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A PROSPECTIVE STUDY ON VIDEO ASSISTED THORACOSCOPIC SURGERY VS TUBE THORACOSTOMY WITH FIBRINOLYSIS FOR EMPYEMA IN CHILDREN AT A TERTIARY CARE CENTRE

General Surgery

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ABSTRACT

Background: An empyema is a localised or free collection of purulent material in the pleural space caused by a combination of pleural dead space, pleural fluid culture medium, and bacterial inoculation. With multiple treatment modalities available, a prospective, randomised comparison is required to determine whether thoracoscopic decortication by video assisted thoracoscopic surgery (VATS) or tube thoracostomy with fibrinolysis (TTF) should be used as the first line treatment in paediatric patients with empyema. As a result, the present study was done among children with empyema. **Methods:** In the present study, 40 children with empyema undergoing VATS and TTF were included in the study to investigate the effects of these two procedures on clinical improvement and duration of stay in children with empyema. **Results:** The mean age of study participants in group VATS and TTF were found to be 8.12+4.02 and 7.89+3.96 respectively with male majority in both the groups. 85% and 75% of study participants in group VATS and TTF had Stage II empyema respectively. 25% and 35% of study participants in group VATS and TTF had cavitation respectively. The mean days of hospitalization of study participants in group VATS was significantly shorter than group TTF. The mean duration of symptoms after intervention in group VATS was significantly shorter than group TTF. 25% cases of TTF had failed & had to undergo VATS **Conclusions:** In our study, the VATS group had a faster clinical recovery than the TTF group. Under the camera's view, fibrin and septations in the pleural space can be removed more effectively and quickly. VATS hastens children's recovery from empyema. TTF alone causes both slow clinical recovery and disease progression, as well as time loss. As a result, we believe that VATS should be the first option in the treatment of empyema, with no time wasted with TTF beforehand.

KEYWORDS

Empyema; Fibrinolysis; Thoracoscopic debridement; Tube thoracostomy; VATS

INTRODUCTION:

An empyema is a localised or free collection of purulent material in the pleural space caused by a combination of pleural dead space, pleural fluid culture medium, and bacterial inoculation[1]. The worldwide incidence of empyema is increasing, with the incidence of 5-10 % in India.[1,2,3]

The American Thoracic Society classified the empyema process into three stages: 1) **exudative**, with low cellular content in the pleural fluid; 2) **fibrinopurulent**, with frank pus present and an increase in white cells, and fibrin formation begins to cover the pleura with the formation of loculations; and 3) **organising**, with thick peel formation by fibroblasts and the pleural space characterised by a very thick exudate with heavy sediment.[4,5,6] Hamm and Light added another stage that precedes the exudative stage, which they termed the **pleuritis sicca stage**. In this stage, the pleura is inflamed, causing chest pain and a pleural rub, but it does not always progress to the exudative stage. In order to aid management, Hamm and Light assigned pH and lactate dehydrogenase (LDH) levels to each stage.[7] The pH is normal during the exudative stage, and LDH is less than 1,000 IU. The pH is less than 7.2 and LDH is greater than 1,000 IU during the fibrinopurulent stage. It should be noted, however, that these values apply to adult patients and have not been properly validated in the paediatric population, despite the fact that some paediatric papers suggested that pH could be a useful prognostic marker.[8,9]

Pleural empyema in children continues to be a serious problem despite recent advances in the management.[10,11] The goal of treatment is to halt sepsis and restore pleural fluid circulation, restoring normal lung function. To accomplish this, the pleural cavity must be sterilised and the lung must be allowed to expand as much as possible. Antibiotics alone or in combination with thoracocentesis; chest-drain insertion; chest drain with fibrinolytics; open decortication; and video-assisted thoracoscopic surgery (VATS) are the specific treatment regimens available.[12] Instilling fibrinolytics into the pleural cavity is intended to lyse fibrinous strands and clear lymphatic pores, thereby improving drainage.[13]

Many of the recent literature shows primary role of VATS in the management of childhood empyema .When compared to other treatment options, early and primary use of VATS for post-pneumonic empyema in children demonstrated a higher success rate, low conversion to open procedures, significantly reduced the number of surgical procedures, duration of chest tube drainage, and length of stay. The majority of authors advocate VATS as a safe and effective primary treatment option for children with empyema.[14,15,16]

Decortication may be required in 3 to 8% of children with empyema during treatment. It is mostly needed for patients who have persistent pleural sepsis despite intercostal drainage(ICD), antibiotics, chest physiotherapy, chronic empyema/advanced stage, and failure of other treatments. VATS decortication is also a safe and effective treatment for empyema in the hands of an experienced practitioner, and it has proven to be an effective and less-invasive replacement for the open decortication procedure.[17]

Decortication is very effective in management of chronic parapneumonic empyema.[18] It gives very gratifying results ameliorating the disease rapidly and is well tolerated by young patients.[19] A prospective, randomised comparison is required to determine whether VATS or fibrinolysis should be used as the first line of treatment in patients with empyema. As a result, we began this study in children with empyema.

