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Original article
SURGICAL MANAGEMENT OF PAEDIATRIC EMPYEMA

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ABSTRACT

Introduction: Empyema thoracis is defined as a collection of suppurative fluid in the pleural space. Pleural space infections arise secondary to a subjacent pneumonia or may complicate thoracic injury. In the paediatric population, parapneumonic effusion is the most frequent aetiology. [1]

Aims and Objectives: We undertook a study of all patients admitted between 2014 to 2016 with empyema thoracis who required surgical intervention in the form of intercostal drainage tube insertion, thoracotomy, thoracoscopy or a combination thereof.

Materials and Methods: We did a retrospective study of 290 patients in VS General Hospital, patients ranging from infancy to 14 years who presented with empyema thoracis.

Conclusions: Video assisted thoracoscopic surgery is the preferred modality for the management of paediatric empyema if they present in the early stage as it is minimally invasive. More complicated empyemas or those that present in the later stages might need thoracotomy with decortication.

INTRODUCTION

The diagnosis and treatment of bacterial empyema are best understood in relation to the altered anatomy and pathological physiology of the pleura and the associated host defence dysfunctions.

Streptococcus pneumoniae used to be the most common organism causing parapneumonic effusions in the pre-penicillin era[6]. However, in the late 1950s Staphylococcus aureus became the main organism producing childhood empyema. Both traumatic and iatrogenic injury to adjacent structures may lead to secondary infection and involvement of the pleura. Similarly, retropharyngeal, retroperitoneal and vertebral or paravertebral infections can also extend to the pleura.

The formation of empyema has been divided into three phases- the exudative phase during which pus accumulates; a fibro purulent phase during which fibrin deposition and loculation of pleural exudate occurs; and an organisation phase during which fibroblast proliferation and scar formation cause lung entrapment. Prompt diagnosis and intervention should circumvent the second and the third phases of empyema formation. To achieve this goal, physicians need to appreciate the subtleties of clinical expression of pleural empyema and the adverse effects of the suppurative environment on antimicrobial efficacy and tissue injury in the pleural space.

Currently patients of empyema are treated with antibiotics, percutaneous aspirations under USG guidance, intercostal drain tube placement, open thoracotomy, or a video-assisted thoracoscopic surgery, or a combination thereof. The treatment is individualised according to the way the patient presents and the extent and stage of empyema.

MATERIAL AND METHODS

The present study of 'Surgical management of paediatric empyemas' was carried out in the Department of Paediatric Surgery in V.S. General Hospital, a tertiary care centre. We studied 290 cases of empyema thoracis admitted for a duration of six years from the year 2011 to 2016, the age group extending from infancy to 14 years.

While assessing the patients, a detailed history was taken and signs and symptoms of empyema were noted. Most of the patients were referred from PHCs, CHCs and district hospitals and by paediatricians. Most of them had been treated by oral and often an inadequate antibiotic course. The most common presentation consisted of fever, cold, cough and respiratory distress. However, fever persisted with gradual development of respiratory distress. At this stage, an X-ray of the chest and ultrasound were done which were suggestive of pleural effusion, hydropneumothorax or

empyema. Treatment in all cases of empyema was started as soon as diagnosis was confirmed by investigations. Primary treatment was supportive including oxygen through mask/hood or by nasal catheter. In the event of respiratory distress, ICD insertion was done, followed by thoracoscopy or open thoracotomy at a later stage. If there was no respiratory distress and a short clinical history of less than 15 days, a primary thoracoscopy was done. Initial antibiotic regime consisted of amoxicillin +clavulanic acid and amikacin, awaiting the culture and sensitivity.

RESULTS

Pleural fluid culture showed growth in only 90 out of 290 patients as most of our patients had received some form of antibiotic therapy before presenting to us.

Organism	Pleural Fluid Culture
Staphylococcus aureus	50
Pseudomonas	26
Streptococcus pneumoniae	4
Klebsiella	8
Escherichia coli	2

The most commonly identified organism is Staph aureus, followed by Pseudomonas.

The stage of the disease was decided by the consistency of pus, chest X-ray, thoracotomy/thoracoscopy findings. The stage of empyema most commonly seen in this study of 290 patients was Stage 2 (fibrinopurulent) consisting of 200 patients, followed by Stage 1 (exudates) with 50 patients and lastly stage 3 (organised) with 40 patients.

