

## Clinical profile, diagnosis and outcome of patients of Pneumothorax and Hydropneumothorax: Observational study

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### Abstract

**Introduction:** Pneumothorax and hydropneumothorax are among two important clinical conditions that come across in pulmonary medicine. Data regarding the clinical profile, diagnosis, and outcome of pneumothorax and hydropneumothorax are limited. This study was done to know more about these two important respiratory entities. **Aim:** To describe clinical profile, diagnosis with reference to pathology, and outcome of hydropneumothorax/pneumothorax. **Materials and Methods:** It was a hospital-based prospective observational study. The patients included were the diagnosed cases of pneumothorax and hydropneumothorax during the period June 2016 to November 2018. Clinical symptoms and a thorough clinical history were asked, followed by a detailed clinical examination. Chest X-rays were done for confirmation of clinical diagnosis. Whenever applicable, blood, sputum, and pleural fluid investigations were advised. As a treatment, an Intercostal Drainage (ICD) tube was inserted and kept until the clinical and radiological recovery of the patient. **Results:** Hundred patients were studied. Most of the patients presented with breathlessness, cough, chest pain, loss of appetite, and fever. About 92% of patients with pneumothorax had breathlessness, while about 94% of pneumothorax had breathlessness. About 43% of cases of pneumothorax and 65% of cases of hydropneumothorax were due to tuberculosis. We inserted an ICD tube in all the patients. The mean duration of the requirement of an ICD tube was 11.08 days (SD=8.60) in cases of pneumothorax and 18.6 days (SD=10.16) in cases of hydropneumothorax. **Conclusion:** The most common clinical feature is breathlessness. Tuberculosis was the most common etiology. ICD was required for a longer duration of time for hydropneumothorax compared to that for pneumothorax.

**Keywords:** Pneumothorax, Hydropneumothorax, Tuberculosis, Intercostal drainage

### Introduction

“Abnormal presence of air in the pleural cavity is called as pneumothorax” while “in hydropneumothorax there is abnormal presence of air as well as fluid in the pleural space”. During a whole respiratory cycle, the usual pleural pressure is negative with regard to both alveolar and atmospheric pressure<sup>(1)</sup>. In tuberculosis, the pathophysiological progression of the disease process leads to cavity formation, which eventually ruptures and releases fluid and/or air that accumulates in the pleural cavity. Equilibrium between the production and absorption of fluid/air in the pleural cavity is also disturbed, leading to various clinical features<sup>(2)</sup>.

Pneumothorax may be primary or secondary spontaneous pneumothorax. The patients having primary spontaneous pneumothorax usually present with symptoms of breathlessness and chest pain. Upon respiratory system examination, the ipsilateral side with pneumothorax is larger compared to the contralateral side. During the respiratory cycle, the ipsilateral side moves less. There is the absence of tactile vocal fremitus, percussion notes are hyper-resonant,

and the breath sounds are either absent or drastically minimized on the pathological side. The trachea usually shifts toward the contralateral side. With right-sided pneumothoraxes, the lower edge of the liver may be shifted inferiorly. The 'Coin Test' or 'Scratch Test' is sometimes useful for diagnosis. Usually, in secondary spontaneous pneumothorax, the clinical features are more severe compared to those associated with primary spontaneous pneumothorax. Almost all patients having secondary spontaneous pneumothorax present with breathlessness disproportionate to the size of the pneumothorax<sup>(3)</sup>.

In hydropneumothorax, symptoms are similar to secondary spontaneous pneumothorax. Clinical signs include a tracheal shift to the opposite side, in ipsilateral side fullness of chest, reduced chest movements, hyper-resonant followed by dull note, shifting dullness, succussion splash, amphoric bronchial breath sounds, and reduced breath sounds can be appreciated<sup>(4)</sup>. Intercostal drainage (ICD) tube insertion is the definite treatment for both pneumothorax and hydropneumothorax. Refractory cases may sometimes require surgical interventions.

This study was done to know more about these two important respiratory entities. The objective of this study was to describe clinical profile, diagnosis with reference to pathology, and outcome of hydropneumothorax /pneumothorax.