OBJECTIVE OF THE STUDY:

To compare the effect of thoracoscopic decortication by VATS & tube thoracostomy with fibrionolysis in disease progression & clinical recovery for empyema in children

METHODOLOGY

Study Design: Prospective study

Study Duration: 12 months (September 2021 - September 2022)

Study Area: Al-Ameen Medical college Hospital (AMCH), Bijapur.

Study Participants:

- Children with empyema attending the Surgery OPD/IPD of Al-Ameen Medical college Hospital (AMCH), Bijapur.
- The study population consisted of patients younger than 18 years with a diagnosis of empyema.

Inclusion Criteria:
- Patients younger than 18 years admitted to Al Ameen Medical College & Hospital with a diagnosis of empyema whose parents/guardian are willing to take part in the study
- Empyema is defined as septations or loculations identified in the pleural space by computed tomography or ultrasound. In addition, patients with a frankly purulent tap with white blood cell count greater than 10,000 cells/μL were included. Stage II and III empyema cases were considered for the study

Exclusion Criteria
1. Patients with stage I empyema
2. Patients with additional foci of infection, comorbid or immunocompromised conditions
3. Patients who are not fit for anaesthesia as per ASA score
4. Patients with contraindication for thoracoscopy or streptokinase

The study was conducted in department of surgery, Al-Ameen Medical college Hospital (AMCH), Vijayapura. Clearance from the institutional ethical committee was taken before starting the study. Purposive sampling was done and written consent was obtained from parents of children younger than 18 years, diagnosed with empyema. The study participants were included in the study, till the sample size was reached. A pre-tested, semi-structured questionnaire was used to collect information on socio-demographic variables and history of empyema by interview method. After diagnosis, patients were randomized to treatment by either video-assisted thoracoscopic decortication or pleural infusion of fibrinolytic solution with tube thoracostomy. The fibrinolytic agent used was streptokinase.

Estimation Of Sample Size:
On the basis of statistics obtained from Department of Surgery, Al-Ameen Medical college Hospital, an average of 3 case per month fitting the criteria of the study with study duration of 12 months, we can expect to have N=36. Based on this population size, using YAMANE equation, for a known population size, sample size (n) equal to
- n =N/1+Ne2
- n=sample size
- N=population size
- e= margin of error (for 95% of confidence level, margin error =0.05)
- n=36/1+36*0.05*0.05 = 36/1.09 = 33.02

Therefore, after approximating, the sample size of the study participants was fixed at 40, 20 study participants in VATS and TTF group respectively.

RESULTS:
The mean age of study participants in group VATS and TTF were found to be 8.12+4.02 and 7.89+3.96 respectively with male majority in both the groups. 80% and 75% in group VATS and TTF had left lung empyema respectively. The mean duration of complaints of the study participants in group VATS and TTF were found to be 11.01±4.13 and 10.56±5.13 respectively. The weight and the oxygen support were comparable across the groups.

85% and 75% of study participants in group VATS and TTF had Stage II empyema respectively. Majority of the symptoms were fever, cough, respiratory distress and tachycardia across both the groups. 25% and 35% of study participants in group VATS and TTF had cavitation respectively.

The mean days of hospitalization of study participants in group VATS and TTF were found to be 7.52±1.65 and 11.07± 1.17 respectively. This association was found to be statistically significant. The mean duration of symptoms after intervention in group VATS and TTF were found to be 3.92±1.17 and 6.62±1.52 respectively. This association was found to be statistically significant. 25% cases of tube thoracostomy (5 cases) has failed & had to undergo thoracoscopic Decortication

Table 1: Patient Characteristics

Patient Characteristics	Group		P value
	VATS	TTF	
Age	8.12+4.02	7.89+3.96	0.785
Gender (M/F)	14/6	12/8	0.832
Side (L/R)	16/4	17/3	0.923
Duration Of Complaints	11.01±4.13	10.56±5.13	0.683
Weight (KG)	23.12±5.33	24.62+3.42	0.791
Oxygen Support (L/MIN)	0.72±0.36	0.79 ± 0.33	0.882

Table 2: Empyema Characteristics

Empyema Characteristics		Group		P value
		VATS	TTF	
Stage	Stage II	17 (85%)	15 (75%)	0.843
	Stage III	3 (15%)	5 (25%)	
Symptoms	Fever (>38°C)	14 (70%)	16 (80%)	0.934
	Cough	16 (80%)	17 (85%)	
	Respiratory Distress	17 (85%)	18 (90%)	
	Tachycardia	14 (70%)	15 (75%)	
	Pleuritic Type Chest Pain	7 (35%)	9 (45%)	
	Pyrulent Mucus	5 (25%)	6 (30%)	
Cavitation	5 (25%)	7 (35%)	0.732	

