

Surgical Management of Paediatric Empyema: Open Thoracotomy versus Video-assisted Thoracic Surgery

Farhan Ahmad Majeed¹, Sohail Saqib Chatha², Usama Zafar¹, Umar Farooq Chatha³, Abdullah Zakauallah Chatha³ and Zain Farooq²

¹Department of Thoracic Surgery, Combined Military Hospital, Multan, Pakistan

²Department of Thoracic Surgery, Combined Military Hospital, Rawalpindi, Pakistan

³Department of General Surgery, Fauji Foundation Hospital, Rawalpindi, Pakistan

ABSTRACT

Objective: To compare the effectiveness of open thoracotomy and video assisted thoracic surgery (VATS) for *empyema thoracis* in paediatric population.

Study Design: Observational study.

Place and duration of study: This observational study was conducted at Department of Thoracic Surgery, CMH, Lahore, from October 2013 to August 2018.

Methodology: Medical record of children up to the age of 14 years who were operated for *empyema thoracis* was reviewed. Patients were divided into two groups: Open thoracotomy, and VATS; and compared for etiology, preoperative treatment, grade of empyema, procedure performed; histopathology and complications, e.g. post-thoracotomy neuralgia, surgical site infection, recurrence over 6 months.

Results: A total of 61 paediatric patients were operated for *empyema thoracis*. Age ranged between 1 to 14 years (mean = 10.25 ± 3.30 years). Most common etiology of empyema was tuberculosis in 24 (39.3%) cases, followed by pneumonia in 22 (36.1%). Surgical treatment consisted of open thoracotomy in 40 (65.5%) cases, while 21 (34.5%) underwent VATS. Postoperative X-ray was satisfactory in 38 (95%) cases undergoing open thoracotomy as compared to 21 (100%) cases undergoing VATS (p-value 0.29). There was no recurrence in either of the two groups over a follow-up period of six months. Overall complication rate was 32.5% (13 cases) in cases undergoing open thoracotomy, while 33.3% (7 cases) in VATS group (p-value 0.95). There was one (2.5%) mortality in open thoracotomy group, while no death occurred in VATS group.

Conclusion: Early surgical treatment, both open as well as VATS, gives satisfactory results in management of paediatric *empyema*. VATS is a safe alternative to open thoracotomy with good success rate and less incidence of complications.

Key Words: *Empyema thoracis*, Thoracotomy, VATS, Paediatrics.

How to cite this article: Majeed FA, Chatha SS, Zafar U, Chatha UF, Chatha AZ, Farooq Z. Surgical management of paediatric empyema: open thoracotomy versus video-assisted thoracic surgery. *J Coll Physicians Surg Pak* 2020; **30(3)**:309-312.

INTRODUCTION

Paediatric *empyema thoracis* is a common condition in children managed by thoracic and paediatric surgeons in developing countries, and is associated with significant morbidity and mortality.¹ It is considered as a significant cause of paediatric hospital admissions, and especially in developing countries where hospital resources are limited.² Most cases respond to antibiotic therapy and intercostals drainage in earlier stages; however, in majority of cases surgical management is required especially in our part of the world due to delayed presentations, multiresistant strains, delayed diagnosis, poor compliance with medication, and mismanagement at early stages of the disease. A meta-analysis performed

regarding management of paediatric *empyema thoracis* has shown that primary operative therapy is associated with lesser mortality, decreased hospital stay, shorter duration of antibiotic therapy and less chances of reintervention.³

Historically, the treatment consisted of open thoracotomy and decortications. However, now VATS is also being employed as a standard treatment at majority of centres by thoracic surgeons. Recent studies demonstrate the efficacy and safety of VATS in the treatment of *empyema* in children.^{4,5}

The purpose of this study was to evaluate and compare open thoracotomy and VATS in the management of paediatric *empyema*.

METHODOLOGY

This observational study was conducted in the Department of Thoracic Surgery, CMH, Lahore, from October 2013 to August 2018. Medical record of children with diagnosis of *empyema thoracis* from age 1 to 14 years, who had open thoracotomy or VATS, were

Correspondence to: Dr. Sohail Saqib Chatha, PAF Hospital, Lahore, Pakistan

E-mail: drsohailchatha@hotmail.com

Received: April 26, 2019; Revised: August 02, 2019;

Accepted: September 11, 2019

reviewed retrospectively. The children included in the study were diagnosed with empyema thoracis based on purulent pleural tap and effusion demonstrated on chest X-ray, ultrasound, and CT scan of chest. Decision to perform open surgery or VATS was made by consultant thoracic surgeon based on condition of the patient and stage of the empyema. Stage 1 and early stage 2 empyema underwent VATS; whereas, late stage 2 and stage 3 empyemas were treated by open thoracotomy. All the procedures were performed by single surgeon. Fluid obtained was subjected to gross examination (total and differential cell count), biochemistry (sugar and protein), gram/AFB stain, and bacterial culture and sensitivity (C/S). The criteria for discharge of the patients were absence of fever for at least 3 days, expanded lung on postoperative chest X-ray, chest tube removed, absence of tachypnoea, and good oral intake. Patients were followed up for at least 6 months after discharge.

