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A STUDY ON INTERCOSTAL CHEST TUBE IN PATIENTS WITH PNEUMOTHORAX IN A TERTIARY CARE CENTRE: A RETROSPECTIVE STUDY

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ABSTRACT **Background :** Pneumothorax is the accumulation of air within the pleural space, i.e within two layers of the pleura. It may occur spontaneously due to underlying lung pathology or due to trauma in various forms. Spontaneous pneumothorax is further classified into primary and secondary depending on the etiological findings. Intercostals water sealed drainage system, commonly known as chest tube, are designed to remove air or fluid from the pleural cavity which accumulates due to various etiologies and has been used for the management of pneumothorax for a long time. **Methods :** This is a retrospective observational study made on 50 patients who presented with pneumothorax due to various causes and were managed by chest tube drainage in a tertiary care hospital. Results and observations : Of 50 patients, 46 patients (92%) had successful outcome. However the p-value came out to be 0.64 (> 0.05), hence the role of chest tube in primary management of pneumothorax is ruled out. **Conclusion :** The initial management of pneumothorax is conservative with observation and needle aspiration. Chest tube drainage should be considered only when conservative measures fail and clinical and radiological parameters suggest deterioration, since the more invasive method as primary treatment causes more complications.

KEYWORDS : Chest tube, Primary spontaneous pneumothorax, Secondary spontaneous pneumothorax, Traumatic pneumothorax, Tube thoracostomy, Intercostal chest drain

INTRODUCTION

Chest tube placement (also called tube thoracostomy) is a common procedure in daily clinical practice which is performed to drain fluid, blood or air from the pleural cavity. It also serves as a route for instillation of antibiotics, sclerosing agents as well as fibrinolytics and saline. The most common indications for insertion of a intercostal chest drain are pneumothorax, complicated parapneumonic effusions, hemothorax, pyothorax besides pleurodesis and following cardiothoracic surgery or thoracoscopic procedure to allow for appropriate lung expansion[7]. Pneumothorax is the abnormal accumulation of air within the pleural space, i.e within two layers of the pleura. The term ' pneumothorax' was first coined by Itard and then Laennec in 1803 and 1819 respectively[6]. It may occur spontaneously or as a result of trauma, surgery, needle aspiration, central line insertion, increased pressure from mechanical ventilation, or lung diseases (e.g., COPD, cystic or pulmonary fibrosis) or other conditions[1].Spontaneous pneumothorax occurs when the visceral pleura ruptures without an external traumatic or iatrogenic cause. Spontaneous pneumothorax is divided into primary spontaneous pneumothorax (PSP) and secondary spontaneous pneumothorax (SSP). Pneumothorax can also occur following external trauma or iatrogenic injury such as insertion of a central line. Tension pneumothorax is when (independent of aetiology) there is a build-up of positive pressure within the hemithorax, to the extent that the lung is completely collapsed, the diaphragm is fattened, the mediastinum is distorted and, eventually, the venous return to the heart is compromised[2].Symptoms of pneumothorax mostly include pain and dyspnoea. Patients with spontaneous pneumothorax are usually tall and thin young men .

Diagnostic imaging includes CXR and occasionally CT [3]. Accurate diagnosis relies on physical examination and chest radiograph, though occasionally a chest CT might be needed, which is gold standard for occult pneumothorax[4] . The management of Pneumothorax varies among which intercostal tube drainage is one option. A pneumothorax of less than 2 cm is considered "small," whereas one of greater than 2 cm is considered "large." [5]

AIMS AND OBJECTIVES

1. To evaluate the role of chest tube in management of pneumothorax
2. To determine the proportion of various causes of pneumothorax requiring intervention by intercostal tube insertion.
3. To evaluate the outcome of intercostal tube drainage in different causes of pneumothorax

MATERIALS AND METHODS:

The study was carried out in the Department of General Surgery and Department of General Medicine, Tezpur Medical College and Hospital from 1st May 2022 to 31st October 2022. It is a hospital based retrospective observational study. Data was collected from Medical Records Department, Tezpur Medical College and Hospital. 50 patients admitted for various causes of pneumothorax in the Department of Surgery and Department of Medicine of both gender and aged 12 years and above were selected. Demographic, clinical, radiological and treatment data were collected and analyzed.

