ORIGINAL RESEARCH

A clinical study of pediatric patients requiring inter-costal drainage tube at a tertiary care centre in central India

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ABSTRACT

Introduction: Intercostal drainage (ICD) tubes are indicated to drain clinically undesired substances such as air, excess fluid, blood, chyle or pus from the intrathoracic space. There are very few studies on pediatric patients managed with intercostal drainage tube insertion for different indications.

Aims: To study the clinico-epidemiological profile, indications, complications and outcomes of pediatric patients admitted in Pediatric Intensive care unit who were managed with ICD tube insertion.

Material and Methods: Records of pediatric patients from Pediatric intensive care unit (PICU) of Shyam Shah Medical college Madhya Pradesh during a period of one year i e from July 2020 to June 2021 was collected and analysed prospectively.

Results: a total 25 patients were included in the study (male:female= 1.27:1; mean age 4.9± 3.7 years). Common clinical presentation of the patients were fever (n=18, 72%) followed by fast breathing (n=11, 44%). Mean duration of stay was 18.7±11.7 days. Common indications for ICD tube were pyothorax (n=8, 32%), pyopneumothorax, empyema and pneumothorax (n=4, 16% each). 80 % cases were unilateral and 28% required blood transfusion and inotropes for shock. Most common pathogen isolated from cultures was staphylococcus aureus (>75%). 11 patients were started with antitubercular treatment. In our study the mortality was 24%.

Conclusion: In this study, Staphylococcus aureus was the most common organism isolated from culture whereas 44% cases were treated with antitubercular treatment that reflects how common tubercular pleural effusions are in pediatric age group in this area. Early diagnosis and treatment is the key of management. More extensive studies are required in this topic of interest.

Keywords: Intercostal drainage tube, Pediatric pleural effusion, Tuberculous pleural effusion, Pyothorax, Empyema, Outcomes

INTRODUCTION

Intercostal drainage (ICD) tubes are indicated to drain clinically undesired substances such as air, excess fluid, blood, chyle or pus from the intrathoracic space. There are very few studies on pediatric patients managed with intercostal drainage tube insertion for different indications. Any conditions that may lead to fluid effusion increase into the pleural space can

cause pleural effusion[1–2]. The effusion secondary to pleural infections is the most common cause of this abnormality in children, while the most common causes in adults have been shown to be congestive heart failure and malignancies[3]. Other causes of pediatric pleural effusions are pneumonia, followed by malignancies, renal disorders, trauma, and heart failure[4] . Bacterial infections may lead to serious complications such as empyema[5–7] . Although Streptococcus pneumoniae is the most infectious etiology for pediatrics pleural effusion followed by Staphylococcus aureus, Haemophilus influenzae type B, coagulase-negative staphylococcus, and other streptococcal species[8–10] . Another cause of pleural effusion in children is pulmonary tuberculosis that was widely reported in 2 to 38%[11]. This infection is frequently unilateral that may be occurred primarily from direct hematogenous invasion or secondary from reactivation[12–14] . Pleural tubercular effusion is a diagnosis which must be considered in isolated pleural effusions in non-toxemic children over 5 years of age. A history of close contact with an adult with pulmonary tuberculosis reinforces the suspicion for its diagnosis. There are few data regarding the specific prevalence in children[15–16] . Early diagnosis is crucial, although it may be challenging in situations where the availability of some diagnostic tools are limited. The diagnosis of a tuberculous pleural effusion can be difficult[15] . Routine complete drainage of the pleural fluid at the time of diagnosis does not appear to improve middle or long-term outcomes[17] . The response of tuberculous pleural effusions to therapy is generally good, with total fluid reabsorption occurring within 2 to 4 months[18] . The aim of the present study was to study the clinico-epidemiological profile, indications, complications and outcomes of pediatric patients admitted in Pediatric Intensive care unit(PICU) who were managed with ICD tube insertion.

METHODOLOGY

In this prospective study we had collected data from all pediatric patients (age group >1 months till 14 years of life) admitted in Pediatric Intensive care unit of Shyam Shah Medical College, Madhya Pradesh who were managed with Intercostal drainage tube insertion for any indications during the period from 1st July 2020 to 30th June 2021 by using a preformed proforma. All required data regarding our study objectives were documented during the hospital stay of the patients. Routine investigations like complete blood counts, c reactive protein and blood culture; specific investigations like Adenosine deaminase, analysis of pleural fluid, CBNAAT and Tuberculin skin test, and radiological investigations like bed side sonography, CT chest and chest X-ray were done as per consultation instruction given by treating physician. All patients were managed accordingly as per institutional treatment protocol. Deaths and discharges were counted as outcome, whereas Left against medical advice and refer cases were excluded from the study. After entering data in a Microsoft Excel Spreadsheet and coded appropriately, we analyzed them using SPSS version 18.0.