### Materials and Methods

This study was a prospective observational hospital-based study. Patients attending the Respiratory Medicine department from June 2016 to November 2018, with age more than 13 years clinically diagnosed and radiologically confirmed cases of pneumothorax and hydropneumothorax were included in this study. Pneumothorax and hydropneumothorax cases developed secondary to traumatic conditions were excluded.

The patients were asked regarding clinical symptoms, Clinical history regarding comorbidities, Past history regarding any immuno-compromised status and Tuberculosis (TB). Then, a thorough clinical examination was performed. We carried out initial investigations like complete hemogram, serum proteins, serum lactate dehydrogenase, random blood sugar, chest x-ray, and sputum examination such as gram stain, Ziehl-Neelsen (ZN) stain, and KOH mount of all patients. The pleural fluid examination was done, especially in the cases of hydropneumothorax, for the diagnosis of underlying etiologies.

As a treatment, an ICD tube was inserted in all the patients just below the axilla at the safe triangle. Depending on the etiological diagnosis, medical treatment was also given. The patients were reviewed for ICD status and subsequent radiological changes during the treatment. Depending on the expansion of lung areas, absence of draining of pleural fluid, and air leak, the decision of ICD removal was taken. The criterion of ICD removal was less than 50ml pleural fluid collection for at least three successive days.

The data was collected and processed in a Microsoft Excel sheet and Statistical Package for Social Sciences (SPSS).

### Results

#### Pneumothorax

In our study, 49 patients with pneumothorax were included. The mean age of presentation was 42.79 years (SD=17.93). A

maximum number of 18 patients were distributed in the age group of 13-30 years. Pneumothorax was found to be higher in males (75.51%) than in females (24.49%). Breathlessness was seen in 45 patients (91.84%), followed by cough in 41 patients (83.67%), chest pain in 40 patients (81.63%), loss of appetite in 19 patients (38.78%) and fever in 17 patients (34.69%) (Refer Table 1). Past history of tuberculosis was present in 7 patients (14.29%). About 40% of patients (19) were addicted to tobacco smoking. About 30% of patients (15) had hypotension at presentation, 30 patients (61.22%) had tachycardia, and tachypnoea was present in 31 patients (63.27%) of pneumothorax. Anaemia was noted in 19 patients (38.78%), Leucocytosis was noted in 22 patients (44.90%), and hypo-proteinemia was present only in five patients (10.20%). All the patients were treated with an ICD. The pneumothorax was resolved in 87% of patients within 15 days. Out of the remaining 6 patients, five patients showed resolution within the next 15 days. Only one patient required an ICD for more than one month.

#### Hydropneumothorax

The total number of patients included was 51. The mean age of the included patients was 37.78 years (SD=18.290). Gender-wise, hydropneumothorax was found to be higher in males (71.55 %) than in females. The commonest symptom was breathlessness seen in 48 patients (94.12%), while cough was present in 47 patients (92.16%), fever in 44 patients (86.27%), chest pain in 38 patients (74.51%), loss of appetite in 40 patients (78.43%). Pulmonary tuberculosis as a past history was present in 12 (23.53%) patients (Refer Table 1). Smoking addiction was noted in 21 (41.18%) patients. Tachypnea was noted in 35 (68.63%) patients, and tachycardia was noted in 25 (49.02%) patients. Patients with anemia were noted in 31 patients (60.78%), and patients with hypoproteinemia were present in 10 patients (19.61%). Eight patients i.e., 15.69% of the patients were sputum positive by ZN staining. On applying Lights criteria<sup>(9)</sup> there was exudative pleural effusion in all the cases. Lymphocyte predominance was noted in 64.71% of patients. After insertion of the ICD tube, 9.8% of patients showed complete improvement by one week. About 80% of patients showed complete improvement by 30 days. The rest of the patients improved after 30 days.