Data was analysed using SPSS statistical package 20.0. Descriptive statistics was used and analysed by using cross tabs; and level of significance was calculated using Pearson Chi-square test. P-value <.05 was considered significant.

RESULTS

Sixty-one children were treated surgically for *empyema thoracis*. Age ranged between 1 to 14 (mean = 10.25 ±3.30) years. Tuberculosis was etiology in 24 (39.3%) cases followed by pneumonia in 22 (36.1%), other causes included trauma in 9 (14.8%) cases, post-surgical in 3 (4.9%) cases and 3 (4.9%) cases had other causes. Organism isolated on C/S were gram-negative in 17 (27.9%) followed by gram-positive in 16 (26.2%) cases and anaerobes in 6 (9.8%) cases, while in 22 (36.1%) no organism was isolated. There was no growth of AFB in any of the fluid sampes (Table I).

Treatment consisted of open thoracotomy in 40 (65.5%) cases, while 21 (34.5%) underwent VATS. In open procedure, standard posterolateral serratus sparing thoracotomy was done while in VATS uniportal incision was used. Average scar size in case of open thoracotomy was 11 cm; whereas, in case of VATS it was 3 cm uniportal incision. Postoperative X-ray was satisfactory (expanded lung) in 38 (95%) cases undergoing open thoracotomy as compared to 21 (100%) cases undergoing VATS (p = 0.29). There was no recurrence in either of the two groups over a follow-up period of six months (Figure 1).

Overall complication rate was 32.5% (13 cases) in cases undergoing open thoracotomy, while 33.3% (7 cases) in VATS group (p=0.95). Most common complication in open thoracotomy group was PTN, which occurred in 9 (22.5%) cases; while in VATS group, most common complication was again PTN but it occurred in 3 (14.5%) cases (p = 0.44). There was 1 (2.5%) mortality in open

thoracotomy group while no death occurred in VATS group. Bleeding occurred in 5 (12.5%) cases in open thoracotomy group, while in VATS group it occurred in 2 (9.5%) cases. Surgical site infection occurred in 7 (17.5%) cases in post-thoracotomy group, while no case of SSI occurred in those undergoing VATS (p=0.042, Figure 2).

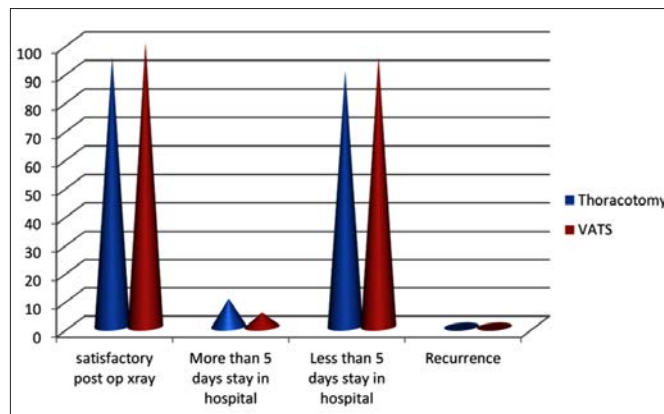


Figure 1: Postoperative efficacy of the two procedures.

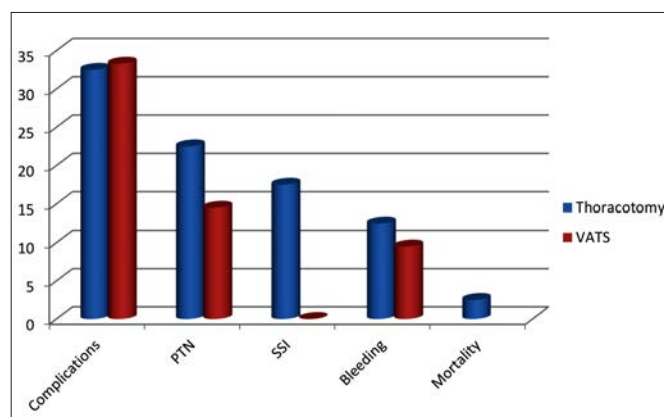


Figure 2: Complications of thoracotomy and VATS.

