

Evaluation of Clinical Background and Yield of Chest Tube Thoracotomy in Hydro pneumothorax, A Pulmonologist Point of View

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ABSTRACT

Introduction: The enlightenment of Hydro-pneumothorax arrived in former times of primitive Greece. It is a term which explains simultaneous existence of both free air and fluid (i.e., pneumothorax and hydrothorax) in the pleural space. The goal was to contribute and update the knowledge of clinical aspect as well as yield of diagnostic modalities in handling the cases of Hydropneumothorax.

Materials and Methods: Diagnosed cases of hydropneumothorax from casualty and routine OPD are considered. Detail of clinical background entered. Patients were subjected for analysis of sputum, blood and pleural fluid. Radiological investigation was done. Patients underwent tube thoracotomy procedure and observed till resolution.

Results: Total 97 subjects had participated. Among them 76(78.35%) were men and 21 (21.64%) women. 91(93.85%) subjects had shortness of breath. 34 subjects (35.05%) had tuberculosis in the past. Sputum smear AFB was positive in 19 subjects (19.58%). Plural fluid GeneXpert MTB was detected in 11 subjects (11.34 %) and MGIT Culture positive in 23(23.71%) subjects. Plural fluid gram stain culture was conclusive in 24 (24.74%) subjects. Pleural fluid ADA was raised in 74 (76.28%) subjects. Hypoxemia was observed in 46 (47.42%). In 38 (39.19%) cases chest tube was removed between 31 to 60 days.

Conclusion: Tuberculosis turns up as the most common aetiology of hydropneumothorax and duration required for resolution is uncertain. Evaluation of pleural fluid (cytology, microbiological culture, biochemical measure) and Computed tomography were essential to reach aetiology of condition. Chest tube thoracotomy remains most practiced modality of treatment in hydropneumothorax. However advanced techniques have promising outcome and it's an opportunity to research further.

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Introduction

The enlightenment of Hydro-pneumothorax arrived in former times of primitive Greece. It is a term which explains simultaneous existence of both free air and fluid (i.e., pneumothorax and hydrothorax)

in the pleural space (1). Obstructive or cystic lung disease, pulmonary infection or infarction and few conditions of connective tissue diseases comprise etiology of hydropneumothorax. It can present as unfavorable outcome of dealing pleural

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ailments by invasive approach like pleural tapping, transbronchial biopsy or intercostal drainage (ICD) tube insertion. Some of the additional causes comprise of carcinoma, chest wall damage, and consequence of lung surgeries (pneumonectomy) (2-5). There are numerous literatures available throwing light on the topics related to plural pathologies like plural effusion, haemothorax, chylothorax and pneumothorax but somehow the hydro-pneumothorax has been sidelined by the national and international researchers. As very few articles have been published on this entity it was an excellent opportunity to work on this topic. The goal was to contribute and update the knowledge of clinical aspect as well as yield of diagnostic modalities in handling the cases of Hydropneumothorax.

Material and Methods

This was a prospective observational cohort study conducted at institute of a tertiary health care standard in north region of Maharashtra from 2016 to 2019. Approval from institutional ethics committee was obtained. Diagnosed cases of hydropneumothorax by clinical and radiological assessment attending emergency unit as well as OPD of pulmonary medicine were considered as study subjects. Patients who fit in the inclusion criteria were then explained about the study and valid consent taken for their participation.

Chest injury or trauma was excluded from study. Details of clinical background, comorbidities and examination findings entered. Laboratory investigations like complete blood count, random blood sugars, serum proteins and serum lactate dehydrogenase were done as well as sputum for acid fast bacilli by Z-N Stain. The Pleural fluid was sent for GeneXpert, pathological examination (Total and Differential cell count) and assessment of Biochemical parameters (proteins, glucose, cholesterol, lactate dehydrogenase, adenosine deaminase levels). Microbiological investigation such as Gram stain culture, Mycobacterium growth indicator tube (MGIT) culture were done.

High resolution CT thorax is done for all subjects to derive more details. Only one conclusive finding

was considered among the investigation to avoid duplication in segregating aetiology.

All the subjects underwent Inter Costal Drainage (ICD) tube insertion procedure as a part of treatment along with medical management. Negative suction through ICD tube was used in few indicated patients to meet expansion of lung. Chest tube was monitored for air leak and fluid drainage for 90 days.

