DELAYED PRESENTED PEDIATRIC THORACIC EMPYEMA, SURGICAL MANAGEMENT AND OUTCOME ANALYSIS

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ABSTRACT

Objective: Analysis of 175 pediatric thoracic empyema patients, all of them treated by open decortication of the chest, regarding their clinic features, delay in their referral for surgery, perop findings, their postop results and follow-up.

Materials and Methods: All the patients with empyema thoracis in whom open decortication was done during the study period were included. Patients with tuberculous empyema, post traumatic clotted heamothorex and children with chylothorax were excluded from the study. Preoperative workup included base line investigations, chest radiograph, ultrasound chest, pleural fluid analysis, pus culture and chest computed tomographic (CT) scan

Results: One hundred and seventy-five patients (110 males, 65 females), age range was 5 months12 years, (mean 4.9 years) were operated during a 3-year period. Out of these 175 patients 154 (88%) were referred from other hospitals and pediatric units. 104 patients were referred to us with more than 3 weeks of onset of symptoms, and 50 patients within 3 weeks of onset. All patients had already been chest intubated. CT scan shows multiloculated pus, thickened pleura, and lung involvement. Broncho pleural fistula was present in 18 children and empyema necessitain in two. In all of these cases decortication was performed, with debridement of necrotic tissue and repair of air leaks in some patients. One child underwent bilateral thoracotomies. Follow-up was done from 3 months to 3 years. Two patients died of septicemia (1.1%). Morbidity was 9 (5.1%), six patients had wound infection, and three patients had prolonged chest tube drainage

Conclusions: Delayed referral for surgery causes irreversible changes in the lung, and also prolong disease causes increased thickness of the pleura and injury to the underlying lung with prolonged recovery. Of the referred patients 50 (32.4%) presented in their early period of the disease. Open decortication gives satisfying results and the condition of the lung at the end of surgery is a major prognostic factor.

Keywords: Thoracic empyema, decortication, empyema necessitain, pediatric, chylothorax.

INTRODUCTION

Para pneumonic effusion is effusion that occurs secondary to an infectious process in the lung parenchyma such as pneumonia or lung abscess. A complicated Para pneumonic effusion which is called empyema requires an invasive procedure for resolution and usually a bacterial organism can be cultured from the pleural fluid[1]. Para pneumonic effusion and empyema are both important medical conditions associated with significant morbidity and mortality, and as it progresses it is difficult to treat.

Hippocrates defined empyema thoracis as a collection of pus in the pleural cavity.[1] In third world countries where hospital resources are limited empyema is one of the major cause of pediatric hospital admissions and morbidity.[2-4] There is still debate over the proper management of empyema thoracis in children. It continues to have a high mortality rate (10-16%).[5] Pleural effusion and empyema are main complications of bacterial pneumonia in children. Effusion occur in at least 40% of bacterial pneumonias, and 60% of these effusions then results in the formation of empyema in all age groups.[6,7]

Pleural space is normally sterile but when it is invaded by bacteria it is converted to empyma. The American Thoracis Society has described three stages of empyema, which are exudative stage, fibrinopurulent stage, and organizing stage.[8] The exudative stage (1-3 days) is caused by increased permeability of the inflamed pleura. The fibrinopurulent stage (4-14 days) is characterized by accelerated fibrin deposit, becomes purulent leading to empyema and loculations and the organizing stage (after 14 days) is characterized by thickened pleura, producing an inelastic membrane 'the peel, which restrict lung movement termed as trapped lung. Management of empyema depends on stage of disease at time of presentation.

In the developing countries Staphylococcus aureus is the most common cause, while the Streptococcus pneumoniae in the developed world.[9,10] The reported rates of identifying an infectious cause

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from pleural fluid vary from between 8% and 76%, respectively. Pleural fluid is sterile due to widespread early use of antibiotics.[11,12] Other causes are Streptococcus pyogenes, Haemophilusinfluenza, Mycobacterium species, Escherichia coli etc.

Various treatments have been employed including antibiotics, thoracentesis, tube thoracostomy, intrapleural fibrinolytic, video-assisted thoracoscopic surgery (VATS), thoracotomy and open window thoracostomy. Unfortunately, results with these treatments have been highly variable.[13-16] This study is carried out to evaluate the effectiveness of surgical intervention in managing empyema thoracis in children, and the effect on out come on its delayed presentation and referral.

