A Study On Comprehensive Management Of Acute And Chronic Empyema Thoracis In The Pediatric Age Group And Their Outcome

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Abstract

Background: Empyema thoracis remains a common problem in the pediatric age group. We undertook the present study to outline key aspects of the presentation and management of this condition at our tertiary care hospital.
Patients and Methods: Sixty patients were analyzed between January 2006 and October 2007. The study included patients up to 12 years of either sex. Patients were subjected to detailed diagnostic and management protocols with a view to define successful diagnostic and management strategies.
Results: Both sexes were equally affected. The most common age affected was 0-4 years. Mean age was 4.4 ±3.47yrs and mean weight was 10.48±3.67kg. Patients presented most commonly with fever (90.1%), cough (80.6%), and respiratory distress (60%). The most common isolated organism was E.coli (21.7%) while 28.3% yielded a sterile culture. Two patients had associated pericardial effusion and one had liver abscess. Tube thoracostomy was done in all patients with a success rate of 50%. The remaining patients underwent an open decortication with a success rate of 96.6%
Conclusion: Tube thoracostomy should be done in all patients to reduce septic load. Open decortication is a safe procedure in experienced hands. In a developing country where access to expensive therapy like fibrinolytics and VATS is not freely available, decortication remains a valuable and indispensable tool.

ABBREVIATIONS

DOTS: Directly Observed Treatment Short course.
ATT: Anti-Tubercular Therapy.

INTRODUCTION

Empyema is a localized or free collection of purulent material in the pleural space as a result of combination of pleural dead space, culture medium of pleural fluid, and inoculation of bacteria. It is an advanced parapneumonic effusion.

The most common bacteria implicated with postpneumonic, non-tubercular empyema are Staphylococcus aureus, Pneumococci, E. coli, Pseudomonas, Klebsiella, and anaerobes.

The cultures are sterile in 30-50% of the cases due to antibiotics. Staphylococcus aureus is now the most commonly retrieved organism ([2], [3], [4]). The increasing incidence of methicillin-resistant Staphylococci reported from the developed countries has also been recognized in the Indian scenario ([5], [6]). Postoperative and post-traumatic empyemas may contain Bacteroides or Pseudomonas aeruginosa ([1]). Anaerobes have also been recognized as important cause of childhood and adolescent empyema ([7]).

Tubercular empyema is common in India and usually associated with lung disease. Tuberculosis being rampant in India may present as acute empyema. In cases of late diagnosis, non-compliance with antitubercular treatment, and resistant strains of mycobacterium, it is usually a chronic disease with underlying parenchymal involvement.

While most cases would respond to antibiotic therapy, needle aspiration and intercostal drainage, few cases require further surgical management. The most common non-tubercular etiological agent is Staphylococcus. Tubercular etiology is not uncommon in India, especially due to delayed presentation, multiresistant strains, mismanaged cases, and non-compliance with antitubercular treatment amidst malnutrition and anemia. Clinical symptoms and a skiagram of the chest followed by thoracentesis are enough for

diagnosis. Pleural fluid is usually diagnostic and helps in choosing the appropriate antibiotics. Further investigations and management depends on the stage of the disease. Thoracentesis alone may be sufficient for the exudative phase. In the fibrinopurulent stage, a properly sized and well-placed tube thoracostomy with underwater seal is curative in most cases. Interventional radiologists have placed small-bore catheters, specifically directed to the loculated collection and have used fibrinolytics like urokinase, streptokinase, and tissue plasminogen activator (TPA) to break loculations, ameliorate fibrous peel formation, and fibrin deposition ([8,9,10]). Thoracoscopic debridement and thoracoscopic decortication are alternatives with distinct advantages over thoracotmy and are indicated if there was no response with intercostal drainage. In the organizing stage, a thoracotomy (for decortication) would be required if there is loculated empyema, underlying lung disease or persistently symptomatic effusion ([11]). Timely institution of proper management prevents the need for any surgical intervention and avoids long-term morbid complications.

Empyema thoracis constitutes approximately 5-10% of cases seen by a pediatrician in India. Culture positivity has decreased significantly over the years as the patients receive antibiotics before presentation.

PATIENTS AND METHODS

PATIENTS

This study comprised 60 patients up to 12 years of age treated in the pediatric surgical ward of M. Y. Hospital and M. G. M. Medical College, Indore, from January 2006 to October 2007.

