

Clinico-Radiological Profile, Etiological Diagnosis and Treatment Outcome of Spontaneous Pneumothorax

Mazher Maqsood¹, Abhishek Kumar², Chinmaya Jethi³, Devanshu Singh⁴, Pradeep Nirala⁵, Pooja Bansal⁶

¹Professor, Department of Respiratory Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India

²Associate Professor, Department of Respiratory Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India

³Assistant Professor, Department of Respiratory Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India

⁴Senior Resident, Department of Respiratory Medicine, Fortis Hospital, Greater Noida, Uttar Pradesh, India

⁵Professor, Department of Respiratory Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India

⁶Junior Resident, Department of Pathology, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India

Abstract

Background: Spontaneous pneumothorax (SP) happens when there is an underlying lung disease such as pulmonary tuberculosis, chronic obstructive pulmonary disease (COPD), asthma, etc., PSP happens when there is no underlying lung disease. Primary SP (PSP) and secondary SP (SSP) are two types of SP. The present study was planned to evaluate the clinico-radiological presentation, etiological diagnosis and to study the response to primary and secondary spontaneous pneumothorax after intervention. **Material and Methods:** Study was done on 60 patients diagnosed with pneumothorax. Patients were assessed by High resolution computed tomography thorax (HRCT), Chest X-ray, Complete blood counts(CBC), Viral marker and PT-INR. The data gathered was then subjected to statistical evaluation by SPSS version 20.0 software at significance level of $p < 0.05$. **Results:** 95% cases suffered from dyspnea and chest pain, followed by 83.3% cases having cough and 11.7% showed hemoptysis. 93.3% cases were diagnosed as Secondary spontaneous pneumothorax, whereas 6.7% had primary spontaneous pneumothorax. On CT examination, 48.33% showed emphysema, followed by 28.3% showing consolidation, 21.66% with cavitation. 95% cases were managed using Intercostal tube drainage (ICTD) insertion, and 81.7% showed complete lung expansion. Mean time of resolution was observed to be 11.2 days. **Conclusion:** Compared to SSP, PSP is less prevalent. Smoking postpones its resorption and is a risk factor in and of itself. Primary care doctors and family doctors are essential in identifying, diagnosing, and treating PT since they are the front-line healthcare professionals. Mild and often self-limiting complications such as surgical emphysema can arise from needle aspiration and ICD insertion.

Keywords: Spontaneous pneumothorax; Chronic obstructive pulmonary disease; Lung; Cough; Consolidation.

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INTRODUCTION

Pneumothorax is defined as an abnormal condition of the lung characterized by the collection of air/gas in the pleural space between the lungs and the chest wall.^[1] Pneumothorax based on etiology can be of two types: Spontaneous pneumothorax (SP) and Traumatic. Primary SP (PSP) and secondary SP (SSP) are two types of SP. While SSP happens when there is an underlying lung disease such as pulmonary tuberculosis (PTB), chronic obstructive pulmonary disease (COPD), asthma, etc., PSP happens when there is no underlying lung disease. The incidence of PSP and SSP in males is 6.2:1 and 3.2:1, respectively, compared to females.^[2] One of the most frequent physical examination findings is tachycardia; nevertheless, the examination may not be noteworthy in individuals with smaller SP (less than 15% of the hemithorax). Reduced chest wall movement, ipsilateral diminished or missing breath sounds, jugular venous distension, pulsus paradoxus, hyper-resonance on percussion, and decreased tactile fremitus are possible signs of patients with larger SP (more than 15%).^[3,4] The patient's

history and physical examination results frequently point to SP, and imaging can corroborate this diagnosis. A hallmark of chest radiography is the displacement of the visceral pleural line, leaving a gap between that lacks lung marking.^[5] There is proof that ultrasonography is more sensitive than chest radiography, but the accuracy of both modalities in estimating the extent of a pneumothorax is not perfect.^[6]

For the diagnosis of SP, chest computed tomography (CT) has been regarded as the "gold standard" in terms of identifying and estimating the size of tiny pneumothoraces. For patients with SP,

Address for correspondence: Dr. Chinmaya Jethi, Assistant Professor, Department of Respiratory Medicine, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India
E-mail: kumar010290@gmail.com

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starting 100% oxygen with a non-rebreather mask and ongoing cardiovascular monitoring is appropriate. Emergency needle decompression is a treatment option for clinically unstable patients exhibiting significant symptoms or indications of tension pneumothorax, serving as a transitional measure before tube thoracostomy. Larger SP can be treated further with mechanical pleurodesis (dry gauze abrasion), bullectomy, and pleurectomy using video-assisted thoracoscopy surgery (VATS) or thoracotomy. VATS has been demonstrated to be an effective treatment and preventative measure for SP recurrence, and it is less invasive than thoracotomy.^[7] With this background, the present study was planned to evaluate the clinico-radiological presentation, etiological diagnosis and to study the response to primary & secondary spontaneous pneumothorax after intervention.