MATERIAL AND METHODS

A prospective study of 175 children between the age of 5 months to 12 years diagnosed to have empyema thoracis, admitted or referred to our unite from January 2016 to December 2018 were included in our study. Most of the patients were already diagnosed in pediatric units and then referred to our unit. Children who came directly to our outpatient department were diagnosed with the help of history, examination, and investigations, which includes X-ray chest. Ultrasonography (USG) and pleural fluid examination. Computed tomography (CT) scan were done in selected cases only. All cases having empyema thoracis or its complications were included in the study. Patients diagnosed to be having tuberculosis or other associated lung diseases such as chylothorex, malignancy and post traumatic clotted heamothorax were excluded from the study. Any patient found tubercular during the study on histopathological examination were also excluded. Pus was send preoperatively for culture and sensitivity in all cases. Informed written consent was taken and the procedures to be performed were well-explained to patient's parents or whosoever was available. The demographic characteristics of patients were noted.

Decortication was done in cases with multiloculated empyema, patients with trapped lung, patients with Broncho plural fistula and patients with empyema necessitain. Procedure was performed by different consultants of our unit. Posterolateral thoracotomy incision was given in all cases with or without resection of rib. The intrapleural debris, fibrinous tissue and all pus was evacuated. The thick encasing visceral pleural peel was carefully removed thus expending the lung on the table. Peel was removed down to diaphragm. Partial thick pleura was removed from chest wall and costodiaphragmatic surface, taking care of the diaphragm and phrenic nerve. All significant air leaks were meticulously closed with vicryl. Necrotic lung tissue was debride and bronchopleural fistulas were closed. Chest tubes were placed and the thoracotomy wound closed with vicryl, Intercostal block were given to all patients for post op pain control.

The postoperative care included care of the thoracotomy wound, chest physio, chest drain and monitoring of vitals. Chest radiographs were taken daily to assess the expansion of lung and for any collection. Ultrasound chest was done found to differentiate between residual collection and consolidation. Patients were put on low pressure suction. Patients were started on steam inhalation and incentive spirometry (those children who can do it) as early as possible along with nursing in an upright position. Adequate pain relief and antibiotics were given intravenously till good oral intake resumed. Pus/debris were sent at the time of surgery for culture and sensetivity, antibiotics were changed depending on the culture report. Patients were followed up at 3 months and 1 year or more frequently in the presence of symptoms.

RESULTS

One hundred and seventy-five patients were treated. There were 110 boys and 65 girls. Age ranged from 5 months to 12 years in boys (mean 5 years) and from 7 months to 11 years in girls (mean 4 years). Decortication was performed on the right side in 98 patients, on the left in 74, while 3 patients underwent bilateral thoracotomies. More children presented in the 1-7 year age group compared to 7-12 years in both the sexes. There was a peak incidence during the months of June, July and August compared to rest of the year.

History of fever and cough was the commonest feature [Table 1]. Respiratory distress often appeared to be the triggering factor for referral. Most of the patients were malnourished. Serum albumin ranged from 1.1 to 3 g% with an average of 1.7 g%. Pallor was common with mean Hb 8.7 g% (5.5-10.9 g %). This indicated the severe malnourished status in these patients.

Intercostal chest drain had been inserted before referral in 139 patients (90%). In 14 patients, it had been inserted twice. The drain had been kept for a period with a mean of 3 weeks. Unsuccessful use of streptokinase injection was also noted in some hospitalized patients. 54% preoperative pus cultures were no growth, 46% were positive and mostly grew Staphylococcus, Pseudomonas, and occasionally, Acinetobacter. The most commonly isolated organism was Pseudomonas aeruginosa. In the postoperative cultures, a few patients grew α and β hemolytic Streptococcus, Klebsiella and Pseudomonas. In the majority, it was reported as sterile. Before referral, nearly all the patients had been administered multiple antibiotics. Six patients in the series were diagnosed to have tuberculosis on histopathological examination of pleural/lung biopsy. These 6 patients were excluded from the study.