METHODS

This study is a prospective study in which the diagnosis of post-pneumonic or tubercular empyema was made using clinical examination and investigations like chest X-ray, chest ultrasonography, and CT scan of the chest.

Treatment included closed tube drainage, thoracotomy with decortication and/or lobectomy/pneumonectomy. Selection of the appropriate treatment protocol was dependant on the staging of the empyema diagnosed by USG and CT scan. Tube thoracostomy was done immediately as early as possible after diagnosis.

Closed thoracostomy was carried out with a straight chest tube (Mallecot catheter, size according to age), attached to a water seal system. Successful closed tube drainage was evidenced by improvement in clinical and radiological status within 24 to 48 hours. Continuous drainage was maintained until daily fluid output dropped to below 30ml and/or improvement in the chest radiograph was noted. The chest tube was removed when lung expansion was seen on X-ray.

Decortication was performed if there was a stage III empyema (organized stage), and if patients did not improve after tube thoracostomy. Decortication was carried out through a standard posterolateral thoracotomy with or without resections of ribs.

More extensive surgical procedures such as lobectomy/pneumonectomy were done if the lung was non-viable. As a routine, antibiotic cover was given as part of the treatment protocol to all patients. ATT was given to diagnosed tubercular empyema up to 6 months according to DOTS therapy.

RESULTS

In this study a total of 60 patients up to 12years of age were included. The mean age was 4.4±3.47 years. Both sexes showed equal affection for the disease. There mean weight was 10.48±3.67kg. The most common age groups affected were from 0 to 4years (63.3 %), from 5 to 8 years (28.3%) and from 9 to 12 years (8.3%), (Table-1). The most common symptom was cough in 55 patients (90.1%) followed by fever in 52 patients (80.6%) and respiratory distress in 36 patients (60%), (Table-2).

Pus culture of 17 patients (28.3%) was found to be sterile. The most commonly isolated organism was E. coli in 13 (21.7%), followed by Staphylococcus in 12 (20%), Pneumococcus in 11 (18.3%), Klebsiela in 5 (8.3%) and Pseudomonas also in 5 (8.3%). Mixed organisms were seen in 6 (10%), (Table-3). In 36 patients (60%), ADA level was found to be below 40U/l, in 6 patients (10%) 40-60 U/l and in 18 patients (30%) above 60U/l (Table-4). Patients' average haemogram was 9.5gm, average total leucocyte count was 8450 and average ESR was 15.

Right-sided empyema was more commonly encountered (37 patients; 61.6%), followed by left-sided (20; 33.3%); both sides were affected in 3 patients (5%), (Table-5). Tube thoracostomy was done in all the patients. Decortication was undertaken in 30 patients (50%), lobectomy in1 patient (1.6%), pneumonectomy in 1 patient (1.6%), other procedures like pericardiostomy, pericardial drainage and

liver abscess drainage in 3 patients (5%).

Post-operatively, antibiotics were given in all patients (100%), ATT was administered to 22 patients (36.6%) and glucocorticoids were used in 34 patients (56.6%).

In our study, total mortality was 6.6% (4/60). Out of them, only 3.3% (1/30) succumbed after decortication. Success rate after decortication was 96.7%.

Figure 1

Table 1: Distribution of the disease in different age groups.

Age (years)	No. of patients (n = 60)	Percentage
0-4	38	63.3%
5-8	17	28.3%
9-12	5	8.3%

Figure 2

Table 2: Presenting symptoms.

Symptoms	No. of patients (n = 60)	Percentage
Fever	52	80.6%
Cough	55	90.1%
Respiratory distress	36	60%

Figure 3

Table 3: Isolated organisms in pus culture.

Organism	No. of patients (n = 60)	Percentage
Staphylococcus	12	20%
Pneumococcus	11	18.3%
E. coli	13	21.7%
Streptococcus	2	3.3%
Klebsiella	5	8.3%
Pseudomonas	5	8.3%
Mixed organisms	6	10%
Sterile	17	28.3%

Figure 4

Table 4: ADA level distribution

ADA level (U/l)	No. of patients (n = 60)	Percentage
<40	36	60%
40-60	6	10%
>60	18	30%

Figure 5

Table 5: Lung involvement.