Chest tube removed once the lung got expanded and air leak stopped completely. The needed duration (number of days) of chest tube was documented. Entire data was entered in Microsoft Excel then Continuous variables were expressed as Mean \pm SD whereas categorical variables were expressed in absolute numbers or percentage.

Results

Total 97 subjects of hydro-pneumothorax were part of this study, among them 76 (78.35%) were males and 21(21.64%) were females. The presenting symptomatology of subjects in our project was in following order; 91(93.85%) subjects had shortness of breath and 89 (91.75%) subjects had cough during the illness. Fever was mentioned by 68 (70.10 %) subjects while chest pain was experienced by 64 (65.97%) subjects. Haemoptysis was mentioned by 12 (12.37%) subjects and 69(71.13%) had loss of weight. Total 55 subjects (56.70%) had Smoking or Biomass exposure. Co-morbid conditions such as Diabetes was seen in 20 subjects (20.61%), Hypertension in 24 subjects (24.74%) and 34 subjects (35.05%) had earlier history of tuberculosis. Sputum smear for Acid fast bacilli was positive in 19 subjects (19.58%). The Gene Xpert of plural fluid came MTB detected in 11 subjects (11.34 %). Plural fluid gram stain culture was conclusive in 24 (24.74%) subjects, while MGIT culture showed positive growth in 23 (23.71%) subjects. Pathological assessment of plural fluid shows Lymphocyte prominence in 79 (81.44%) subjects and polymorphic prominence in 18 (18.55%) subjects. Biochemical parameters evaluation of pleural fluid showed mean value of protein which was 4.8g/dl and for glucose was 74.4 mg/dl. Pleural fluid ADA level were rose in 74 (76.28%) subjects.

Hypoxemia was observed in 46 (47.42%) subjects. In radiological examination by CT Thorax among 97 subjects, 19 (19.58%) had Bronchiectasis (post infection sequelae) and 17 (17.52%) had Emphysematous changes.

22 (22.68%) subjects showed consolidation and 8 (8.24%) had cavity lesion. 7(7.21%) had carcinoma lesion and 13 (13.40%) had post-operative (interventional) changes. 11(11.34 %) subjects had no abnormal changes.

The duration required to keep the chest tube till resolution of condition was divided in four groups (Table: 1). 31 (31.95%) cases needed it up to 30 days and in 38 (39.19%) cases chest tube was removed between 31 to 60 days. The aetiology of hydropneumothorax in all subjects was assess after detailed review of investigation reports. (Table. 2) Overall in 53 (54.63%) subjects the aetiology was tuberculosis, pyogenic bacterial infection (non-TB) was found in 24 (24.74%) subjects.

Table 1: Duration required to keep the chest tube till resolution of condition

No. of Days (From- To)	N	Percentage %
1 to 30	31	31.95
31 to 60	38	39.19
61 to 90	24	24.74
>90	4	4.12
Total	97	100

Table 2: Distribution of Aetiology of Hydro-pneumothorax

	N	Percentage %
Tuberculosis	53	54.63
Pyogenic Bacteria (Non-TB)	24	24.74
Post Intervention	13	13.40
Carcinoma (Metastasis/Localised)	7	7.22
Total	97	100

Majority of patients presents with sudden onset of shortness of breath, cough and unilateral pricking type of chest pain due to pleurisy. Hydropneumothorax could be complication of interventional procedure like pleural fluid tapping (thoracocentesis),

trans-bronchial lung biopsy, and wrong placement of central venous catheter. At times it is a sequelae to the operative surgeries of lung like decortication, lobectomy and pneumonectomy. An air fluid level is key finding in chest X ray and computed tomography can confirm the diagnosis of hydropneumothorax (6). It is treated by insertion of chest tube. The chest tube is inserted at a point where the fluid and air can be drained. A single tube is preferred very often however two different tubes can be inserted to drain air and fluid separately. Hypoxemia was detected in some of the patients which responded to oxygen therapy. Re-expansion pulmonary oedema is a fatal complication of chest tube procedure in hydropneumothorax, so it is suggested to perform the chest tube procedure in intensive care unit. We observed the Shortness of breath was most common symptom at the time of presentation i.e.

