Original Article

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

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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

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most common cause of SSP followed by tuberculosis.[5] In this study, we have tried to analyze the etiology, clinical profile, management, and outcome of SP among adults in a tertiary hospital of Kolkata, because there is a paucity of data on pneumothorax from the eastern part of India.

MATERIALS AND METHODS

Study design

This was a prospective, observational, cross-sectional study, over a period of one year, carried out in the Department of Pulmonary Medicine of a tertiary level teaching institution of eastern India.

Study population

Sixty (60) consecutive adult cases of SP, belonging to both the genders, attending the department of pulmonary medicine during the study period, were included after conforming to the inclusion and exclusion criteria.

Inclusion criteria

Adult patients of both genders having features of SP (both primary and secondary) detected clinically and/or radiologically, attending the Outpatient and Inpatient departments of pulmonary medicine, were included in the study.

Exclusion criteria

Patients known to have traumatic and iatrogenic pneumothorax, clinically and radiologically detected hydropneumothorax, patients having a poor general condition (poor nutrition, severe anemia, hemodynamic instability, semiconscious/unconscious patients), recent history of myocardial infarction, and unwilling patients were excluded from our study.

Study protocol

Approval of the Institutional Ethics Committee was obtained and a written informed consent was taken from every patient included in this study. A detailed history and clinical examination (including general, respiratory, and other systemic examinations) findings were recorded for each patient. Chest radiography and other relevant investigations were carried out in each patient. Depending upon the results of the initial clinical evaluation and chest radiography, all patients underwent detailed investigations to ascertain the underlying cause of spontaneous pneumothorax (pulmonary function test, sputum acid fast bacilli (AFB) smear and culture, human immunodeficiency virus (HIV) status, high resolution computed tomography (HRCT) thorax, fiberoptic bronchoscopy, and analysis of bronchoalveolar lavage fluid). Patients who did not have any underlying pulmonary disease were classified as primary spontaneous pneumothorax (PSP) and those having an underlying pulmonary disease were classified as secondary spontaneous pneumothorax (SSP).[6] A small pneumothorax was defined as that in which the rim of air between the visceral pleura and the chest wall was <1 cm, moderate 1-2 cm, and large >2 cm, based on the chest radiography.[7] 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.[8] Referral for surgical intervention was done for those patients, whose lungs did not expand after 14 days of intercostal tube drainage.

Statistical analysis

Statistical analysis was performed using the SPSS version 10.0 (SPSS Inc, Chicago, IL) software for MS Windows. Descriptive frequencies were expressed by mean + standard error of mean (SEM). The *P* value was calculated using the Fisher's exact test and $P < 0.05$ was considered to be significant.

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%). The clinical presentation was sudden in

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 indentified 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 foracid-fast bacilli (AFB)-positive by Zeihl–Neelsen staining. All these patients were having radiological signs of pulmonary tuberculosis or its sequelae. Radiologically, the upper zone involvement and cavitary 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 onlyhigh-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.

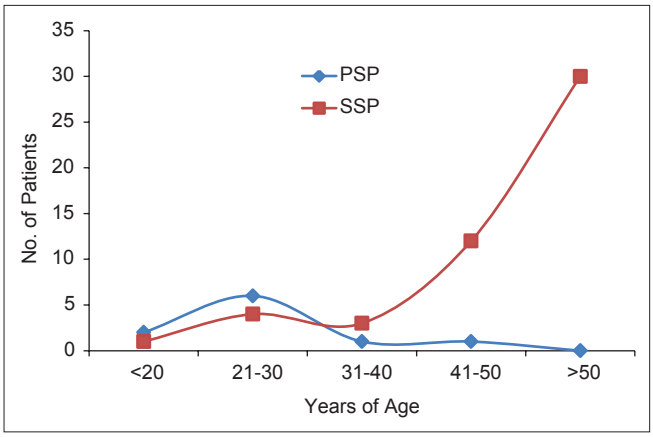

Figure 1: Line Diagram showing age distribution of spontaneous pneumothrax. PSP peaked in the 21-30-year age group and SSP in the above-50-year age group

