MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.5.475.479

Study of Outcome of Surgical Intervention in Cases of Empyema Thoracis in Paediatric Age Group

[1]Rajgopal Totla, [2]Falak Pancholi, [3]Arjun Pawar and [4]Shubham Tatu

[1]Department of General Surgery, MGM Medical College, Aurangabad, India

[2,4]MGM Medical College, Aurangabad, India

[3]Department of Paediatric Surgery, MGM Medical College, Aurangabad, India

ABSTRACT

Empyema thoracis is commonly observed in children with a worldwide increasing incidence. There are different treatment modalities which have been described which include thoracentesis, antibiotics, intrapleural fibrinolytic, tube thoracostomy, video-assisted thoracoscopic surgery (VATS), open window thoracostomy and thoracotomy. Present study was aimed to study outcome of surgical intervention in cases of empyema thoracis in paediatric age group. Present study was single-center, prospective, observational study, conducted in patients of age 6 months to 18 years, either gender, primary as well as secondary cases of empyema thoracis. Among 31 cases, majority were from age group 1-5 years (41.94%), were female (54.84%). The mean age of the patients was 4.65 ± 3.85 years. Pleural peel was found to be 7.1- 8 mm in majority cases (54.84%). Side of ET was observed to be the right side (74.2%) in majority cases as compared to left side (25.8%). Common treatment modality was open decortication (45.16%), followed by VATS (32.26%), ICD (12.9%) and VATS to open (9.68%). The analysis of data showed that the ICD was removed earlier in the case of VATS as compared to open decortication. In the first week post op, the ICD was removed in 10 patients in the case of VATS while it was just in 5 patients in the case of open decorticating. The culture was found to be Sterile in case of 48.4% of the patients while it was Streptococcus pneumoniae (19.3%) and Mycobacterium Tuberculosis (16.2%) were common culture positive organisms. Hospital stay was the minimum in the case of VATS as compared to open decortication and ICD. Early detection of the disease can lead to better outcome with minimal access intervention (VATS) and lesser complications post-surgery and faster recovery.

OPEN ACCESS

Key Words

Empyema thoracis, ICD removal, video-assisted thoracoscopic surgery (VATS), open decortication

Corresponding Author

Shubham Tatu,
MGM Medical College, Aurangabad, India
tatushubham@gmail.com

Author Designation

[1]Associate Professor
[2]M.S General Surgeon
[3]Assistant Professor
[4]Junior Resident

Received: 26 January 2024
Accepted: 16 February 2024
Published: 6 March 2024

Citation: Rajgopal Totla, Falak Pancholi, Arjun Pawar and Shubham Tatu, 2024. Study of Outcome of Surgical Intervention in Cases of Empyema Thoracis in Paediatric Age Group . Res. J. Med. Sci., 18: 475-479, doi: 10.59218/makrjms. 2024.5.475.479

INTRODUCTION

Empyema thoracis is commonly observed in children with a worldwide increasing incidence. It affects around 1 out of every 150 children who are hospitalised for pneumonia with incidence rate ranging from 0.4-6 cases per 1000 children who are admitted[1,2]. Inappropriate use of antibiotics, low socio-economic status, malnutrition and delay in finding treatment are risk factors for its development in patients suffering from pneumonia[3.4]. Management of childhood empyema is challenging due to the scarcity of evidence-based A-level studies and the fact that results from adults studies cannot be used for therapeutic decisions in children[5]. The fundamental difference between empyema in adults and children is that usually empyema in children affects a previously healthy child, as a result of which clinical outcome tends to be usually excellent in spite of the associated morbidity[5]. There are different treatment modalities which have been described which include thoracentesis, antibiotics, intrapleural fibrinolytic, tube thoracostomy, video-assisted thoracoscopic surgery (VATS), open window thoracostomy and thoracotomy. However, there exists today no consensus on the optimal method and timing of the therapy[6-8].

The approach in majority of the cases depends on the stage of the disease and available resources. Although antibiotic treatment, thoracentesis and chest tube (CT) drainage tend to be usually sufficient for early stages of the disease, usually advanced empyema needs options like VATS with or without thoracotomy or fibrinolysis[9]. Present study was aimed to study outcome of surgical intervention in cases of empyema thoracis in paediatric age group

MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in department of General Surgery, MGM Medical College and Hospital, Aurangabad, India. Study duration was of 2 years (January 2021 to December 2022). Study approval was obtained from institutional ethical committee.