93.85%, this match up with the work by Ghare AP7. The Hypoxemia observed in 59.79 % subjects with concomitant breathing distress suggest mismatch in ventilation perfusion. Tuberculosis turns out as significant cause of hydropneumothorax in our study overall, in 54.63% cases the aetiology was mycobacterium tuberculosis (Sputum/Pleural fluid outcome). India bears higher number of cases of tuberculosis including pulmonary and extra pulmonary tuberculosis.

Rupture of tuberculous granuloma or cavity could lead to hydropneumothorax. Pleural involvement may present as effusion, pneumothorax and hydropneumothorax. In our study overall 24.74% cases had pyogenic bacterial infection and this was the 2nd common cause after tuberculosis, this correlates with the research work by Ghare AP (7). 13.40% cases developed hydropneumothorax due to intervention. Hydro pneumothorax occurring after thoracocentesis is an expected complication of procedure while it develops as a part of surgery like lobectomy and decortication. We utilized modern diagnostic technique like GeneXpert for detection of tuberculosis bacilli in plural fluid. Around 11.34% cases turned out positive in GeneXpert test.

This observation is close to the research done by Javed N et al (8) & Pravin KN et al (9) where it was 8% & 10.1% respectively. However, their research focused on assessment of pleural fluid by diagnostic techniques. We found 47.42% cases had hypoxemia which is a salient finding of study, although it is very common in pneumothorax.

In our study it might have developed due to underlying lung pathology like emphysema, bronchiectasis.

Pleural fluid ADA level was a valuable diagnostic tool in supporting diagnosis of pleural tuberculosis. In our study it rose in 76.28% cases among which 71% were confirmed as tuberculosis case. This matches with the research by Ghare AP7.

This supports that estimation of ADA level is more precise in diagnosing tuberculous aetiology of pleural fluid. We suggested to include it in the panel of standard investigations of pleural fluid (10).

We implemented Lights criteria on pleural fluid result of entire cases which showed all were exudative effusion. Lights criteria played a key role in differentiating between transudative and exudative effusion (11). Evaluation of biochemical parameters showed mean value of pleural fluid protein and glucose which were 4.8g/dl and 74.4mg/dl respectively which is close to the findings by Chakraborty A et al (12). Cytology examination of pleural fluid showed lymphocyte predominant in 81.44% cases although a few researchers had reported distinct findings such as 63% by Kushwaha R et al (13) and 97% by Chakraborty A (12) Out of 97 study subjects 23.71% cases had positive growth in MGIT culture of pleural fluid. This correlate with work by Goyal VK et al (14).

Although the Chest X-ray was good enough for diagnosis of hydropneumothorax, High resolution Computed tomography played a vital role in providing crucial details of lung parenchyma and pleura to find out aetiology of the condition. We recommend it as an essential investigation in cases of hydropneumothorax.

Entire cases were managed by chest tube insertion. Majority of cases i.e. 39 (39.19%), responded well and got their chest tube removed between 31 to 60 days. However, in

2013 a study by Kao JH et al (15) mentioned 57% of subject had their chest tube removed in range of 2 to 88 days which is quite a wide range of duration. Although his work was focused on pneumothorax and ours was hydropneumothorax, our findings had narrowed down the range of duration. We observed that patients of tuberculous aetiology needed varying duration to get chest tube removed and cases of malignancy needed chest tube for more than 90 days. To convince the patient and patient's kin was a difficult task as it was difficult for them to accept the fact that patient has to carry the chest tube even after discharge. Multiple counselling sessions and making the relative aware of the condition helped us in maintaining their compliance to treatment and follow-up. Few articles from developed countries recommended to opting for modern surgical intervention if resolution not achieved within 7 days (16). However, in our country these modern intervention techniques like video assisted thoracoscopic surgery and open chest surgeries are not options for many patients due to financial constraints. We need further research on outcome of these advanced techniques in managing hydropneumothorax.

Conclusion:

Tuberculosis turns up as most common aetiology of hydropneumothorax and duration required for resolution is uncertain. Evaluation of pleural fluid (cytology, microbiological culture, biochemical parameter) and Computed tomography were essential to reach aetiology of condition. Chest tube thoracotomy remains most practiced modality of treatment in hydropneumothorax. However advanced techniques have promising outcome and it's an opportunity to research further.

Conflict of interest: None

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