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.[9] Sousa *et al*.[10] 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	3 (5)	Nil	3 (6)
Closed needle aspiration	5 (8.33)	2 (20)	3 (6)
Chest drain	51 (85)	7 (70)	44 (88)
Chemical pleurodesis	6 (10)	1 (10)	5 (10)

SP: Spontaneous pneumothorax, PSP: Primary spontaneous pneumothorax, SSP: Secondary spontaneous pneumothorax

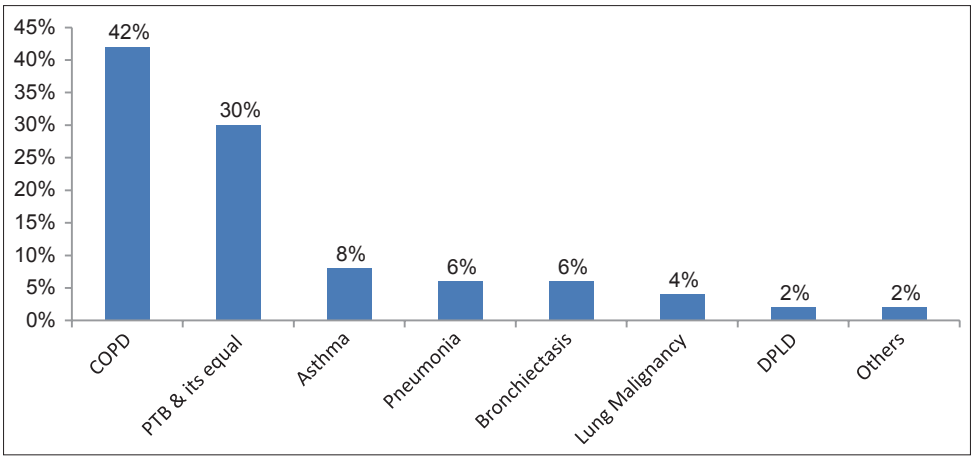

Figure 2: Bar diagram showing that COPD was the leading cause of SSP followed by tuberculosis

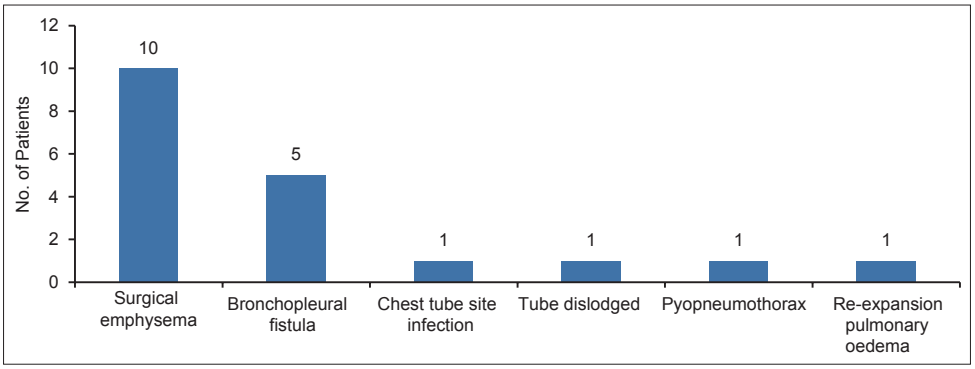

Figure 3: Bar diagram showing complication during management with intercostal chest tube drainage

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] Sausa *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 4:1, which 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.[14] 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*.[12] 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

of SSP, from the west,[8] 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.[19] 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).[3,4] 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 88% 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.