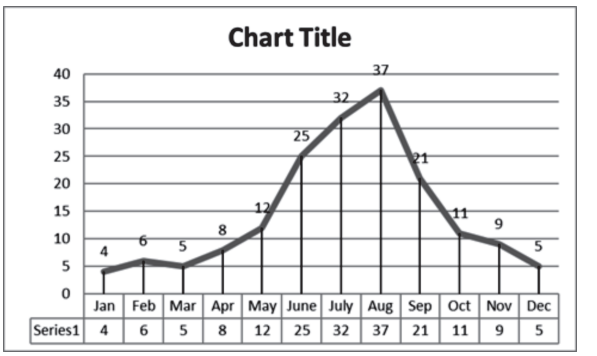
Out of the 154 referred patients, 50 (30.4%) presented to us before 3 weeks of onset of illness. One Hundred and four patients (67.5%) were referred more than 3 weeks after the start of symptoms. A comparison

Table 1: Presenting Complaints

Presenting Complaints	No. Of Patients
Fever	145
Cough	88
Respiratory Distress	80
Vomiting	10
Chest pain	24
Loss of Weight	60
Septic Shock	01
Empyema Necessitans	02

Table 2: Comparison of Patient Presenting before and after 03 weeks of onset of Empyema

Presentation Of Patients	<03 weeks	>03 weeks
No. of Patients	50	104
Deformity of Chest	0	18
BPF (Bronchopulmonary Fistula)	1	17
Empyema Necessitans	0	2
Bilateral Chest Tubes	0	3
Operative Findings		
Collection		
Air	2	10
Pus	38	40
Debris	8	45
Pleura		
Thin	15	4
Thick	32	62
Very Thick(>1 cm)	3	36
Condition of Lungs		
Consolidation	4	10
Necrosis	0	8
Poor Lung Expansion	0	10
Prolong ICU Care(>5 day)	2	22
Time of Discharge from Hospital	(3-8 days)	(5-28 days)
Morbidity	2	7



Month Wise Presentation

of patients presenting before and after the duration of 3 weeks was done [Table 2]. As a consequence of delay, they had a higher incidence of lung necrosis and required lobectomies. The recovery time in these patients was higher (maximum 1 month) as compared to early patients (maximum 8 days). The ICTD drainage was also prolonged. 10 patients had Broncho pleural fistula, which was evident with large amount of air leak in the chest drain. Amongst them two patients were on ventilator support at the time of referral, with one arriving in shock to the hospital. Three patients underwent lobectomy of necrotic lung. In the rest, the air leaks were closed with debridement of local necrotic tissue. Three patients had prolonged ICT drainage of more than 1 month after surgery. Rest of them recovered quickly. Two patients presented with empyema necessitans with associated necrotizing involvement of thoracic muscles. Follow-up of these patients was from 3 months to 3 years (mean = one year). No procedure-related or delayed deaths were seen. Weight gain was seen in nearly all patients, 2 months after surgery. Eight patients complained of occasional fever and cough .Six patients had wound infection. There was loss of lung tissue and poor expansion of the remainder. Overall mortality was two (1.1%) and morbidity was Nine (5.1%) in our study.

DISCUSSION

Empyema thoracis is considered as the disease of third world countries but its incidence is seen all over the world gradually increasing in the West.[2,3] In countries like Canada and Australia where a national database for disease statistics exists, the incidence of empyema was found to be 6.4 per million and 7.35 per million respectively with an increased incidence in 1-6 year age group in our study the age range with increased incidence of empyema thoracic is 1-7 year age group. In our experience, over the past few years, there appears to be an increasing awareness amongst pediatrician colleagues over the requirement and benefits of decortication, which has led to a higher referral rate.

Controversies exists about the management of early empyema in developed countries because they

are not having any clear-cut guidelines to follow.[3] With the introduction of Video Assisted Thoracoscopic Surgery (VATS), many studies have shown that patients have now bypassed medical thoracostomy and proceed directly to video-assisted thoracoscopic surgery (VATS).[4] Although the role of VATS in stage III empyema is very much debatable.[5]

In our study Fourteen patients had been started on anti-tuberculous treatment empirically due to persistent symptoms before they were referred to our unit. Only six of them and another four patients in the entire series were eventually proven to have tuberculosis on the basis of histopathology report. So chronic cough should not be assumed to be due to tuberculosis