**Table 1: Presenting symptoms of Pneumothorax and Hydropneumothorax patients**

Symptoms	Pneumothorax n (%)	Hydropneumothorax n (%)
Breathlessness	45 (91.84)	48 (94.12)
Cough	41 (83.67)	47 (92.16)
Chest pain	40 (81.63)	38 (74.51)
Loss of appetite	19 (38.78)	40 (78.43)
Fever	17 (34.69)	44 (86.27)

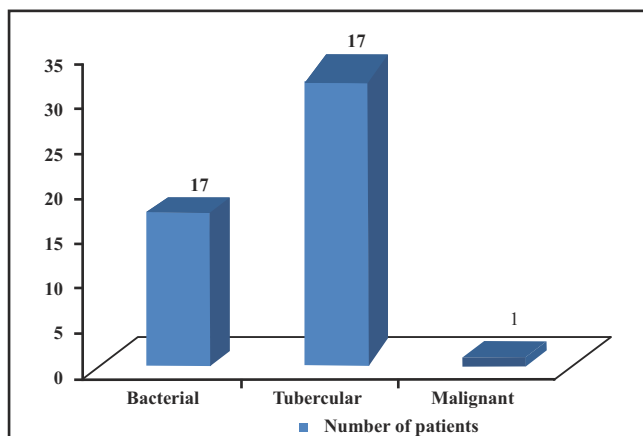


Figure 1: Etiological profile of Hydropneumothorax

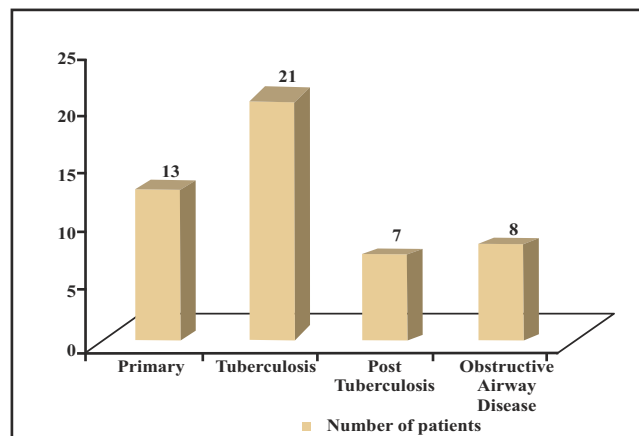


Figure 2: Etiological Profile of Pneumothorax

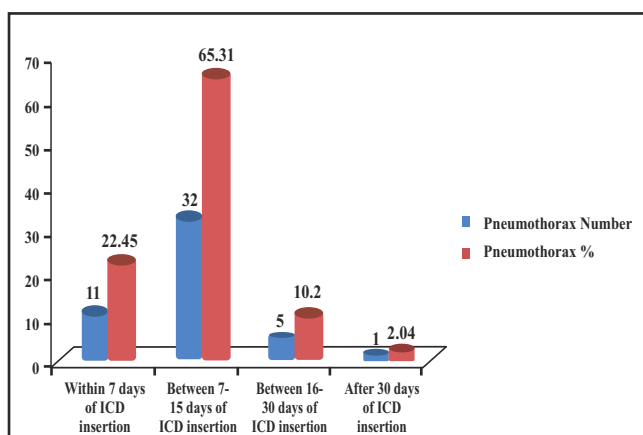


Figure 3: Outcome of Pneumothorax as per duration

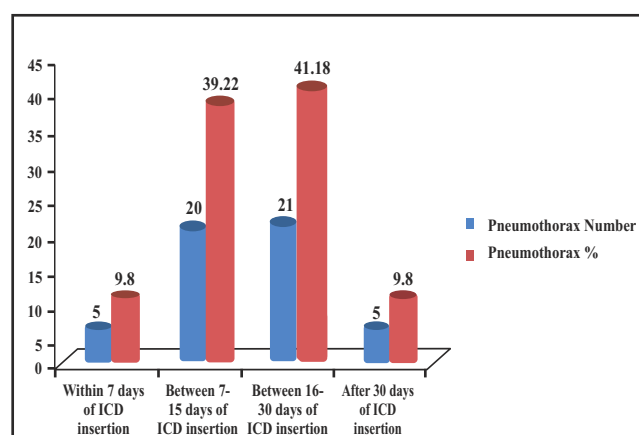


Figure 4: Outcome of Hydropneumothorax as per duration

## Discussion

### Pneumothorax

In our study, the mean age of presentation was 42.79 years $\pm$ 17.93 years. A maximum number of 18 patients were distributed in the age group of 13-30 years. This correlates with an Indian study by Gupta et al.<sup>(6)</sup> in which the mean age of presentation was 34.5 years. In our study, pneumothorax was found to be higher in males that was similar to a study in Pakistan among clinical symptoms. In our study, it was noted that breathlessness was present in 45 (91.84%) patients, followed by cough in 41 patients (83.67%), chest pain seen in 40 patients (81.63%). The findings are in concordance with the other studies<sup>(6,7)</sup>. Thus, we can conclude that in patients presenting with breathlessness, chest pain, and cough, in the large majority of patients, pneumothorax should be a differential diagnosis. Past history of tuberculosis was present in 7 patients (14.29%). According to a Spanish study<sup>(8)</sup>, out of 872 patients treated for Spontaneous pneumothorax, 47 (5.4%) had TB antecedents. This being a Western study where the prevalence of tuberculosis is lower and tuberculosis as a cause for spontaneous pneumothorax is

lower, too, could explain a lesser number of patients having a past history of tuberculosis.

India has a large number of patients with tuberculosis and its complications in active and inactive forms. Tobacco smoking constitutes a high-risk factor for contracting pneumothorax to the tune of nine-fold among females and 22-fold among males. The risk is proportional to the quantum of tobacco smoking. In our study, smoking addiction was present in 19 patients (38.78%). In a study by Gupta et al.<sup>(6)</sup>, nearly 50% of patients were smokers. When severe respiratory symptoms are associated with tachycardia, tachypnea, and hypotension (signs of cardiorespiratory distress), the possibility of tension pneumothorax must always be kept in mind. In our study, 15 patients (30.61%) had hypotension at presentation, 30 patients (61.22%) had tachycardia, and 31 patients (63.27%) with pneumothorax had tachypnea. Anemia was noted in 19 patients (38.78%) in our study. The higher prevalence was probably due to the presence of tuberculosis-associated anemia of chronic diseases<sup>(9)</sup>, lower economic status, and malnutrition in our patients. Leucocytosis was noted in 22 patients (44.90%), and hypoproteinemia was present only in 5 patients (10.20%).