Table I: Baseline characteristics.

Variable	Frequency	Percent
Gender		
Male	35	57.4
Female	26	42.6
Grade of empyema		
Early	16	26.2
Late	45	73.8
Etiology		
Tuberculosis	24	39.3
Pneumonia	22	36.1
Post-trauma	9	14.8
Post-surgical	3	4.9
Others	3	4.9
Organism on C/S		
Nil	22	36.1
Gram negative	17	27.9
Gram positive	16	26.2
Anaerobes	6	9.8

Overall hospital stay was less than 5 days in 36 (90.0%) cases in open thoracotomy group, while 20 (95%) patients stayed less than 5 days in VATS group ($p=0.48$). In open thoracotomy group, single chest tube was inserted in 23 (57.5%) cases, while 2 chest tubes were inserted in 17 (42.5%) cases whereas in VATS group single chest tube was inserted in 20 (95%) cases while in only 1 (5%) case 2 chest tubes were inserted. Average day of chest tube removal for first chest tube was 2.8 days in VATS group, while in thoracotomy group first chest tube was removed averagely on 2.3 days, while second chest tube was removed averagely on 5.4 days. Blood transfusion was needed in 19 (47.5%) cases in open thoracotomy group while in VATS group blood transfusion was needed in 7 (33%) cases.

DISCUSSION

Early aim in the management of empyema is to control sepsis and eradicate the fever by evacuation and sterilisation of pleural cavity and ensuring reexpansion of the lung and restoration of lung function;⁶ whereas, the long term aim is to prevent lung damage. Inadequate treatment and drainage can lead to persistence of infection and significant morbidity and mortality. Early and prompt surgical treatment is necessary to achieve this goal. However, decision to choose between operative and non-operative treatments has been a matter of debate amongst clinicians treating empyema thoracis due to difficulty in adequately deciding the stage of empyema.⁷ However, it has been shown in multiple studies that earlier intervention and debridement yields better results.^{8,9} The indication and choice of surgical intervention depend largely on stage of the disease, local surgical experience and expertise and personal preference of the surgeon. With growing trend towards non-invasive surgery, thoracoscopy has established its place in the management of thoracic empyema even in paediatric population. With the advent of fiberoptic and more advanced instrumentation, more thoracoscopic procedures are now being performed.^{10,11}

This study highlighted the effectiveness of early surgical treatment for empyema thoracis in children and effectiveness of VATS, especially in early stages of empyema.

The use of VATS in the management of fibrinopurulent stage 2 empyema has shown rewarding results in several reports.^{12,13} It was shown in the present study as well, where 75% of empyema was of late stage and effectively treated by VATS. In one of the largest studies, which was conducted in the United Kingdom by Bishay *et al.*,¹⁴ 114 children underwent and it was concluded that VATS has a very good outcome in childhood empyema as it has an important role in the management of this condition. This finding was verified in this study as well, where 100% X-rays in the postoperative period

showed fully expanded lungs and resolution of empyema. There was no recurrence over a follow-up period of six months. In one of the retrospective studies conducted on VATS for management of paediatric empyema, there was good pleural recovery and zero mortality,¹⁵ and these findings are consistent with the results of this study.

In this study, mean hospital stay was less than 5 days in 90 percent of patients undergoing open thoracotomy and 95% of patients undergoing VATS. In the study conducted by Jadhav *et al.*,¹⁶ the median postoperative hospital stay was 10.31 ± 3.751 days in case of VATS, whereas in case of open thoracotomy it was 4.41 ± 1.593 days. Gupta *et al.*¹⁷ found a more rapid recovery with a less number of chest tube days and decreased length of hospital stay. In the present study, the average time of chest tube removal was 2.8 days while in thoracotomy it was 5.4 days. In a study conducted by Sharma *et al.*, chest tube was removed on an average 7 days in VATS arm, while in a primary thoracotomy arm longer time (16 days) required for chest tube removal.¹⁸

Use of VATS in the management of *empyema thoracis* in children has gained popularity in last few years. VATS is suggested to have potential advantages over open surgery in terms of having shorter incisions and lesser injury to muscles, nerves and lesser incidence of post operative pain, infection and scar size.¹⁹ This study also verified this fact where PTN was less in case of VATS (14.5% vs. 22.5%), no case of surgical site infection (SSI) vs. 17.5% in open thoracotomy. In this study, success rate in the treatment of empyema was similar in both groups (VATS vs Open thoracotomy) and this fact has been verified in various studies.

Retrospective collection of data and smaller number of cases are major limitations of this study. However, this study gives an insight into the management of paediatric empyema, based on which well designed studies can be conducted to establish standard guidelines.