In our series, Intercostal chest drain had been inserted before referral in 139 patients (90%). In 14 patients, it had been inserted twice. The drain had been kept for a period with a mean of 3 weeks. Unsuccessful use of streptokinase injection was also noted in some hospitalized patients. It is important to remember that not only multiloculation but also thick debris resembling cheese will give a dry yield. Sometimes, after an initial drainage of pus, the only content is air, which remains because the lung is unable to expand, because of the thick unyielding visceral pleura. It is that the true nature of the pleural collection and the status of the lung can be determined only by a CECT scan.[1,6] Most centers in the devolving countries still manage complications of pneumonia with chest radiographs alone or at the most with an ultrasonography.[1] The world is gradually giving importance to other modalities of imaging for timely detection and intervention of pleural space infections.[7]

As a tertiary level referral unit, most of the patients we receive are at a late stage of the disease. Only 30.4% patients in our series gave a history of less than 3 weeks. Even in this group, thin pleura was seen at thoracotomy only in four patients. In most cases, the pleura had become a hard, leathery peel densely adherent to the underlying lung. However, we advise surgery only based on the clinical features (persistent high grade fever, cough, respiratory distress, irritability, poor appetite, etc.) along with corroboration by CECT scan and not on the duration of the disease.[1] Some patients who have been referred 2-3 weeks after the onset of disease have been continued on medical management when they are symptomatically improving, i.e. regression of fever, reducing contents in a chest drain in the presence of an expanding lung on chest radiograph, etc.

We found in our study an increased incidence of the disease between June to August every year. A study from Taiwan also showed that the incidence of both pneumonia and empyema was highest each summer.[8] Another study from Canada showed that there were admissions throughout the year, they peaked between November and April.[9]

Most patients had received one or more courses of antibiotics, with 14 patients having been started on antituberculous treatment empirically. Of these, only 6 patients were proven to have tuberculosis on histopathological specimen of pleural/lung biopsy. In 10 patients, there was leakage of large amount of air in the chest drain (BPF). At thoracotomy, the previously placed intercostal drain was found within the lung tissue in six patients. While a few underwent lobectomy of the necrotic lung, in the others the fistula could be closed after local debridement.

A higher complication rate has been observed in pediatric empyema patients with lower hematocrit on admission.[10] Pallor at presentation was common with preoperative Hb averaging 8.7 g% in our series. This average was much lower in children presenting after 3 weeks (7.67 g%) compared to the children who presented before 3 weeks. We usually transfuse whole blood preoperatively when the Hb is below 8-9 g%. Malnutrition was evident in most patients at the time of admission.

During open thoracotomy in our study three significant changes which affected morbidity were noted in the lung: (a) consolidation, (b) cavitary necrosis and (c) poor compliance/fibrosis with poor expansion on Ambu bag ventilation. All these prolonged the recovery and removal of intercostal drain. In a recent study from Brazil, 52 children who had undergone thoracoscopy for empyema were retrospectively studied, comparing patients with and without necrotizing pneumonia.[11] The incidence of thoracic drainage prior to thoracoscopy (79-36%), pneumothorax (46-32%) and BPF (67-18%) was far lesser in the second group. The hospital stay was also lesser in this group. In our series, BPFs were associated with necrotizing pneumonia or to a wrongly inserted chest drain. The key to early recovery and early removal of the chest tube appears to be complete removal of necrotic lung tissue. This often entails lobectomy which some surgeons are reluctant to do leading to delayed recovery. Patients with persistent consolidation are more difficult to treat as excision is not the answer here.

One has to wait patiently for the lung to heal. Some patients had to be discharged home on open tube thoracostomy. There were only two patients with nearly complete involvement of the entire lung, due to chronic compression by the thick pleura However, no patient underwent obliteration of pleural space by muscle/omental flaps or thoracoplasty.

Our study has shown that most cases of empyema are secondary to pneum. Delayed referral increases morbidity by not only increasing parenchymal involvement but also causing a state of malnutrition. The effect on the lung by the pneumonitic process and the compression by the thickened pleura which has stopped physiologically functioning has a variable effect. Apart from necrosis and consolidation which may be similar in patients presenting before and after

3 weeks, the incidence of reduced compliance of the lung and loss of lung tissue in chronic cases has a major effect on postoperative recovery. One should strive to correctly treat these patients at least when they are in stage II of their disease.

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