The data recorded included demographic details (age, gender, residence, occupation, smoking habits), history of co-morbidities, preexisting lung conditions, history of recurrence, anthropometric details [height, weight, body mass index (BMI)], clinical presentation, physical examination findings, and details of relevant investigations like chest radiograph, computed tomogrpahy (CT), sputum, viral markers (HIV, HBsAg, anti HCV), routine blood investigations, duration of hospital stay , and the treatment and clinical outcome details including recovery, duration of ICD kept in-situ , ICD insertion related complications , date of discharge and deaths . 50 patients above 12 years, radiologically and clinically diagnosed with pneumothorax was included in the study. Patients below the age of 12 years and patients with ICD due to clinically and radiologically detected hydrothorax, haemothorax , pyothorax, patients with severe respiratory failure or need for assisted ventilation, bilateral pneumothorax were excluded from this study

The patients were classified as having PSP if routine clinical and radiographic evaluation, as well as results of relevant additional investigations, failed to reveal any underlying pulmonary disease that could explain the occurrence of pneumothorax. All patients, in whom an underlying pulmonary disorder that could be linked to pneumothorax was detected by means of radiological investigations were classified as having SSP. Traumatic pneumothorax cases

included blunt and penetrating trauma to the chest and iatrogenic injury diagnosed clinically or radiologically who underwent chest tube decompression.

Successful outcome is defined by absence of signs and symptoms of pneumothorax and failure of recurrence at 3 months follow-up.

Demographic and outcome data were expressed as the means (±Sds), and dichotomous variables were reported as numbers (percentages). Qualitative data were compared using Fisher exact test, and quantitative data, using the unpaired Student t or the Mann-Whitney U test when appropriate. P < .05 was considered significant.

RESULTS AND OBSERVATION:

The present study was conducted at Department of General Surgery and Department of General Medicine in a tertiary care hospital at Tezpur over a period of 6 months. A total of 50 patients who underwent Intercostal tube drainage due to various etiologies of pneumothorax were evaluated and outcomes observed. Patients were followed up to enquire about the current health status in regards to their previous chest disease.

Demographic variable

Table 1 : Age distribution

Age (in years)	Primary Spontaneous pmeumothorax	Secondary Spontaneous pnemothorax	Traumatic pneumothorax	Total
12-30	4	2	10	16
31 -50	2	8	8	18
>50	-	14	2	16
Total	6	24	20	50

The mean age was 42.1 years SD ± 17.82; minimum age was 12 years and maximum age was 80 years. The most common age group was 31 – 50 years.

Table 2 : Gender distribution

Gender	Primary spontaneous pneumothorax	Secondary spontaneous pneumothorax	Traumatic pneumothorax	Total
Male	5	20	18	43
Female	1	4	2	7
Total	6	24	20	50

Male to female ratio in PSP, SSP and Traumatic pneumothorax was 5:1, 5: 1 and 9:1 respectively.

Table 3 : Mechanism of injury in traumatic pneumothorax

Mechanism of injury	No. of cases	Percentage (%)
Road traffic accident	15	75
Falls	4	20
Fall of heavy object over chest	1	5
Total	20	100

A total of 20 patients of traumatic pneumothorax managed with chest tube were included in the study. Males were affected more than females with a ratio of (9:1) .The main mechanism of injury was RTA (75%), followed by falls (20%), and fall of heavy object (5%).

Table 4 : Distribution of symptoms

Symptoms	PSP	SSP	Traumatic	Total
Chest pain	1	3	17	21
Shortness of breath	2	7	-	9
Both	1	8	2	11
Asymptomatic	2	6	1	9
Total	6	24		50

The most common symptom was chest pain (42%), followed by overlap of both chest pain and shortness of breath (22%).

Table 5 : Distribution of complication

Complications	PSP	SSP	Traumatic	Total
Pain	1	3	5	9
Subcutaneous emphysema	1	2	2	5
Tube block	-	-	-	-
Self expulsion	1	-	-	1
Lung injury	-	1	1	2
Total	3	6	8	17

Of the 50 cases, 17 cases had various complications. The most common complication seen was pain followed by subcutaneous emphysema. Traumatic pneumothorax showing the highest complication with a total of 8 cases of which there were 2 cases of subcutaneous emphysema and 1 case of lung injury.

Table 6 : Outcome of ICD

Outcome	PSP	SSP	Traumatic	Total
Successful	5	22	19	46
Unsuccessful	1	2	1	4
Total	6	24	20	50

Out of total 50 patients of pneumothorax who has undergone chest tube insertion, 46 had successful outcome with complete resolution of pneumothorax. 4 patients had unsuccessful outcome defined by recurrence of pneumothorax and persistent mild chest pain. The p-value is 0.65 which is not significant.