Inclusion Criteria:

- Patients of age 6 months to 18 years, either gender, primary as well as secondary cases of empyema thoracis, willing to participate in present study

Exclusion Criteria:

- Post traumatic cases
- Parents not willing to participate, lost to follow up

Study was explained to parents in local language and written consent was taken for participation and study. On admission, a detailed history was taken regarding age, sex, chief symptoms and duration of symptoms. A thorough clinical examination was done. All cases were investigated by routine lab tests for blood and urine and imaging in the form of chest x-ray and CECT which ever appropriate or any specific tests. CECT was done to get detailed information regarding the pleural thickening, trapped lung, endobronchial obstruction and mediastinal pathology. All patients were admitted, underwent investigations and appropriate management as per departmental protocols. Frank purulent or turbid pleural fluid on needle aspiration required prompt ICD. Other criteria of ICD procedure were pH<7,2 in pleural aspirate, isolation of organism in the pleural aspirate by gram stain or pus culture. intervention of choice is either intercostal drainage or video-assisted thoracoscopic surgery and decortication as and when needed. Primary outcome measures were to study the clinical symptomatology, etiology, microbiological cause of Empyema Thoracis and also to study the therapeutic modalities like tube thoracostomy (ICD), thoracoscopy, VATS, thoracotomy, decortication and their outcomes. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

RESULTS AND DISCUSSIONS

Among 31 cases, majority were from age group 1-5 years (41.94%), were female (54.84%). The mean age of the patients was 4.65±3.85 years. Pleural peel was found to be 7.1-8 mm in majority cases (54.84%). Side of ET was observed to be the right side (74.2%) in majority cases as compared to left side (25.8%).

Table 1: General characteristics

	No. of patients	Percentage
Age groups (in years)		
6 months-1 year	7	22.58
1.1-5	13	41.94
5.1-10	8	25.81
10.1-18	3	9.68
Mean age (mean±SD)	4.65±3.85	
Gender		
Male	14	45.16
Female	17	54.84
Pleural peel (in mm)		
6.1-7	6	19.35
7.1-8	17	54.84
8.1-9	6	19.35
9.1-9.2	2	6.45
Side of ET		
Left	8	25.81
Right	23	74.19

Table 2: Treatment Modality

Treatment modality	No. of patients	Percentage
Open decortication	14	45.16
VATS	10	32.26
ICD	4	12.9
VATS to open	3	9.68

Table 3: ICD removal and Modality

	Open Decortication	ICD	VATS	VATS to Open decortication	Total (%)
Day 4-day 8	8 (25.81%)	2 (6.45%)	10 (32.26%)	2 (6.45%)	22 (70.97%)
>day 8	6 (19.35%)	2 (6.45%)	0	1 (3.23%)	9 (29.03%)

Table 4: Histopathology

	No. of patients	Percentage
Consistent empyema	18	58.06
Tuberculous pleuritis	6	19.35
Fibrinosuppurative inflammation	3	9.68

Table 5: Antibiotic sensitivity

Sensitive antibiotic	No. of patients	Percentage
Piperacillin, amikacin	6	19.35
Piperacillin, vancomycin, amikacin	6	19.35
Piperacillin, vancomycin	4	12.9
Piperacillin, amikacin	2	6.45
Vancomycin, meropenem	2	6.45
Meropenem, colistin	2	6.45

Table 6: Culture

Culture report	No. of patients	Percentage
Sterile	15	48.39
Streptococcus pneumoniae	6	19.35
Tuberculosis	5	16.13
Klebsiella pneumoniae	3	9.68
Staph aureus (MRSA)	1	3.23
M. tuberculosis+ streptococcus	1	3.23

In present study, common treatment modality was open decortication (45.16%), followed by VATS (32.26%), ICD (12.9%) and VATS to open (9.68%). The analysis of data showed that the ICD was removed earlier in the case of VATS as compared to open decortication. In the first week post op, the ICD was removed in 10 patients in the case of VATS while it was just in 5 patients in the case of open decortication.Consistent empyema was the dominant histopathology observed (58.1%), followed by Tuberculous pleuritis (19.35%). Combination of Piperacillin+Amikacin+Piperacillin, Vancomycin+ Amikacin were the most frequently used antibiotics combination (19.35% patients each). The culture was found to be Sterile in case of 48.4% of the patients while it was Streptococcus pneumoniae (19.3%) and Mycobacterium Tuberculosis (16.2%) were common culture positive organisms. The analysis of the data clearly shows that hospital stay was the minimum in the case of VATS as compared to open decortication and ICD. No complication was seen in majority of cases (80.6%) while drain site infection, minimal pleural effusion, pneumothorax with recurrence, pneumothorax, recurrence and surgical site infection were seen in one patient each (3.23%).

