Clinicoradiological Profile of Patients with Hydropneumothorax: A Prospective Study of a Hospital Population in Northern India

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Abstract

Background: Hydropneumothorax is defined as the presence of air and liquid (pus, fluid, or blood) in the pleural cavity, and it carries significant morbidity. **Aim:** The aim of the study was to explore the demographic and clinical-radiological characteristics of patients with hydropneumothorax. **Patients and Methods:** This study was conducted in the tertiary care center of northern India. Patients diagnosed with hydropneumothorax between January 2017 and December 2019 were included in the study. Sociodemographic characteristics, causes, symptoms and signs, and X-ray findings were collected and analyzed prospectively. **Results:** Fifty-two patients with hydropneumothorax were included in the study, 39 of whom were male. The mean age of patients was 34.17 ± 11.6 years. Dyspnea and cough were the most common findings in 50 (96.2%) and 49 (94.2%) patients, respectively. Fever was seen in 47 (90.3%), chest pain in 48 (92.3%), weight loss and loss of appetite in 30 (57.7%) patients, and hemoptysis in 11 (21.2%) patients. Cavitation was the most common chest X-ray finding seen in 34 (65.4%) cases. Tuberculosis (61.5%) was the most common cause of hydropneumothorax. For the management of hydropneumothorax, an underwater intercostal tube drain (ICD) was inserted in all the patients. The mean duration of intercostal drainage (ICD) in 51 patients was 21.3 ± 10.6 days. **Conclusion:** Patients of hydropneumothorax presenting with symptoms of respiratory distress required a prolonged period of chest tube drainage and usually showed a good response to the treatment.

Keywords: Dyspnea, hydropneumothorax, intercostal tube drain, tuberculosis

INTRODUCTION

The abnormal presence of air and liquid (pus, fluid, or blood) in the pleural cavity is known as hydropneumothorax. On the erect chest X-ray, it appears as radiodense lower pleural space, radiolucent upper pleural space, and air/fluid level at their interface.^[1] This may be associated with the primary benign infection and may/may not have associated parenchymal involvement. It has been reported secondary to thoracentesis, thoracic trauma, esophagopleural fistula, or bronchopleural fistula.^[2] Although the diagnosis is confirmed radiologically, clinically, it may be suspected by demonstrating succussion splash, immediate shifting dullness, straight-line dullness, and coin test.^[3,4]

There has been tremendous advancement in the diagnosis and management of pleural diseases, but still, there is limited literature on hydropneumothorax. Therefore, our study was aimed to explore the signs and symptoms, causes, and management of patients with hydropneumothorax.

PATIENTS AND METHODS

This prospective and descriptive study was done at the department of respiratory medicine, a tertiary care teaching hospital in northern India between January 2017 and December 2019. Ethical clearance was approved by the institutional ethical committee. All patients ≥ 12 years old with a diagnosis of hydropneumothorax were included in the study. Patients with traumatic or iatrogenic hydropneumothorax were also excluded from the study.

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Particulars of the patients were recorded in full. A detailed record of the presenting symptoms such as fever, cough, weight loss, loss of appetite, and hemoptysis was made. History of contact with tubercular patients was also recorded. The history of tuberculosis treatment by the patient was noted. Modified Prasad classification was used to assess the economic status of the patients.^[5] A chest X-ray (posterior-anterior view) was obtained to assess the pulmonary involvement in all the patients of hydropneumothorax. Directly observed treatment short-course, according to the Revised National Tuberculosis Control Program for India^[6] was used for the treatment of drug-sensitive tuberculosis.

In all cases, straight-line dullness, immediate shifting dullness, coin test, and succussion splash were noted.^[3,7] The examination was done in a sitting or standing position. For the shifting dullness, the patient was first examined in a sitting position and later was asked to lie supine. This examination was performed by two researchers (SKS and PY). In case of a discrepancy in findings, the cases were examined by the third researcher (KKT), and his findings were considered final.