Site	No. of patients (n = 60)	Percentage
Bilateral	3	5%
Right	37	61.6%
Left	20	33.3%

DISCUSSION

In our study a total of 60 pediatric patients were included. No sex predominance was seen. This was in accordance with a similar study done by Satpathy and colleagues in Orissa in 2005([12]). In this study the patients' mean age was 4.8 ± 3.47 years and mean weight was 10.48 ± 3.67kg. Patients presented most commonly with fever (90.1%), cough (80.6%), and respiratory distress (60%). The most common isolated organisms were E.coli (13; 21.7%), Staphylococcus (12; 20%), Pneumococcus (11; 18.3), Klebsiella (5; 8.3), Pseudomonas (5; 8.3) and mixed organisms (6; 10%). Cultures were sterile in 28.3% ([17]). In a similar study done by Kumar L. Gupta in North India (13), the most commonly organism isolated was Staphylococcus. A recent study done in America and Europe by Puz and colleagues ([14]) and another study done by Hardie amd Bokulic ([15]) showed Pneumococcus as most commonly isolated organism. The more commonly involved side was the right one (37; 61.6%), followed by the left one (20; 33.3%); bilateral involvement was found in 5% ([3]).

In our study, tube thoracostomy was usually the first step in the treatment of acute empyema. The success rate for tube thoracostomy is 70-85%. Interventional radiologists have used fibrinolytics such as urokinase, streptokinase, and tissue plasminogen activator (TPA) in complicated empyemas with loculations and ameliorated fibrous peel formation and fibrin deposition. The advent of video-assisted thoracic surgery (VATS) for the management of fibrinopurulent stage II empyema has shown rewarding results in several reports. VATS has the advantage to be less invasive than open decortication and to have a better acceptance by the referring physician and the patient. Decortication represents the most invasive treatment for organized empyema cavities. Decortication allows a more rapid recovery with a decreased number of chest tube days, and decreased length of hospital stay. The success rate for decortication is 90-95%. In our series, it also had an excellent result (96.6%). Open decortication still remains the gold standard procedure for managing chronic empyema thoracis. Fibrinolytic therapy was not done routinely in our study due to high cost as all patients were of low socioeconomic strata and they could not afford this therapy. VATS has its limitations for the treatment of stage III disease due to the extensive fibrosis encountered. Furthermore, VATS could not be done in our center due to lack of equipment which is a common problem encountered in most of the government hospitals in the country. In our study, initially tube thoracostomy was done in all the patients. Out of these, 30 patients had adequate drainage of their empyema corresponding to a success rate of 50%. This is likely to be explained by the fact that most of our patients present late with the empyema in organizing stage. Despite the expected low success rate for tube thoracostomy in the

treatment of late empyema, it remains a first line therapy to decrease the severity of pleural sepsis until further therapy can be instituted. The cases of acute empyema were discharged on an average of 7 days post tube insertion and the patients with unresolving chronic empyema were prepared for decortication. In the remaining 50% of cases, open decortication was electively done after stabilizing the patients' hemodynamics and nutrition status. All the patients were successfully treated and the success was gauged by lung expansion and general well-being of the patient. The patients were discharged after 7 days postoperatively. There were 4 mortalities in this study (6.6%), all these patients had come in respiratory failure and had severe protein energy malnutrition with decreased immunity. Only 1 mortality occurred amongst the 30 patients who underwent open decortication (3.3%). Three patients had other organ systems affected along with the empyema. Two had associated pericardial effusion and one had liver abscess. In one of these patients a pericardial window was created anterior to the left phrenic nerve and the pericardial effusion was drained. The other one underwent a pericardiotomy at bedside as the patient had signs of severe pericardial effusion. The liver abscess was drained. Out of 60 patients, 22 were diagnosed to have tuberculosis and antitubercular therapy was started as per DOTS registration.

CONCLUSION

Tube thoracostomy should be done in all patients regardless of the stage as this leads to a reduction in septic load. Open decortication is a safe procedure in the hands of an experienced surgeon. It has shown similar survival benefits and mortality rates as VATS. The results showed no statistical difference in the mortality amongst our patients and those in studies conducted at various other centers. In a developing country where access to expensive therapy like fibrinolytics and VATS is not freely available, decortication remains a valuable and indispensable tool in the armamentarium of pediatric surgeons.

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