DISCUSSION

The procedure of chest tube insertion is commonly carried out to drain various abnormal collections in the pleural cavity. This study assesses the indications, risks, and results of tube thoracostomy performed in a tertiary care hospital of Tezpur. In this study we observed the 50 patient with pneumothorax who underwent tube thoracostomy for a period of 6 months out of which 6 patients (12%) had primary spontaneous pneumothorax, 24 patients (48%) had secondary spontaneous pneumothorax and 20 patients (40%) had traumatic pneumothorax compared to study by Contou D.et.al[32]. In this study, the mean age of patient was 42.1 years SD ± 17.82, minimum age was 12 years and maximum age was 80 years compared to a study by Hassan.et.al[13] where the mean age was 32.66 years SD± 13.59, minimum age was 13 years and maximum age was 80 years. Another study on complications on chest tube by Al-Tarshihi MI.et.al[17] had age ranged from 15 to 86 years (mean 41±10.11). The most common age group was 31 – 50 years which is comparable to study by Hassan.et.al[13]. The most common cause of pneumothorax in both males and females were secondary spontaneous pneumothorax in this study. The male to female ratio in the study was 6.14:1 as compared to 7.33:1 in study by Hassan.et.al. The most common symptom was chest pain, 21 (42%) followed by overlap of both the symptoms of chest pain and shortness of breath, 11 (22%). 9 patients were asymptomatic out of which, 2 had PSP, 6 had SSP and 1 had traumatic pneumothorax. According to Collop NA et al.[8], the incidence rate of spontaneous pneumothorax was 2.30% among patients with chest symptoms who were older than 15 years old.

In India , the main etiological factor for secondary spontaneous pneumothorax is pulmonary tuberculosis. Pneumothorax can be identified solely by chest X-Ray[9,10,11]. The diagnosis of underlying lung pathology is aided by CECT Thorax. This is consistent with the findings of Aylwin CJ et al[12]. Patients with pneumothorax typically had positive sputum for AFB under RNTCP (p=0.023), and the data is statistically significant and strongly correlated.

Intercostal tube insertion, being an invasive procedure, has the potential to cause various complications ranging from minor complications like pain to major complications like lung injury. In this study, 17 patients (34%) had complications, out of which 9 patients (53%) had pain at site of ICD insertion and were managed conservatively with analgesics. 2 patients (12%) had lung injury, 5 patients (29%) had subcutaneous emphysema. In other studies by Hassan.et.al[13] and Thelle A.et.al[31] , the most common complication was subcutaneous emphysema. Subcutaneous emphysema was observed in 19% of patients in multiple studies by Maritz D et al[14], Omar HR et al[15], and Baldt M et al[16], which is lower in comparision to the current study. Compared to the current study, Al- Tarshihi MI et al[17] identified an overall complication rate of 16.8% which is much lower. Self expulsion of the tube occurred in 1 patient of PSP which was due to inappropriate fixation.

In the current study recurrence was seen in 3 patients (6%) which is

similar to study by Hassan.et.al[13]. In the current study, successful outcome was seen in 46 out of 50 patients (92%) and unsuccessful outcome in 4 patients (8%). The p-value is 0.65 which is not significant. The mean duration for ICD in-situ was 7 days (4-10 days) compared to 4.6 days (2.3–7.8 days) in study by Thelle A.et.al[31]

Table 7 : Comparision with other studies.

Studies	Age range (in years)	Sample size	Unsuccessful outcome (%)	p-value
Contou D.et.al (2012)[32]	20-68	212	21	0.60
Hassan.et.al (2019)[13]	13-80	100	5	0.33
Present study (2023)	12-80	50	8	0.65

There are some limitations in this study : a) it is a single centre retrospective study, b) small sample size, c) non-availability of specialized thoracic surgery units, d) inability to treat recurrences with pleurodosis.

For decades management of spontaneous pneumothorax has remained highly debatable despite different published guidelines[20,21,22], many of which contradict each other. The old concept [23] of PSP because of a localised rupture of a bleb or a bulla is obsolete and has been questioned by many recent studies[18]. In recent years, there has been a change in the management strategy of spontaneous pneumothorax leading to more use of a conservative approach[20,22] based on the idea that air in the pleural cavity is well supported[18]. With the advent of the chest tube, the use of chest tube drainage (CTD) became widespread although such an approach required hospitalisation and was mainly practised by surgeons[24]. Many randomised studies[25-30] proved that simple needle aspiration significantly reduced hospital stay without a higher recurrence rate of pneumothorax, explaining the choice of needle aspiration as a first-line therapy. Hence, the first line of treatment in a first episode of spontaneous pneumothorax has definitely to be observation, or needle aspiration if some treatment has to be offered to the patient. Unless there really is some respiratory distress, one should definitely avoid chest tube insertion, which is not only painful for the patient, as shown by AYED et al. [29], but exposes him/her to a risk of potential complications[18]. Whereas for patients with traumatic pneumothorax, those who are hemodynamically stable and with small pneumothoraces, can be managed conservatively without affection of morbidity, mortality or complication. However, all patients should be observed for atleast a period of 24 hours for clinical and radiological signs of deterioration. If these occur, insertion of chest drain should be considered[19].

CONCLUSIONS

Current management protocols for spontaneous pneumothorax (both primary and secondary) and for traumatic pneumothorax in hemodynamically stable patients dictates a more conservative approach with observation and needle aspiration. However patients needs to be monitored and if clinical and radiological parameters deteriorate, the role of an intercostals chest drain comes into play in the form of small bore chest tube (</== 14F) for spontaneous pneumothorax and large bore chest tube in case of failure of small bore tubes and in large traumatic pneumothoraces.

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