CONCLUSION

In the present study, early surgical treatment, whether open or VATS, gives satisfactory results in the management of paediatric empyema; and VATS is an attractive and safe alternative to open thoracotomy in experienced hands with equal success rate and lesser incidence of complications and postoperative morbidity and mortality. Moreover, similar results have been reported in the literature as well.

ETHICAL APPROVAL:

Institutional and Ethical Review Committee of CIMS approved the study and the said letter was sent as well.

PATIENTS' CONSENT:

Consent was obtained from patients regarding publication of data

CONFLICT OF INTEREST:

Authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

FAM, SSC, UZ, UFC, AC, ZF: Data collection, literature review, and analysis.

REFERENCES

1. Menon P, Kanojia RP, Rao KLN. Empyema thoracis: Surgical management in children. *Int J Contemp Pediatr* 2017; **4**:882-5.
2. Mishra OP, Das BK, Jain AK, Lahiri TK, Sen PC, Bhargara V. Clinico-bacteriological study of empyema thoracis in children. *J Trop Pediatr* 1993; **39**:380-1.
3. Avansino JR, Goldman B, Sawin RS, Flum DR. Primary operative versus nonoperative therapy for pediatric empyema: A meta-analysis. *Pediatrics* 2005; **115**:1652-9.
4. Stringel G, Hartman AR, Marandi P. Video-assisted thoracoscopy for pulmonary decortication in children. *Pediatr Surg Int* 1995; **10**:205-6.
5. Stovroff M, Teague G, Heiss KF, Parker P, Ricketts RR. Thoracoscopy in the management of pediatric empyema. *J Pediatr Surg* 1995; **30**:1211-5.
6. Avansino JR, Goldman B, Sawin RS, Flum DR. Primary operative versus nonoperative therapy for pediatric empyema: A meta-analysis. *Pediatrics* 2005; **115**:1652-9.
7. Zampoli M, Zar HJ. Empyema and parapneumonic effusions in children: An update. *SA J Child Health* 2007; **1**:121-8
8. Menon P, Kanojia RP, Rao KL. Empyema thoracis: Surgical management in children. *J Indian Assoc Pediatr Surg* 2009; **14**:85-93
9. Kang DW, Campos JR, Andrade Filho Lde O, Engel FC, Xavier AM, Macedo M, et al. Thoracoscopy in the treatment of pleural empyema in pediatric patients. *J Bras Pneumol* 2008; **34**:205-11.
10. Yim AP, Hui-Ping L. Complications and failures of video-assisted thoracic surgery: Experience from two centers in Asia. *Ann Thorac Surg* 1996; **61**:538-41.
11. Rodgers BM. Pediatric thoracoscopy: Where have we come and what have we learned? *Ann Thorac Surg* 1993; **56**:704-7.
12. Ris HB, Krueger T. Video-assisted thoracoscopic surgery and open decortication for pleural empyema. *Multimedia Manual Cardiothoracic Surg* 2004; 000273.
13. Waller DA, Rengarajan A. Thoracoscopic decortication: A role for video-assisted surgery in chronic postpneumonic pleural empyema. *Ann Thorac Surg* 2001; **71**:1813-16.
14. Bishay M, Short M, Shah K, Nagraj S, Arul S, Parikh D, et al. Efficacy of video-assisted thoracoscopic surgery in managing childhood empyema: A large single-centre study. *J Pediatr Surg* 2009; **44**:337-42.
15. Manasa G. Paediatric empyema: Video-assisted thoracoscopic surgery (vats) and its outcome study. *Int J Contemp Pediatr* 2017; **4**:882-5.
16. Jadhav P. Surgical strategy of empyema thoracis in children: Open thoracotomy v/s video assisted thoracoscopy. *Int Surg J* 2018; **5**:3823-5.
17. Gupta AK, Lahoti BK, Singh S, Mathur RK, Mishra H, Wadhwa S. A study on comprehensive management of acute and chronic empyema thoracis in the pediatric age group and their outcome. *Internet J Surg* 2008; **14**:1.
18. Sharma S, Sonker SK, Nirala S. Prospective comparative study of video assisted thoracoscopic surgery versus conventional thoracostomy drainage in emyema thoracis in paediatric age group. *Int J Res Med Sci* 2015; **3**:2538-42.
19. Cardillo G, Carleo F, Carbone L, Martino MD, Salvadori L, Petrella L, et al. Chronic postpneumonic pleural empyema: comparative merits of thoracoscopic versus open decortication. *Eur J Cardiothorac Surg* 2009; **36**:914-8.