MATERIALS AND METHODS

The present research study was done in the Department of Respiratory Medicine from Nov 2023 to May 2025. The study was done on 60 patients aged more than 18yrs, diagnosed with pneumothorax on the basis of clinical features and radiological imaging. After taking clearance from Ethical Committee of Institute (IEC no-TMU/IEC Nov 23/39), all incorporated cases were detailed about the research and a signed informed written consent was taken from all. Patients suffering from traumatic pneumothorax and not willing to give written and informed consent were excluded from study. Patients were assessed by HRCT thorax, Chest X-ray, Complete blood counts, Viral marker (HIV, HCV, HBsAg) and PT-INR. The data gathered was then subjected to statistical evaluation by SPSS version 20.0

software (IBM, Chicago) at significance level of $p < 0.05$.

RESULTS

We found that maximum 23.33% cases were aged 41-50yrs of age with mean age being 46.417 ± 18.04 yrs. We also observed male predominance (81.7%). Maximum 66.7% cases had BMI < 18.5 , with mean BMI being 18.58 ± 3.03 . Most of the patients (40%) were farmers by profession. 95% cases suffered from dyspnea and chest pain, followed by 83.3% cases having cough and 11.7% showed hemoptysis. 43.3% cases suffered from COPD, followed by 15% cases having PTB as co-morbidity. 36.7% cases reported past history of ATT, 11.7% cases had history pneumothorax and 55% cases were smokers. 93.3% cases were diagnosed as Secondary sponataneous pneumothorax, whereas 6.7% had primary sponataneous pneumothorax. 60% cases showed involvement of right side, followed by 38.3% cases had involved left side and 1.7% had bilateral involvement. 46.7% showed COPD as etiological factor, followed by 40% with PTB. [Table 1] On CT examination, most of the cases (48.33%) showed emphysema, followed by 28.3% showing consolidation, 21.66% with cavitation. [Table 2] 95% cases were managed using ICTD insertion, 1.7% were given oxygen supplementation and 3.3% were kept only on observation. [Table 3] Treatment outcome revealed: 81.7% cases showed complete lung expansion, 10% revealed partial lung expansion with BPF formation and 3.3% showed trapped lung. 5% cases died in our study. [Table 4] Mean time of resolution was observed to be 11.2 days. [Table 5] 60% cases showed no complications, but 18.3% cases had surgical emphysema, 10% showed BPF formation and 5% each had recurrent pneumothorax, secondary infection and self removal; and 1.7% had hematoma formation. [Table 6]

Table 1: Distribution of study subjects according to Etiology

Etiology	Frequency (n)	Percentage (%)
Bronchiectasis	1	1.7
COPD	28	46.7
DPLD	3	5
Fungal cavity (Aspergilloma)	3	5
Malignant	1	1.7
Primary	4	6.7
PTB	24	40
Ruptured liver abscess	2	3.3
Total	60	100.0

Table 2: Distribution of study subjects according to findings of CT thorax

CT thorax	Frequency (n)	Percentage (%)
Emphysema	29	48.33
Consolidation	17	28.33
Cavitation	13	21.66
Tree in bud	11	18.33
Bronchiectasis	4	6.66
Apical blebs	2	3.33
Lung mass	1	1.66

Table 3: Distribution of study subjects according to Treatment modality

Treatment modality	Frequency (n)	Percentage (%)
ICTD insertion	57	95
Observation	2	3.3
Observation with O2 supplementation	1	1.7
Total	60	100.0