According to Western literature, Chronic Obstructive Pulmonary Disease (COPD) was the most common etiology for secondary spontaneous pneumothorax. However, in an Indian study by Gupta et al.<sup>(6)</sup>, tuberculosis was the most common cause, accounting for 42% of the cases. Similarly, Tuberculosis was most frequent in our study, accounting for 42.6% of the cases. Tuberculosis was the most common cause in Pakistani study as well<sup>(7)</sup>. This is probably an impact of epidemiology, with tuberculosis being common in India and Asian countries.

All the patients were treated with an intercostal drainage tube. Chee et al.<sup>(8)</sup> showed that when treated by tube drainage, 100% of primary pneumothoraces with a persistent air leak for more than seven days had resolved within two weeks. Even among secondary pneumothoraces with a persistent air leak, 79% were resolved within two weeks. No patient died from either group. This finding correlates with our study, in which 87% of the pneumothorax patients showed resolution within 15 days. Out of the remaining 6 patients, 5 patients showed resolution within the next 15 days. Only one patient required an ICD for more than one month. No mortality was present in our study, too.

#### Hydropneumothorax

The mean age of the patients in the present study was 37.78 years (SD =18.29), and the majority of them were males (71.55 %). This compares with an Indian study by Kasargod et al.<sup>(9)</sup> in which the mean age of the patients was 44.2 years (SD=16.3), and 80.7% of patients were males. Our study is in concordance with yet another Indian study by Singh et al.<sup>(12)</sup> where the mean age of the patients was 34.17 (SD=11.6), and 75% of patients were males. Among clinical features, breathlessness was present in 48 patients (94.12%). Cough was noted in 47 patients (92.16%). Fever was present in 44 patients (86.27%), chest pain was present in 38 patients (74.51%). These findings are similar to the Indian study carried out by Kasargod et al.<sup>(9)</sup>, in which breathlessness was noted in 94.7% of patients, followed by cough in 93%, fever in 87.7% of patients, and chest pain in 71.9% of patients. The study done by Singh et al.<sup>(12)</sup> also reported a similar clinical presentation of breathlessness in 96.2% of patients, cough in 94.2%, and fever in 90.3% of patients.