Underwater sealed chest tube drainage was done under local anesthesia. The safe triangle was marked. The safe triangle is an area bordered by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major, and a line superior to the horizontal level of the nipple, with its apex toward the axilla. This is the site that coincides with the fifth or sixth space in the midaxillary line.^[8] The chest tube was removed when the affected lung became fully expanded with no air leak and daily intercostal tube drain (ICD) drainage of <100 mL.^[8]

Tuberculosis was confirmed by the presence of acid-fast bacilli (AFB) in the sputum by the Ziehl–Neelsen technique. A diagnosis of pulmonary tuberculosis was ruled out if the sputum for AFB was negative on two separate occasions, and the patients did not show a positive response to 2 to 3 weeks of an antibiotics course. They were further confirmed as a case of pulmonary tuberculosis if their clinical features improved with treatment with antitubercular drugs. Pleural fluid was also subjected to routine microscopy, biochemical analyses (proteins, glucose, and lactate dehydrogenase). Light's criteria were used to classify pleural fluid in exudate and transudate pleural effusion. Xpert MTB/RIF (Xpert) (Cepheid, Sunnyvale, CA) for *Mycobacterium tuberculosis* was also carried out in all cases. Culture and sensitivity test for *Mycobacterium* was not done because of its nonavailability.

Statistical analysis

All data were initially entered in Microsoft Excel 2016 (Microsoft Corporation, Microsoft Excel [Internet]. 2016. Available from: <https://office.microsoft.com/excel>) and later analyzed using the same software. Mean, standard deviation, and frequency (percentage) were used to describe the results of this descriptive study.

RESULTS

Fifty-two patients diagnosed with hydropneumothorax were included in this study. The mean age of the patients was 34.17 ± 11.6 years. Thirty-nine (75%) patients were male [Table 1]. Breathlessness and cough were the most common presenting feature seen in 50 (96.2%) and 49 (94.2%) patients, respectively. Fever was seen in 47 (90.3%), chest pain in 48 (92.3%), weight loss and loss of appetite in 30 (57.7%) patients, and hemoptysis in 11 (21.2%) patients. History of antitubercular treatment was present in 20 (38.5%) patients. Twenty-five (48.1%) patients gave a history of contact with tuberculosis patients. Hypertension, diabetes mellitus, and breast carcinoma were present as a comorbidity in 7 (13.46%), 4 (7.8%), and 1 (1.9%) patients, respectively.

Shifting dullness, coin test, and straight-line dullness were demonstrable in all patients. However, a succussion splash was demonstrable in 45 (86.5%) patients only. Sputum for AFB was positive in 17 (32.7%) patients. Sputum Xpert MTB/RIF was positive in 26 (50%) patients, and among them, 3 (5.8%) were found to be resistant to rifampicin. Pleural fluid Xpert TB was positive in 9 (17.3%) patients. All the patients were found to have exudative pleural effusion by Light's criteria. Pleural fluid biochemistry showed protein of 4 ± 0.4 g/dl and glucose of 79 ± 20.7 g/dl. Pleural fluid cytology was acute inflammatory

Table 1: Sociodemographic characteristics of patients

Parameter	n (%)
Age (years)	
12-29	22 (42.3)
30-49	21 (40.4)
>50	9 (17.3)
Sex	
Male	39 (75)
Female	13 (25)
Modified Prasad classification	
Class 1	0 (0)
Class 2	9 (17.3)
Class 3	10 (19.2)
Class 4	14 (26.9)
Class 5	19 (36.5)
Educational status	
Illiterate	12 (23.1)
Primary	9 (17.3)
High school	5 (9.6)
Intermediate	12 (23.1)
Graduates	11 (21.2)
Postgraduate	3 (5.8)
Marital status	
Married	42 (80.8)
Unmarried	10 (19.2)
Smoking status	
Active smoker	27 (51.9)
Nonsmoker	25 (48.1)
History of contact with tubercular patients	25 (48.1)
History of antitubercular treatment in past	20 (38.5)

in 15 (28.9%), chronic inflammatory in 31 (59.6%), and malignant cells were detected in 6 (11.5%) patients.