REFERENCES

1. Seaton D. Pneumothorax: Crofton and Douglas's Respiratory Diseases. 5th ed. Vol. 2. London: Blackwell Sciences; 2000. p. 1182-211.
2. Devaraj U, D'Souza G. Pneumothorax. In, Jindal SK (ed). Text Book of Pulmonary and Critical Care Medicine. 1st ed. Vol. 2. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2011. p. 2041-54.
3. Agnihotri S, Sharma TN, Jain NK, Madan A, Mandhana RG, Saxena A. Spontaneous pnemothorax: A clinical study of eighty cases in Jaipur. Lung India 1987;4:189-92.
4. Gupta D, Mishra S, Faruqi S, Aggarwal AN. Etiology and clinical profile of spontaneous pnemothorax in adults. Indian J Chest Dis Allied Sci 2006;48:261-4.
5. Blanco-Perez J, Bordón J, Piñeiro-Amigo L, Roca-Serrano R, Izquierdo R, Abal-Arca J. Pneumothorax in active pulmonary tuberculosis: Resurgence of an old complication? Respir Med 1998;92:1269-73.
6. Schramel FM, Postmus PE, Vanderschueren RG. Current aspects of spontaneous pnemothorax. Eur Respir J 1997;10:1372-9.
7. Henry M, Arnold T, Harvey J; Pleural Diseases Group, Standards of Care Committee, British Thoracic Society. BTS guidelines for the management of spontaneous pnemothorax. Thorax 2003;58(Suppl 2):ii39-52.
8. Dey A, Bhuniya S, Datta Chaudhuri A, Pandit S, Saha-Dutta Chowdhury M, Sengupta A, *et al*. Iodopovidone pleuredesis: Experience of a tertiary hospital in Kolkata. Singapore Med J 2010;51:163-5.
9. Ferraro P, Beauchamp G, Lord F, Emond C, Bastien E. Spontaneous primary and secondary pnemothorax: A 10-year study of management alternatives. Can J Surg 1994;37:197-202.
10. Sousa C, Neves J, Sa N, Goncalves F, Oliveira J, Reis E. Spontaneous pnemothorax: A 5-year experience. J Clin Med Res 2011;3:111-7.
11. Gupta KB, Mishra DS, Tandon S, Sindhwani G, Tanwar T. Role of chest CT scan in determining etiology of primary spontaneous pnemothorax. Indian J Chest Dis Allied Sci 2003;45:173-7.
12. Ahangar AG, Hussain SS, Mir IA, Dar AM, Bhat MA, Lone GN, *et al*. Spontaneous pnemothorax. Indian J Surg 2003;65:423-6.
13. Harun MH, Yaacob I, Mohd Kassim Z. Spontaneous pnemothorax: A review of 29 admissions in to Hospital University Sains Malaysia 1984-90. Singapore Med J 1993;34:150-2.
14. Taussig LM, Cota K, Kaltenborn W. Different mechanical properties of the lung in boys and girls. Am Rev Respir Dis 1981;123:640-3.
15. Melton LJ 3rd, Hepper NG, Offord KP. Incidence of spontaneous pneumothorax in Olmsted county, Minnesota: 1950 to 1974. Am Rev Respir Dis 1979;120:1379-82.
16. Gobbel WG Jr, Rhea WG Jr, Nelson IA, Daniel RA Jr. Spontaneous pnemothorax. J Thorac Cardiovasc Surg 1963;46:331-45.
17. Weissberg D, Refaely Y. Pneumothorax: Experience with 1,199 patients. Chest 2000;117:1279-85.
18. Granke K, Fischer CR, Gago O, Morris JD, Prager RL. The efficacy and timing of operative intervention for spontaneous pnemothorax. Ann Thorac Surg 1986;42:540-2.
19. World Health Organization. Geneva: WHO report 2010 Global Tuberculosis Control. Available from: http//www.who.int/tb/data. [Last accessed on 2014 Mar 12].
20. Murthy KJ, Sastry LJ. Economic burden of COPD. NCMH Background Papers-Burden of Disease in India. New Delhi, India; National Commission on Macroeconomics and Health, Government of India 2005. p. 264-74.
21. MacDuff A, Arnold A, Harvey J; BTS Pleural Disease Guideline Group. Management of spontaneous pnemothorax: British Thoracic Society Pleural Disease Guideline 2010. Thorax 2010;65 Suppl 2:ii18-31.

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