ECRONICON OPEN ACCESS

EC PAEDIATRICS
Research Article

Role of Primary VATS for the Treatment of Empyema Thoracis in Children

Ali Raza Brohi[1]*, Naseem Mengal[1] and Abdul Lateef laghari[2]

[1]*Peoples University of Medical and Health Sciences, Nawabshah Sindh, Pakistan*

[2]*The Aga Khan University, Karachi, Pakistan*

***Corresponding Author:** Ali Raza Brohi, Department of Paediatric Surgery, M&CH, Peoples University of Medical and Health Sciences, Nawabshah Sindh, Pakistan.

Received: April 04, 2022; **Published:** April 27, 2022

Abstract

Introduction: Empyema is an entity frequently encountered in pediatric age group. It is the collection of suppurative fluid in the pleural cavity secondary to bacterial pneumonia and may include other causes such as malignancies and immunological disorders. Different guidelines are available for management of empyema in adults however there is no consensus on management of empyema in children. Generally accepted treatment modalities in the order of minimal to most invasive include Antibiotics, Intercostal Chest Drainage, Fibrinolytic Therapy, Video Assisted Thoracoscopic Surgery (VATS), and open thoracotomy, with open thoracotomy usually being restricted to treating the most advanced stages i.e. stage 3.

Materials and Methods: This is a retrospective descriptive study conducted at Maternal and Children Hospital; a tertiary care hospital in Nawabshah, Pakistan built with the intention to provide better maternal and child care to the surrounding urban and rural areas. The duration of this study was 6 years (January 2015 to January 2021) during which a total of 65 patients diagnosed with stage II and some stage III empyema were enrolled via non-probability consecutive sampling.

Results: A total of 65 patients were enrolled during the 6-year period of the study, of which 38 were males and 27 were females, with ages ranging from 2 to 11 years and a median of 6 years. 40 patients (61.5%) underwent primary VATS, whereas the remaining 25 patients (38.5%) underwent secondary VATS (VATS after chest tube for drainage initially). The duration of stay ranged from 3 to 10 days, with a median of 6 and 8 days for Primary and Secondary VATS.

Conclusion: Primary VATS is a better modality and, in our experience, should be preferred over simple chest tube drainage where possible. As presented above, the level of complexity is generally lower if opted for earlier. The procedure is simple to learn and will also act in smoothening the learning curve for other thoracoscopic surgeries.

Keywords: *Empyema Thoracis; Children; Primary VATS*

Introduction

Empyema is an entity frequently encountered in pediatric age group. It is the collection of suppurative fluid in the pleural cavity secondary to bacterial pneumonia and may include other causes such as malignancies and immunological disorders [1]. The disease has

three distinct stages as classified by the American Thoracic Society. The first stage is referred to as the exudative stage, which includes sterile inflammatory exudative fluid in the pleural cavity without fusion of the pleura. The second stage referred to as the fibrinopurulent stage is a result of migration of leukocytes, and a resulting fibrin peel deposition which restricts lung movement. The third stage termed as the organizing stage is where the loculations start arising in the pleura forming distinct pouches, with ingrowing capillaries and thick fibrinous peel severely limiting lung movement and therefore ventilation.

Although the incidence of this pathology is 0.6%, it has been associated with a high mortality if not managed appropriately early during the disease process [2]. Different guidelines are available for management of empyema in adults however there is no consensus on management of empyema in children. Generally accepted treatment modalities in the order of minimal to most invasive include Antibiotics, Intercostal Chest Drainage, Fibrinolytic Therapy, Video Assisted Thoracoscopic Surgery (VATS), and open thoracotomy, with open thoracotomy usually being restricted to treating the most advanced stages i.e. stage 3.

Despite the availability of modern drugs, vaccines and better diagnostic modalities, empyema remains one of the most common complication of pneumonia with a reported mortality rate between 10% and 20%. Although Intercostal Drainage is accepted as a relatively less invasive intervention however its role is significantly controversial as compared to VATS or thoracotomy [3]. A recent study showed higher rates of readmission and reintervention in patients treated with chest tubes for thoracic empyema, therefore favoring earlier surgical intervention [4]. The primary goal in the treatment of thoracic empyema is ensuring adequate re-expansion of lung and appropriate treatment modality is stage-dependent as well as on the surgeon's experience and judgment [5]. Although no consensus currently exists on application of VATS as the first-line therapy for empyema, a systematic review showed very convincing results for the use of VATS as the first line management [6].

Rationale: In our experience chest tube placement in children with empyema delays any operative intervention. Primary VATS if done early has shown some promising results at our center, therefore we hereby share our experiences on role of Primary VATS in the treatment of Empyema to encourage this practice and form a better ground to make it a standard of practice.