Pulmonary tuberculosis as a past history was noted in 12 patients (23.53%). Addition to smoking addiction was seen in 21 patients (41.18%). This correlated with a study by Kasargod et al.<sup>(9)</sup> in which a past history of TB was present in 31.6% of patients, and smoking addiction was present in 36.8% of patients. It was noted that 25 patients (49.02) had

tachycardia, and tachypnea was present in 35 patients (68.63%) of hydropneumothorax. Similar findings were obtained in the study conducted in Mumbai<sup>(11)</sup>, in which 49.1% of patients also had tachycardia and 68.4% had tachypnea. In our study, it was noted that anemia was noted in 31 patients (60.78%), and hypoproteinemia was present in 10 patients (19.61%). The higher prevalence was probably due to the presence of tuberculosis-associated anemia of chronic diseases, lower socio-economic status, and malnutrition in our patients. The findings are similar to the study conducted in Mumbai<sup>(11)</sup> in which pulmonary tuberculosis as a past history was noted in 31.6% of patients, and smoking addiction was seen in 36.8% of patients. In our study, 25 patients (49.02%) had tachycardia, and 35 patients (68.63%) had tachypnea.

In our study, it was noted that Sputum examination for acid bacilli by ZN staining was positive in 8 patients, which was 15.69% of the patients. This correlated with a study done by Kasargod et al.<sup>(9)</sup> in which 17.5% of patients had sputum smear Acid-Fast Bacillus (AFB) positive. On applying Lights criteria<sup>(5)</sup>, all the patients had exudative effusion. In the present study, the differential count of pleural fluid showed lymphocytes as the predominant (64.71%). In the study from Mumbai, a slightly higher proportion of lymphocytes (72%) was observed in the pleural fluid differential count by the investigators<sup>(11)</sup>.

ICD was inserted in all patients. About 10% of patients showed complete improvement by one week. About 80% of patients showed complete improvement by 30 days. The rest of the patients improved after 30 days. Overall, the time for ICD removal is much longer in hydropneumothorax than in pneumothorax, as shown earlier in our study. This compares with a study done by Kasargod et al.<sup>(9)</sup>.

Cartridge-based Nucleic Acid Amplification Testing (CBNAAT) and Adenosine Deaminase (ADA) testing has been introduced in National TB Elimination Program guidelines since 2016. However, these tests were not included in the diagnostic procedures where the present study was conducted. Also, a Computed Tomography (CT) scan of the thorax was not performed on the patients due to economic issues. The use of these tests might have provided more details about the etiology and quicker diagnosis of the conditions.

#### Summary and Conclusion

Patients' main clinical features are breathlessness, cough, and chest pain. Along with those clinical signs such as tachypnea, tachycardia, etc., indicative of cardiorespiratory distress

points towards diagnosis. Thus, an initial comprehensive examination with a Chest X-ray is a helpful diagnostic modality. For the etiological diagnosis of hydropneumothorax, microbiological and biochemical examinations were of paramount importance. TB continues to be an important cause of pneumothorax and hydropneumothorax. ICD insertion remains the management of both hydropneumothorax and pneumothorax, along with a cover of antimicrobial chemotherapy. ICD is needed to be in situ for a longer duration in hydropneumothorax patients than in pneumothorax.

**Conflict of Interest:** Nil

**Source of Support:** Nil

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#### Ethical consideration

Institutional ethical committee clearance was obtained. Eligible cases were explained regarding this study, and consent was taken.

#### Authors' Contribution

MS: Data Collection, Implementation, Data analysis, interpretation and manuscript writing, SB: Design, Conceptualization, Data analysis, interpretation

#### Data availability statement

Data will be available with corresponding author on request.

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