Tuberculosis was the most common etiological diagnosis seen in 32 (61.5%) patients. Acute bacterial infection was found in 14 (26.9%) cases. In the rest of the cases, malignancy was the cause of hydropneumothorax [Table 2]. Adenocarcinoma of the lung was the cause of malignancy in five cases, whereas one case was diagnosed case of breast carcinoma.

The chest X-ray showed left-sided hydropneumothorax in 27 (51.9%) patients. Cavitation was the most common chest X-ray finding in 34 (65.4%) cases. Infiltration, consolidation, fibro-destructive lesion, mediastinal lymphadenopathy, and mass were the other chest X-ray findings seen in 27 (51.9%), 18 (34.6%), 16 (30.8%), 7 (13.5%), and 6 (11.6%) cases, respectively.

First-line antitubercular treatment was given to 28 (53.9%) tuberculosis patients. Antitubercular treatment for multidrug-resistant tuberculosis was given to 3 (5.8%) patients. Among the tubercular patients, 7 (13.5%) were receiving antitubercular treatment when they developed hydropneumothorax, while in 24 (46.2%) patients, antitubercular treatment was prescribed after a diagnosis of hydropneumothorax was made.

Hydropneumothorax cases were managed with ICD insertion. Bronchopleural fistula was seen in 23 (44.2%) cases. The mean duration of tube insertion was 21.3 ± 10.6 days in 51 patients. One patient of hydropneumothorax died during the treatment. All the malignant cases underwent talc pleurodesis for malignant pleural effusion. Fifty-one patients showed complete resolution after the intercostal tube insertion [Table 3]. Chest tube-related complications were seen in 9 (17.3%) cases. These

included subcutaneous emphysema (9.5%), dislodgment of the tube (3.9%), and surgical site infection (3.9%).

DISCUSSION

Hydropneumothorax is not an uncommon entity in Northern India. The mechanism of development of hydropneumothorax may be considered the combination of the mechanism of development of pleural effusion and pneumothorax. It can develop due to the rupture of the tuberculous cavity, due to the rupture of subpleural lung abscess, iatrogenic due to aspiration of fluid in pleural effusion, and due to superadded infection in the long-standing intercostal tube in pneumothorax. It may also develop due to penetrating chest injury. Other causes of hydropneumothorax include rupture of necrotic neoplastic tissue and necrotic tumor nodule within the pleural cavity, necrosis of the subpleural metastasis, and secondary infection due to obstruction by the tumor itself.^[9]

In our study, the most common cause of hydropneumothorax was tuberculosis (61.5%), followed by bacterial infection and malignancy. A study by Kasargod and Awad^[10] also found tuberculosis (81%) to be the most common cause of hydropneumothorax, followed by a bacterial infection (14%). The same study detected malignancy as the cause of hydropneumothorax in 3.5% of cases, but in this study, it was seen in 11.5% of cases. All malignancy types except for one were adenocarcinoma. In one case, the recurrence of breast carcinoma was the etiology for hydropneumothorax. Recurrence of breast carcinoma causing hydropneumothorax is rare but has been reported in the literature.^[11] Xpert MTB/RIF in pleural fluid showed positivity in 17% of the cases. It was similar to the study by Kasargod and Awad,^[10] who demonstrated AFB in 14% of cases. In this study, pleural fluid was not subjected to AFB examination. Instead, Xpert MTB/RIF was done, which is a more sensitive test.^[12]

Most of the patients in our study presented with complaints of breathlessness (96.2%) and cough (94.2%). The reason for that presentation is due to pleural involvement in hydropneumothorax, causing the collapse of the lung, leading to ventilation-perfusion mismatch.^[10] A similar study on hydropneumothorax also found breathlessness (95%) and cough (93%) as the main complaint in the majority of patients.^[10] Cough and breathlessness were also the most common presenting features in the study done by Shamaei *et al.*^[13] and Khan *et al.*^[14] although their studies were done on patients of pneumothorax. This emphasizes that patients with pleural involvement usually present with breathlessness and cough. However, Blanco-Perez *et al.*^[15] in their study on the patients of tubercular pneumothorax reported chest pain (90%), dyspnea (45%), cough (45%), and fever (36%) as the most frequently reported symptoms. In our study, fever, chest pain, and weight loss and loss of appetite were seen in 90.3%, 92.3%, and 30% of cases, respectively, probably because tuberculosis and bacterial infection were the main etiology causing the hydropneumothorax in our cases (89%).