Methods

Study population and design

This is a retrospective descriptive study conducted at Maternal and Children Hospital; a tertiary care hospital in Nawabshah, Pakistan built with the intention to provide better maternal and child care to the surrounding urban and rural areas. The duration of this study was 6 years (January 2015 to January 2021) during which a total of 65 patients diagnosed with stage II and some stage III empyema were enrolled via non-probability consecutive sampling and observed for early and late complications, which included Pneumothorax due to persistent leak, Lung Collapse, Extravasation/hemothorax, mechanical ventilation, and Bronchopleural fistula. Outcomes were measured at the time of discharge and during OPD follow-ups. Demographic and anthropometric data were collected using medical records. Descriptive analysis was carried out using SPSS version 26. Mean and standard deviations were calculated for age. Frequency and percentage were calculated for complications.

Surgical technique

All patients underwent general anesthesia with single lumen cuffed endotracheal tube. The patients were positioned in lateral decubitus, with trocar placements optimized based on every individual patient to get maximum exposure and enhanced dexterity. All VATS were done using 3 ports with or without a fourth utility incision. The first 5 mm trocar was inserted according to the site of empyema

so as to provide maximum exposure, generally from the fifth intercostal space along the mid-clavicular line, along with additional two trocars placed depending upon the empyema cavity or loculations and ergonomics to allow for maximum dexterity (Figure 1). Most cases involved an anterior approach as described above, however some cases were approached via posterior trocar insertion as well. A fourth utility incision was given in a few cases to aid the procedure. Two monitors preferred in most of cases as to look all around and debride properly. The gas used was kept at a pressure of 6 - 7 mm Hg at a flow rate of 1 L/min. Debridement/Decortication was done by dividing adhesions while fibrin clots and debris were suctioned and removed using grasping forceps and suction irrigation tube simultaneously to achieve maximal clearance and lung expansion. After this all fissures were identified and on table expansion was done with assistance from anesthetist and decreasing intrathoracic CO2 pressure. This was followed by a chest tube insertion usually along the fifth intercostal space along the mid clavicular line under direct vision using thoracoscope (Figure 2). All patients were observed in ICU for the first 48 hours and shifted to ward once clinically stable.

Figure 1

Figure 2

Results

A total of 65 patients were enrolled during the 6-year period of the study, of which 38 were males and 27 were females, with ages ranging from 2 to 11 years and a median of 6 years. There were variable presenting complains; 49 patients (75%) were febrile, 15 patients (23%) had cough while 19 patients (29%) had respiratory distress. All patients underwent x-ray chest, ultrasound and CT Scan to confirm diagnosis and for staging of the disease which revealed Stage II empyema in 50 patients (77%) and Stage III empyema in 15 patients (23). 40 patients (61.5%) underwent primary VATS, whereas the remaining 25 patients (38.5%) underwent secondary VATS (VATS after chest tube for drainage initially). The duration of stay ranged from 3 to 10 days, with a median of 6 and 8 days for Primary and Secondary VATS. Operative time was between 45 to 120 minutes, and a mean of 66 and 71 minutes for Primary and Secondary VATS, respectively. Intra-operative decision for Conversion to Open thoracotomy was made in 2 patients based on findings during VATS; both patients were advanced cases of Stage III empyema, post operatively chest tube was kept for 3 to 10 days, with a median of 4 and 6 days for Primary and Secondary VATS, respectively whereas mechanical ventilation was required in 3 patients. Other complications included Persistent leak leading to pneumothorax which was found in 7 patients, followed by lung collapse in 5 patients. Broncho-pleural Fistula was found in one patient and was confirmed clinically and radiologically via CT scan. One patient also developed hemothorax.

Discussion

Despite being frequently encountered in the pediatric age group, no consensus for standard management of empyema exists. This pathology is associated with a high mortality if adequate management is not ensured earlier on in the disease process [2]. Generally accepted treatment modalities in the order of minimal to most invasive include Antibiotics, Intercostal Chest Drainage, Fibrinolytic Therapy, Video Assisted Thoracoscopic Surgery (VATS), and open thoracotomy, with open thoracotomy usually being restricted to treating the most advanced stages i.e. stage 3. However, with modern advances and early recovery after minimally invasive surgeries, VATS is the now the most attractive and promising method of treatment. Although Intercostal Drainage is accepted as a relatively less invasive intervention however its role is significantly controversial as compared to VATS or thoracotomy [3]. Keeping this in perspective and the constant advancement in the technique and equipment, VATS is becoming an extremely safe intervention to an extent where it can now be considered as an intervention which can forego a chest tube placement. We studied this at our center and observed significant promising outcomes which is similar to studies elsewhere which observed similar significant results [7-9].

