter hospitalization.

Those cases of PSP with large pneumothoraces were managed with Tube Thoracostomy. All cases of SSP presenting to us with 1st episode of SP were managed with Tube Thoracostomy. In a study conducted by Seremetis¹⁹ on a series of 81 patients, only 3 patients (4%) had persistent air leaks after several days of chest tube drainage. The average duration of hospitalization in this series was only 4 days, with a range of 3 to 6 days. In the present study 48 of 60 cases were managed by Tube Thoracostomy alone (80% of the total cases).

A total of 10 patients were posted for Tube Thoracotomy with Talc Pleurodesis, but in 3 patients were discharged against medical advice, 3 patients were not willing for Talc Pleurodesis, only 4 Patients of SSP (8% of the total cases) were managed with Tube Thoracostomy with Talc Pleurodesis.

Conclusion

Spontaneous pneumothorax has a biphasic pattern of age distribution with the 1st peak in the 3rd decade of life and the 2nd peak in the 6th decade of life corresponding to incidence of PSP and SSP respectively. Spontaneous pneumothorax is more common in the male gender.

Smoking history and taller height are significant risk factors for the development of PSP. The commonest etiological factor of SP is COPD. Majority of the cases are managed effectively by the tube Thoracostomy.

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