Table 2: Causes of hydropneumothorax

Etiology	n (%)
Bacterial	14 (26.9)
Tuberculosis	32 (61.5)
Non-MDR	28 (53.9)
MDR	3 (5.8)
Old healed tuberculosis	1 (1.9)
Malignancy	6 (11.5)
Total	52 (100)

MDR: Multidrug resistant

Table 3: Duration of the requirement of intercostal drainage based on etiology

Etiology	Days
Bacterial	11.9±3.7
Tuberculosis	27.1±9.0
MDR	31.3±11.2
Non-MDR	26.2±8.7
Old healed tuberculosis	39
Malignancy	10.8±5.3

MDR: Multidrug resistant

During the auscultation of the chest in a patient of hydropneumothorax, sudden movement of the chest causes movement of the fluid producing a splashing sound known as the succussion splash (Hippocratic succussion splash).^[16] It is considered as one of the cardinal signs of hydropneumothorax. It is not specific for hydropneumothorax as it can be heard in any hollow viscus containing fluid. In the case of thorax, it can be heard in hydropneumothorax, fluid, and air present in a large cavity, and herniation of abdominal contents such as the stomach and large intestine in the left thorax because of eventration of diaphragm.^[17,18] Normally, the stomach can also produce succussion splash up to 2 h of ingestion of fluid and food. However, abnormally, it can be heard in pyloric obstruction, grossly dilated intestine due to advanced intestinal obstruction, and in paralytic ileus.^[17] In our study, it was not heard in 14% of cases only. The reason for nonelicitation of sound might be due to a lesser amount of fluid present in the pleural cavity along with a thick chest wall causing the nontransmission of sound to the stethoscope.

In our study, hydropneumothorax was more common on the left side. This was similar to other Indian studies, which showed left-sided spontaneous pneumothorax more common than right-sided ones.^[19,20]

ICD was inserted in all the cases, and the mean duration of ICD was 21.3 ± 10.6 days in 51 patients. Tuberculosis patients showed a longer duration of the requirement of ICD (27.1 ± 9.0 days) in comparison to the hydropneumothorax due to bacterial and malignant origin, which showed 11.9 ± 3.7 and 10.8 ± 5.3 days, respectively. The mean duration of ICD was 24.8 days (± 13.1) in the study done by Kasargod and Awad.^[10] Previous studies were done on tuberculosis-associated pneumothorax also found the longer duration of ICD drainage, and it is suitable to delay the surgery needed for persistent drainage from ICD.^[17] A study was done in the same institution on tuberculosis-associated pneumothorax found the mean duration of intercostal drainage was 17.14 ± 6.37 days (range: 6–32 days).^[21]

Limitations

A small sample size is the main limitation of this study. The data are not representative of the whole community as the study was conducted at one tertiary care center. The majority of the patients (35 out of 51) did not return for follow-up, and therefore, the recurrence rate could not be analyzed. However, none of the follow-up patients showed recurrence of hydropneumothorax.

CONCLUSION

Tuberculosis is the most common cause of hydropneumothorax. It can be the presenting feature of tuberculosis, and at times, it can develop during the antitubercular treatment. The mainstay of treatment for hydropneumothorax is the underwater seal intercostal drainage. Apart from this, antitubercular drugs for

the treatment of tuberculosis and antibiotics for the treatment of bacterial etiology should be given. Tuberculosis-associated hydropneumothorax requires a higher longer duration of hospital stay in comparison to nontubercular causes.

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Conflicts of interest

There are no conflicts of interest.

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