Table 4: Distribution of study subjects according to Result

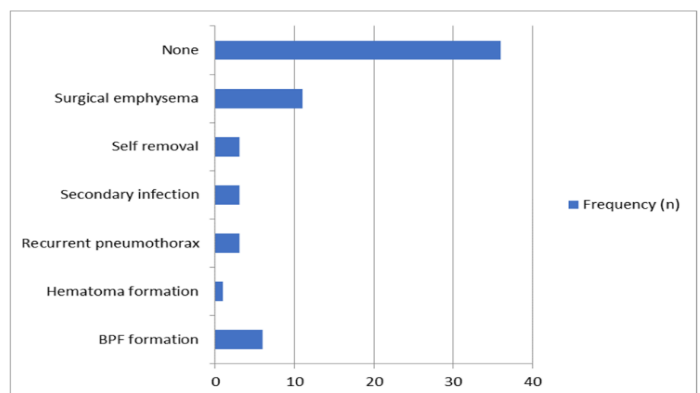
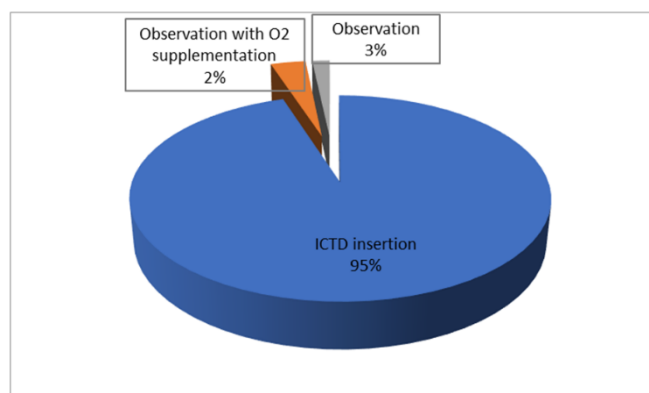
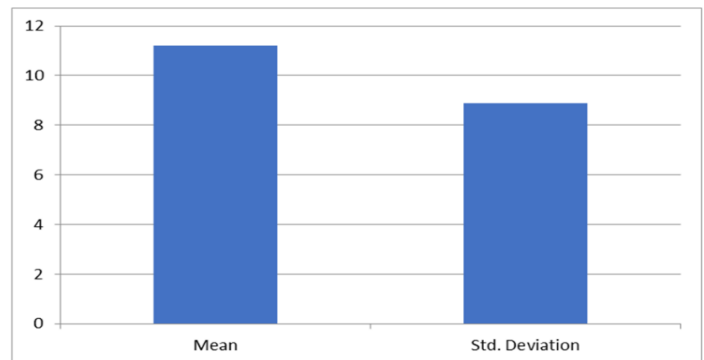
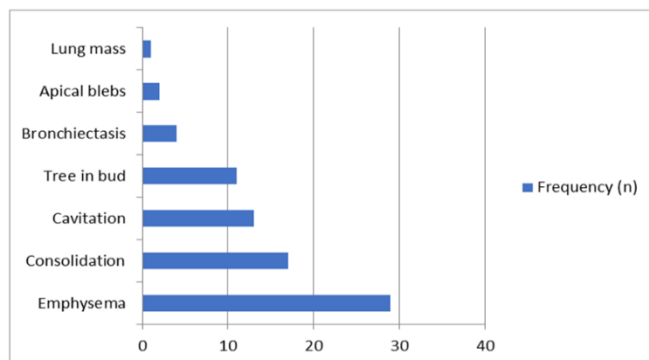
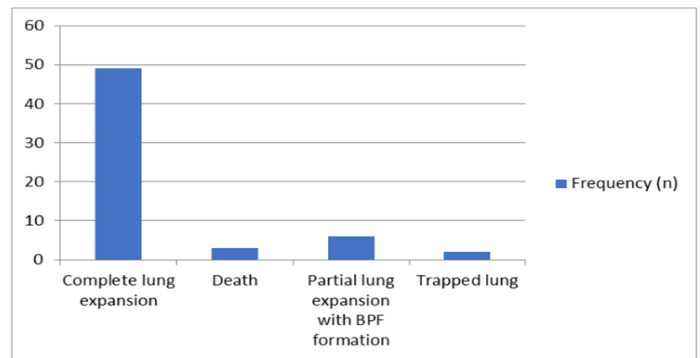
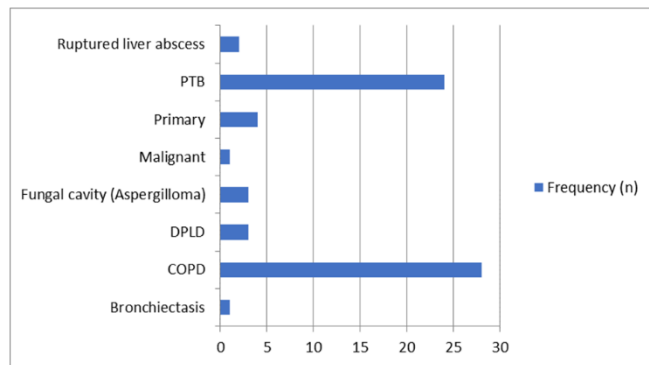
Result	Frequency (n)	Percentage (%)
Complete lung expansion	49	81.7
Death	3	5
Partial lung expansion with BPF formation	6	10
Trapped lung	2	3.3
Total	60	100.0