During the period of the study we enrolled a total of 65 patients with a male to female ratio of 1.4:1, however this predominance likely has no association with the disease pathophysiology. The age of patient population in our study ranged from 2 to 11 years, with a median of 6 years which is similar to observations made elsewhere [10]. Presentations are variable, however patients most commonly presented with fever (75%, n = 49), followed by cough (23%, n = 15) and respiratory distress (29%, n = 19). Prior to any intervention all patients underwent radiographic investigations which included Ultrasound and CT Scan for confirmation of diagnosis and for staging of the disease, which is the standard protocol for empyema thoracis [11]. CT scan revealed Stage II empyema in 50 patients (77%) and Stage III empyema in 15 patients (23%). Depending upon the earliest possible intervention patients were divided into two groups i.e. primary VATS where patient underwent VATS without chest tube drainage initially, and secondary VATS where patient underwent VATS after initial chest tube drainage. Primary and Secondary VATS had 40 (61.5%) and 25 (38.5%) patients, respectively.

The duration of hospital stay ranged from 3 to 10 day, with a median of 6 days for Primary VATS and 8 days for Secondary VATS which isn't much different from other institutions where most authors have observed a median of 6 days post-intervention [12,13]. Operative time in both groups ranged between 45 to 120 minutes, however the average operative time was 65 and 71 minutes in primary and secondary VATS, respectively. Primary VATS therefore also favors in terms of reduced complication due to comparatively early intervention.

Intra-operative decision for Conversion to Open thoracotomy was made in 2 patients based on findings during VATS; which revealed that both patients had advanced cases of Stage III empyema and has already been suggested in literature which suggests that VATS is not the ideal intervention in cases of advanced stage III empyema and Broncho-pleural fistula [14]. Post operatively chest tube was placed for 3 to 10 days, with a Median of 4 and 6 days in primary and secondary VATS, respectively. Similar results were observed elsewhere, with average chest drain placement required for approximately 4.4 days [10]. Observed complications included Persistent leak leading to pneumothorax in 7 patients (10.7%), followed by lung collapse in 5 patients (7.7%). Broncho-pleural fistula was found in one patient, a rather rare complication, and was confirmed clinically and radiologically via CT scan, requiring redo surgery.

Conclusion

Primary VATS is a better modality and, in our experience, should be preferred over simple chest tube drainage where possible. As presented above, the level of complexity is generally lower if opted for earlier. The procedure is simple to learn and will also act in smoothening the learning curve for other thoracoscopic surgeries.

Bibliography

1. Mohajerzadeh L., *et al*. "Thoracotomy versus video-assisted thoracoscopy in pediatric empyema". *Korean Journal of Thoracic and Cardiovascular Surgery* 52.3 (2019): 125-130.
2. Shojaee S and Lee HJ. "Thoracoscopy: Medical versus surgical-in the management of pleural diseases". *Journal of Thoracic Disease* 7.4 (2015): S339-S351.
3. Shen KR., *et al*. "Thoracic: AATS expert consensus guidelines: empyema The American Association for Thoracic Surgery consensus guidelines for the management of empyema". *Journal of Thoracic and Cardiovascular Surgery* 153.6 (2017): e129-e146.
4. Semenkovich TR., *et al*. "Current State of Empyema Management". *Annals of Thoracic Surgery* 105.6 (2019): 1589-1596.
5. Surg LA., *et al*. "Stage-directed therapy of pleural empyema American College of Chest Physicians". *Langenbeck's Archives of Surgery* 402.1 (2016): 15-26.
6. Pan H., *et al*. "A meta-analysis of video-assisted thoracoscopic decortication versus open thoracotomy decortication for patients with empyema". *Journal of Thoracic Disease* 9.7 (2017): 2006-2114.
7. Wait MA., *et al*. "A randomized trial of empyema therapy". *Chest* 111.6 (1997): 1548-1551.
8. Cataneo DC., *et al*. "Comparative Study of Chest Tube Thoracostomy vs Video-Assisted Thoracoscopic Surgery in the Treatment of Empyema in Children". *Chest* 138.4 (2010): 328A.
9. Coote N and Kay ES. "Surgical versus non-surgical management of pleural empyema". *Cochrane Database of Systematic Reviews* 4 (2005): CD001956.
10. Avansino JR., *et al*. "Primary operative versus nonoperative therapy for pediatric empyema: A meta-analysis". *Pediatrics* 115.6 (2005): 1652-1659.
11. Puligandla PS and Laberge JM. "Infections and Diseases of the Lungs, Pleura, and Mediastinum [Internet]". 7th edition. Pediatric Surgery. Elsevier Inc. (2012): 855-880.

12. Sonnappa S., *et al*. "Comparison of urokinase and video-assisted thoracoscopic surgery for treatment of childhood empyema". *American Journal of Respiratory and Critical Care Medicine* 174.2 (2006): 221-227.

13. St Peter SD., *et al*. "Thoracoscopic decortication vs tube thoracostomy with fibrinolysis for empyema in children: a prospective, randomized trial". *Journal of Pediatric Surgery* 44.1 (2009): 106-111.

14. Gates RL., *et al*. "Does VATS Provide Optimal Treatment of Empyema in Children? A Systematic Review". *Journal of Pediatric Surgery* 39.3 (2004): 381-386.

Volume 11 Issue 5 May 2022