Table 3: Clinical Outcomes

Clinical Outcomes	Group		P value
	VATS	TTF	
Hospitalization	7.52±1.65	11.07± 1.17	0.001
Duration Of Symptoms After Intervention	3.92±1.17	6.62±1.52	0.001
Afebrile Days After Intervention	3.2±1.9	3.5±2.1	0.897
Analgesia Doses	24.3±12.7	23.3 ± 11.9	0.967
Failure	-	5 (25%)	-
Posttherapy Days Of O2 Support	2.3±1.6	2.21 ± 2.3	0.923

DISCUSSION:
The primary goal of empyema treatment is to treat the infection with antibiotic therapy and to evacuate the pleural fluid to ensure adequate lung re-expansion. Thoracentesis, tube thoracostomy, fibrinolytic therapy, thoracoscopic debridement, thoracotomy, and decortication can all be used to treat children with empyema.[20] There is, however, no agreement on which treatment should be used and when. The stage of empyema, the condition of the involved lung, the presence of a bronchopleural fistula, and the patient's clinical condition all influence treatment. The theoretical benefit of surgery as first-line treatment is that patients receive prompt, definitive treatment as well as assurance of optimal drain placement. Early and definitive surgery may reduce mortality, length of stay, and cause fewer late complications.[21]

In our study, the mean age of study participants in group VATS and TTF were found to be 8.12+4.02 and 7.89+3.96 respectively with male majority in both the groups. In a study done by Tanri Verdi Hİ et al the mean age of the patients was 4.6 years; the female/male ratio was 25/28.[22] Cobanoglu U et al in his study found that the mean age in fibrinolytic and VATS group was 7.30±2.76 and 8.74±2.60 respectively and with a male predominance.[23] St Peter SD et al in their study found that the mean age of patients were 4.8±4.3 and 5.2±4.2 in group VATS and fibrinolysis respectively.[24]

In our study, the mean duration of complaints of the study participants in group VATS and TTF were found to be 11.01±4.13 and 10.56±5.13 respectively. Majority of the symptoms were fever, cough, respiratory distress and tachycardia across both the groups. 25% and 35% of study participants in group VATS and TTF had cavitation respectively. The most frequent symptoms were respiratory distress, cough, tachycardia and fever in a study done by Cobanoglu U et al.[23]

In our study, the mean days of hospitalization of study participants in group VATS and TTF were found to be 7.52±1.65 and 11.07± 1.17 respectively which was found to be statistically significant. The mean duration of symptoms after intervention in group VATS and TTF were found to be 3.92±1.17 and 6.62±1.52 respectively which was found to be statistically significant.

Thoracoscopic debridement was found to shorten the length of hospital stay in a study done by Tanri Verdi Hİ et al and clinical recovery was faster in cases who underwent thoracoscopic debridement compared to tube thoracostomy where patients returned to their normal lives sooner. With thoracoscopic debridement, purulent and infected material was removed from the body more effectively and rapidly, which reflected to the clinical course. This indicates that thoracoscopic debridement is effective and sufficient in the treatment

of empyema.[22] similar findings were found in a study done by Cobanoglu U et al,[23] Sonnappa et al,[25] Wait MA et al,[26] Doski et al[27] and Huang JX et al[28].

In our study, 25% cases of tube thoracostomy had failed & had to undergo thoracoscopic decoration. In a study done by St Peter SD et al and Cobanoglu U et al 16.6% and 29.63% patients of fibrinolysis group subsequently required VATS for definitive therapy.[23,24] VATS had advantages with respect to the duration of thoracic tube drainage, duration of symptoms after the procedure, and the length of hospital stay while fibrinolytic treatment had cost advantages in a study done by Cobanoglu U et al.[23]

Christensen TD et al found that early goal directed VATS as first-line treatment should be considered the standard regimen of patients with complicated parapneumonic effusion and pleural empyema.[29] It will hopefully benefit the initial management and treatment of this patient population making the treatment based on evidence instead of local preferences.

According to those investigators who recommended VATS, fibrinolytic treatment is unpleasant and takes a long time to resolve. They also reported that it is not very effective in removing the loculation.[25,30] Those who defended the fibrinolytic treatment emphasised that it is simple to use, reduces the rising cost of material use, and protects patients from the morbidity risk posed by thoracic operations.[31,32]

CONCLUSION:

In our study, the thoracoscopic debridement group had a faster clinical recovery and tube thoracostomy than the other group, and the need for thoracotomy was lower. Under the camera's view, fibrin and septations in the pleural space can be removed more effectively and quickly. Thoracoscopic debridement hastens children's recovery from empyema. Tube thoracostomy alone causes both slow clinical recovery and disease progression, as well as time loss. As a result, we believe that thoracoscopic debridement should be the first option in the treatment of empyema, with no time wasted with tube thoracostomy beforehand.

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