Stage of Disease	Number of Patients
Stage I	50
Stage II	200
Stage III	40

The type of treatment given in our study was as follows-

1	antibiotics with/without aspiration	6
2	ICD only+ antibiotics	44

3	ICD followed by VATS	30
4	Primary VATS	170
5	Thoracotomy	40
	➢ Followed by ICD	10
	➢ Followed by VATS	30

The average number of days of intercostal tube drainage required in conservative vs operative management was as following-

Antibiotics with/without aspiration	13
ICD only with Antibiotics	17
ICD followed by VATS	25
Primary VATS	20
Thoracotomy	25

The average length of hospital stay in our study was-

Antibiotics with/without aspiration	25
ICD only with Antibiotics	19
ICD followed by VATS	32
Primary VATS	24
Thoracotomy	27

DISCUSSION

In the pre-antibiotic era, empyema was a complication seen in 10% of patients who survived bacterial pneumonia[5].The optimal management of children with empyema can be controversial[9,10]. While many patients can be treated with antibiotics or closed tube drainage, the success of this treatment depends on the character of pleural exudates. A good intercostal drain care culminates into early and complete expansion of lung, complete evacuation of pus from pleural cavity and reduction of hospital stay.

Thoracoscopy is an ideal minimal invasive procedure which when used early to treat children with acute and fibrinopurulent empyema allows for visualization of the entire pleural cavity and debridement and irrigation of all inflammatory debris. It does not prohibit subsequent surgical intervention or decortication, should these additional procedures become necessary.

In our series, we offer tube thoracostomy as an emergency procedure, followed by VATS decortication whenever indicated. Open decortication was reserved for grade III empyema patients.

Ruptured liver abscess maybe a cause of empyema. In our study 10 patients of ruptured liver abscess presented with empyema and got managed with intercostal drainage and antibiotics. Simultaneously with drainage of liver abscess, 3 of these patients were taken up for VATS decortication.

Multiloculation of the pleural space is the most significant cause of drainage failure[4].

Although VATS does not accomplish as thorough a pleural cleansing as thoracotomy with decortication, it is often successful because the bacterial load and inflammatory exudates are reduced below a critical level allowing the pleural space to recover. It has the advantages of limiting morbidity to skin, muscles, nerves and supporting structures which occur following a large surgical incision.

Lawrence DR in their study concluded that primary surgical therapy with VATS should be considered for all patients with pleural empyema irrespective off the duration of symptoms[7].

Mackinlay et al reported 31 patients in fibrinopurulent phase treated with VATS and compared this group with 33 patients treated by formal thoracotomy[8]. They stated that VATS treatment had the same success rate as open thoracotomy but offered substantial advantages over thoracotomy in terms of resolution of the disease, hospital stay , and cosmesis.

Cassina PC in their study concluded that VATS represent a suitable treatment for fibrinopurulent empyema when chest tube drainage and fibrinolytic agent have failed to achieve the proper results, while in a latest organising phase, full thoracotomy with decortication remained treatment of choice[3]. This was substantiated by the results of our series, where 15 patients presented in later phase had to undergo thoracotomy.

In a study of 10 patients of empyema,Shah et al concluded that, thoracoscopy has come as a new ray of hope for the patients with empyema, with the advantages of complete evacuation, minimal pulmonary

dysfunction, reduced pain and hospital stay[2]. All the patients recovered well with an early removal of intercostals tube and reduced post-operative hospital stay and showed complete resolution of empyema on follow up.

CONCLUSION

Thoracic empyema in the paediatric population is usually a complication of bacterial pneumonic process with several treatment options. In its early stage, it is treated by tube thoracostomy for drainage as an adjunct to appropriate antibiotic therapy directed at causative organisms. Thorough chest physiotherapy is mandatory for management of empyema.

The VATS technique for thoracic empyema is a well-tolerated, minimally invasive technique, with good therapeutic results, mild post-operative complications and reduced hospitalisation. VATS should be considered as a treatment of choice for thoracic empyema in the fibrinopurulent stage as it is more effective when applied primarily.
To achieve a high success rate with VATS, early referral of the patient is required.
Conversion thoracotomy should be liberally used in case of chronicity especially after long history. When organised pus has developed, open surgery should be undertaken and complete decortication done.

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