RESULT

During our study period, a total 29 patients were managed with intercostal drainage tube insertion. Two of them left against medical advice and another two of them were referred to higher centre for further management (for thoracoscopy or video assisted thoracoscopy). So a total 25 patients were included in this study for data analysis (male:female= 1.27:1; mean age 4.9± 3.7 years). Baseline clinico epidemiological characteristics of study samples are depicted in the table 1. Common clinical presentation of the patients were fever (n=18, 72%) followed by fast breathing (n=11, 44%) with a mean duration of symptoms was 9.4 ± 8.6 days before admission. Only 2 patients had previous history of respiratory infections and others were presented for the first time. ICD tubes were inserted in PICU for 52% cases and rest cases were taken to minor Operation theatre of Surgery department for the procedure (Fig.1). Common indications were pyothorax (n=8, 32%), pyopneumothorax (n=4, 16%),

emphyema (n=4, 16%) and pneumothorax (n=4, 16%). 8 cases were parapneumonic effusions. 80 % cases were unilateral and 28% required blood transfusion and inotropes for shock. 24% needed readjustment of ICD tubes (within 27.6 ± 10.8 hours of tube insertion) and 76% had tube removed successfully (mean duration of tube removal 9.5 ±4.4 days) whereas 4 patients needed reinsertion of tube after removal. Blocked tube followed by pneumothorax was the most common complication of the procedure. Eight cases had positive blood culture (Staphylococcus aureus 87.5%) and 4 cases had positive pleural fluid culture (Staphylococcus aureus 75%) Table.1. Total 11 patients (44%) among them were started with antitubercular treatment during this study period (Table 2).Out of 25 patients, 24% were deaths and 76% were successfully discharged (mean duration of stay 18.7±11.7 days).

Table 1: Baseline clinical profile of patients (n=25)

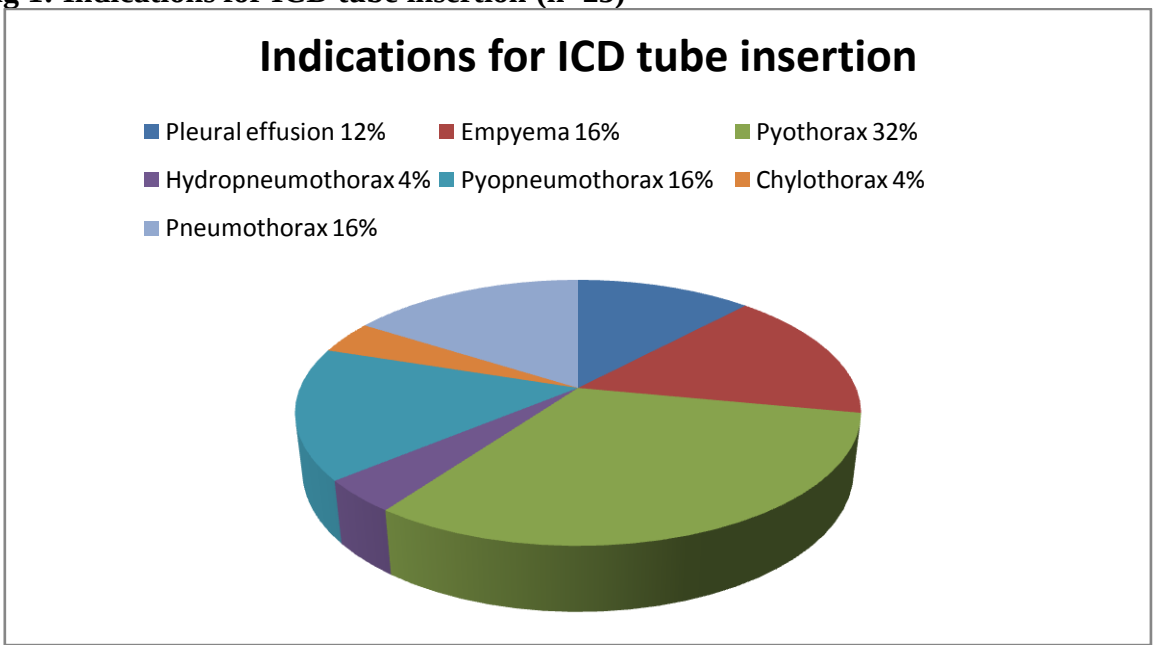
1. Characteristics	
• Male : Female	1.27:1
• Mean age	4.9 ± 3.7 years
• Mean BMI	12.8 ± 2.6
• Mean weight	13.9 ± 6.3 kg
• Mean duration of symptoms	9.4 ± 8.6 days
• Previous history of respiratory tract infections	2 (8%)
• Poor socioeconomic status	18 (72%)
• Time between admission and ICD insertion	26.2 ± 5.4 hours
• Time between ICD insertion and tube removal	9.5 ± 4.4 days
• Unilateral chest pathology	20 (80%)
• HIV	1 (4%)
• Need for inotropes	7 (28%)
• Need for blood transfusion (s)	7 (28%)
• Need for readjustment	6 (24%)
• Successful tube removal	19 (76%)
• Need for reinsertion of tube after removal (n=19)	4 (21%)
2. Symptomology	
• Fever	18 (72%)
• Fast breathing	11 (44%)
• Nonspecific	8 (32%)
• Cough	7 (28%)
• Chest pain	5 (20%)
• Pain abdomen	3 (12%)
3. Investigations	
• Mean hemoglobin	9.2 ± 1.4 gm%
• Mean c reactive protein	12.1 ± 6.9 mg/dl
• Strongly suggestive ADA	6 (24%)
• Positive Blood culture (n=8)	S. aureus 87.5% S. pneumonia 13.5%
• Positive pleural fluid culture (n=4)	S. aureus 75% CONS 25% 21 (100%) 25 (100%) 25 (100%) 15 (60%) 11 (44%)