Table 5: Mean Time of resolution

Time of resolution (days)	Minimum	Maximum	Mean	Std. Deviation
	3	46	11.20	8.899

Table 6: Distribution of study subjects according to Complications

Complication	Frequency (n)	Percentage (%)
BPF formation	6	10.0
Hematoma formation	1	1.7
Recurrent pneumothorax	3	5.0
Secondary infection	3	5.0
Self removal	3	5.0
Surgical emphysema	11	18.3
None	36	60



DISCUSSION

With a peak occurrence in the early twenties, PSP usually affects adults between the ages of 20 and 30 who are otherwise healthy and do not have underlying lung illness. Conversely, people with underlying lung conditions are more likely to get SSP. Sharp unilateral chest discomfort that is constant and made worse by deep breath and postural changes is the most typical way that spontaneous pneumothorax presents itself. Additionally, the patient may exhibit dyspnea, or occasionally both. Any patient with COPD who experiences increasing dyspnea should be evaluated for the possibility of pneumothorax, especially if they also have chest pain. A physical examination and chest radiograph can accurately diagnose the majority of pneumothoraces, while a chest CT scan may occasionally be necessary.^[8,9]

Likewise our research, Joshi P et al,^[10] found that 44% cases were aged 30-50yrs and 92% were males. Rauf-UI-Hassan M et al,^[11] observed “a biphasic pattern” showing the occurrence of first peak at 20-30 yrs (PSP cases) and then second peak at 40-50 yrs (SSP cases). They found male preponderance (73.3%). Gupta D et al,^[3] also depicted M:F ratio of 2.7:1. Greater smoking rates, body behaviours, and distinct lung mechanical characteristics have all been linked to this higher prevalence in men.^[12] As in our research, Joshi P et al.10 found that the most prevalent symptom was chest pain with PT (90.0%), followed by breathlessness (84.0%), cough (74.0%) and hemoptysis (12%). In study by Rauf-UI-Hassan M et al,^[11] 93% cases had dyspnea as their most prevalent manifestation, whereas 83% had chest discomfort. Likewise our research, Joshi P et al,^[10] found that 15.6% cases of PT were because of smear positive PTB; 53.1% cases suffered with COPD including emphysema causing secondary PT. In study by Rauf-UI-Hassan M et al,^[11] the most prevalent aetiology was PTB (44%), 36% of COPD, 10% of pyogenic infections, 4% lung illnesses with HIV. As in our research, Joshi P et al,^[10] found that 60% cases were smokers. In study by Gupta D et al,^[3] 52.0% smokers had a greater incidence of PT.

In our study, on HRCT examination, most of the cases (48.33%) showed emphysema, followed by 28.3% showing consolidation, 21.66% with cavitation. Dhua A et al,^[13] showed that the most frequent results (70%) on the HRCT thorax were blebs and bullae, which were typically bilateral. These results were comparable to those of Granke et al,^[14] study. In present study, 95% cases were managed using ICTD insertion, 1.7% was given oxygen supplementation and 3.3% were kept only on observation. In study of Joshi P et al,^[10] it was found that ICD had a successful outcome in 94.6% cases. Rate of success of ICD insertion was 90%, 62.9%, and 68% in studies by Gupta D et al,^[3] Faruqi S et al. and Parlak M et al respectively.^[15,16]

We found that 81.7% cases showed complete lung expansion, 10% revealed partial lung expansion with BPF formation and 3.3% showed trapped lung. 5% cases died in our study. Likewise Patil SV et al,^[17] found that with an intervention of the proper line of care, 48% of cases had full lung expansion and 32% had partial lung expansion. In study

by Sharma A et al,^[18] 82.25% were treated with tube thoracostomy; in 4.28% sclerosing agent for pleurodesis was tried. In 2.85% cases, an open thoracostomy was performed together with mechanical pleural abrasion and bullae excision. Simple aspiration was used to address the remaining 5.71% and conservatively 4.28%. We found that mean time of resolution was 11.2 days. 60% cases showed no complications, but 18.3% cases had surgical emphysema; 10% showed BPF formation; 5% each had recurrent pneumothorax, secondary infection and self removal; and 1.7% had hematoma formation. As in our research, Sharma A et al,^[18] found that uncomplicated pneumothorax resolution seen in 10 days.

Although we conducted a thorough research, still we encountered few limitations as study was carried on a limited sample size, thus future studies are recommended to be carried on a larger sample. This research is dependent on the outcomes taken from a single centre, so the results could not be applied to whole Indian population. Our suggestion is to do more number of prospective research studies involving elaborated population of India, so as to generalise the study results.

CONCLUSION

Spontaneous pneumothorax, particularly SSP, remains a significant health concern in India, with COPD and PTB as major contributors. ICTD insertion is an effective management strategy, with good overall outcomes. Preventive strategies targeting smoking cessation and tuberculosis control are vital.

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Conflicts of interest

There are no conflicts of interest.

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