• Pleural fluid analysis (n=21) • Chest xray • Bedside USG • CT scan chest	
4. Treatment profile • Antibiotic only (for pleural effusions) • Antibiotic and ICD • Empirical Antibiotic , ICD and ATT • ICD and Antitubercular treatment (ATT) • ATT only (for tuberculous pleural effusions) • Decortications • VATS	13 (not included in the study) 14 (56%) 4 (16%) 7 (28%) 6 (not included in the study) 1 (referred) 1 (referred)
5. Outcomes • Death • Survival • Left against medical advice • Refer	6 (24%) 19 (76%) 2 2
6. Complications • Tension pneumothorax • Bronchopleural fistula • Injury • Subcutaneous emphysema • Blocked drain • Dislodgement • Contralateral pneumothorax • Leakage around chest tube • Empyema	4 (16%) 2 (8%) 2 (8%) 3 (12%) 5 (20%) 3 (12%) 1 (4%) 4 (16%) 2 (8%)

Table 2: Justification for starting antitubercular treatment among patients (n=11)

Investigation	Positive cases (n=25)	ATT started (n)	Percentage (%)
1. ADA	6 (24%)	6	100%
2. Exposure to adult with active tuberculosis	6 (24%)	3	50%
3. Radiological interpretation	8 (32%)	8	100%
4. Clinical decision by treating physician	7 (28%)	5	71.4%
5. TST	1 (4%)	1	100%
6. CBNAAT	1 (4%)	1	100%

Fig 1: Indications for ICD tube insertion (n=25)



DISCUSSION

Pediatric pleural effusion is more common in boys than in girls[12]. The incidence of pleural effusion in children is directly depended on the type of underlying disease. Massive pleural effusion led to empyema can be appeared in about 0.6-2% of children with bacterial pneumonia[14] . Tuberculous pleural effusion commonly occurs in adolescents and is uncommon in the preschool-aged child[19] . The distribution of pleural effusion according to the population studies is now increasing in most industrial countries like United States, Spain and France[20 – 23]. Chest radiography is the first simplest imaging strategy to assess of pleural effusion in children[24] . In children Ultrasonography (USG)can easily detects characteristics of effusion bedside[25] . Chest USG can easily distinguish free from loculated pleural effusion and also differentiate effusion from thickening and solid masses[26 – 28] . For more accurate assessment computed tomography (CT) of chest is preferred[29 – 31].It is also useful in interventions in which effusions are difficult to access [35 – 39] .

The incidence of empyema varies in different countries [36 – 38] . The higher prevalence in under-fives (69.43%) and the slight male preponderance (1.12:1) is in general agreement with the established pattern of acute lower respiratory infections in children compared with 1,27:1 in this study. In other study, 65.28% of the children were malnourished as per IAP classification compared to 36% in our study (40, 41). Fever, breathlessness and cough were the most common (100%) manifestations found at admission similar to many other studies whereas fever 72% and fast breathing 44% were common clinical manifestations in our study (38,39). In one study, pleural fluid culture showed bacterial growth in 37.5% of patients and no growth in 62.5% of patients compared to 19% in this study (38). Most common organism isolated was staphylococcus aureus which is comparable to previous studies from other developing countries[38,39]. The sample with negative culture might be due to high rate of pretreatment with antibiotics or lack of better facilities in our centre for isolating fastidious organism like anaerobes.

Compared to 80.55% (58 cases) in other study by Rao MSP, 100% of our study cases were treated with combination of intravenous antibiotics and intercostal tube drainage (ICTD). Compared to usual duration of antibiotic therapy is 3-6 weeks in that study (Mean duration of hospital stay 22.6 days), mean duration of stay was 18.7 ±11.7 days in our study. A total 7

cases needed both ICTD and decortications compared to two cases in our study. Compared to mean length of ICTD was 11.87 days, it was 9.5 ± 4.4 days in this study[36].

Clinical guidelines usually recommend the treatment of complicated effusion and empyema using ICD tube or video thoracoscopy[46-48]. However, in real life, many differences in daily clinical practice can be observed[42, 43]. Many centers adopt a conservative treatment approach, using only antibiotics, at least initially. Epaud et al. reduced the use of ICD tube from 52 to 25% by changing to a more conservative approach, with no change in the outcomes[44]. Carter et al. reported extensive experience of conservative treatment of empyema, and 52% of their patients, including 23% with mediastinal deviation, were treated with antibiotics alone[45]. Picard et al. followed a conservative approach, using only antibiotics in a third of their patients with empyema[49]. Proesmans et al. treated 37% of children with empyema with antibiotics alone, and only 8% required further interventions[50]. Long et al. treated 27% of children with empyema with antibiotics, and only 3% required a subsequent intervention[51]. In the USA, more than half of children with PPE were treated with antibiotics alone, with an upward trend in the last decade, and similar outcomes were achieved across the most interventional and the most conservative centers[52,53]. In other recent studies, no differences were found in children treated conservatively or with drainage procedures[54,55].Most patients can be treated with antibiotics alone, even in complicated effusion and empyema[56].

Jain et al, 223 children with suspected TB were enrolled with The median age was 31 months, 46% were female, 86% had received BCG, 57% were malnourished, and 10% were HIV positive. 12% had TB disease (definite or probable), 35% did not have TB, while TB could not be ruled out in 53%. Tuberculin skin test (TST) was positive in 20% of children with TB. The majority of children (57%) were malnourished. 88% children with TB had received prior BCG[57]. A study by Sharma S, a total of 74 deaths occurred out of total 1380 pediatric TB patients (78.38% were female) over preceding 6½ years with a mortality rate of 5.36%. A high index of suspicion and early referrals to centers equipped with TB programmatic management facilities is essential for timely diagnosis and treatment of pediatric TB to reduce mortality[58]. In our study, 44% cases were started with antitubercular drugs, median age 6 years, 45.5% were female, 91% had received BCG, 100% were malnourished, 9% were HIV positive and 9% were TST positive. Around 18.1 % of them died.

There were 4 cases of intercostal drainage tube indications for pneumothorax in our study. In 6 cases there was need for readjustment of tube after insertion (within 27.6 ±10.8hrs) and in 4 cases there was need for reinsertion of tubes after removal (within 10.2 ± 6.5 hrs). This is may be due to shifting of patients from PICU to other departments either for procedures (insertion of tubes in PICU vs minor OT was 13:12) or for investigations (CT chest was done for 7 cases); or even may be due to pathological variations of the cases (complications like fistula formation in one case).Limitations of our study were small sample size and unavailability of proper facility for all types of culture sensitivity and other procedures like decortications, VATS.

CONCLUSION

In this prospective study, Staphylococcus aureus was the most common organism isolated from the culture whereas 44% cases were treated with antitubercular treatment that reflects how common tubercular pleural effusions are in pediatric age group in this area. Chest Xray and bedside USG chest were done for every patient for diagnosis and follow up during hospital stay. Pyothorax was the most common indication for ICD insertion and blocked tube was the most common complication. Proper placement of tubes and evaluation of complications related to chest tube may improve patient outcomes. 24% mortality in pediatric population requiring intercostal tube drainage in our setting reflects need of early diagnosis

and treatment as the key of management. More extensive studies beyond perspective limitations are required in this topic of interest.

CONFLICT OF INTEREST

Nil

ABBREVIATIONS

ICD intercostal drainage, PICU pediatric intensive care unit, CBNAAT cartridge-based nucleic acid amplification test, ADA Adenosine Deaminase, CT computed tomography, VATS video assisted thoracoscopic surgery, BMI basal metabolic rate, HIV human immunodeficiency virus, USG Ultrasonography, ATT antitubercular treatment, LAMA left against medical advice, TST tuberculin skin test, ICTD intercostal tube drainage, TB tuberculosis, BCG Bacillus Calmette-Guerin, OT Operation Theatre.

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