Empyema is a serious complication of pneumonia and requires treatment with broad- spectrum antibiotics to ensure ample empiric coverage against the pathogens. In case of failure of treatment or in instances with moderate or large effusion with clinical deterioration and loculations, drainage of the fluid by introducing a chest drain with adding intrapleural fibrinolytics or performing VATS is conducted to boost full and speedy recovery. In present study, mean age of the patients was 4.65±3.85 years. Similar findings were noted by Sakran *et al*.[10] (mean age 4.9 years) and Sehitogullari *et al*.[11] (mean age of 4.8 years). Side of ET was observed to be the right side in case of 74.2% of the patients while it was seen to be the left side in case of 25.8% of the patients. In study by Sakran W et al.,10 right side was involved in 40% of the patients as compared to left side in 55% of the patients.

As a supplement to the antibiotic therapy, to enhance recovery, for improvement in the respiratory function and for lung re-expansion, drainage of the pleural fluid is also necessary in most of the cases. Hence a number of procedures such as chest tube insertion, thoracentesis, VATS or open decortication is needed[6-8]. In our study, analysis of data showed that the ICD was removed earlier in the case of VATS as compared to open decortication. Also, the analysis of the data clearly shows that hospital stay was the minimum in the case of VATS as compared to open decortication and ICD. In line with our findings, Avansino *et al*.[12] found that patients who were operated had lower hospital stay length, had a lower rate of re- intervention and shorter length of treatment. Kurt *et al*.[13] compared conventional thoracotomy with VATS and showed that patients who were a part of the VATS group had a reduction in the length of the stay as well as a reduction in the duration of the drainage and lesser use of narcotics. Fuller *et al*.,[14] highlighted the role played by early VATS in reducing the number of procedures and the duration of chest drainage, with reduction in the level of pain and stay in hospital and reduced morbidity.

Antibiotics are routinely prescribed for children suffering with empyema thoracis and parapneumonic effusion. Antimicrobial therapy should be started in these patients empirically and adjust accordingly to results of culture and sensitivity. The duration of the antibiotic treatment depends on the type of isolated pathogen, laboratory and clinical responses to therapy and progress to complications such as empyema. Albal *et al*.[15] suggested the use of antibiotics such as glycopeptide, cephalosporin, carbapenems, beta lactams, monobactam and aminoglycosides. Similar findings were observed in present study. The culture was found to be Sterile in case of 48.4% of the patients while it was Mycobacterium. Tuberculosis in case of 16.2% of the patients. It was found to be Streptococcus pneumoniae in case of 19.3% of the patients. In study by Sakran *et al*.[10], the most common pathogen which causes empyema in children has been found to be Streptococcus pneumoniae which was followed by

Table 7: Hospital stay

Number of days	Open Decortication	ICD	VATS	VATS to Open decortication	Total n (%)
6-10	1 (3.23%)	0	8 (35.82%)	0	9 (29.03)
11-15	4 (12.9%)	1 (3.23%)	2 (6.45%)	2 (6.45%)	9 (29.03)
16-20	7 (22.58%)	2 (6.45%)	0	1 (3.23%)	10 (32.26)
>20	2 (6.45%)	1 (3.23%)	0	0	3 (9.68)

Table 8: Complications

Complications	No. of patients	Percentage
Drain site infection	1	3.23
Minimal pleural effusion	1	3.23
Pneumothorax with recurrence	1	3.23
Pneumothorax	1	3.23
Recurrence	1	3.23
Surgical site infection	1	3.23

Staphylococcus. Aureus. Other pathogens like H. influenzae type b and Mycoplasma pneumoniae along with streptococcal species was also found. Sehitogullari *et al*.[11] found Staphylococcus aureus to be the most causative pathogen. Although there is variance in data across different countries on the etiology of empyema thoracis in children, Streptococcus pneumoniae has been found to be the leading pathogen[16]. The cause of wide variation may be due to the mandatory vaccination policy or vaccine availability, as well as other problems such as malnutrition and low levels of socioeconomic status.16 No complication was seen in case of 80.6% of the patients while all the other complications in seen in one patient each. Similar findings were noted by Ho YL *et al*.[16].

Overuse of empirical antibiotic therapy has tended the culture reports to be sterile to decide upon the appropriate antibiotic to be used and endangering the chances of resistance from the same in later stages of life. Hence judicious use of antibiotics is essential for the treatment of empyema thoracis. Often the patients were referred to our tertiary care center at a later stage after the progression of the disease leading to longer hospital stays and more aggressive intervention due to thickening of the pleural rind and rib crowding causing complications.

CONCLUSION

The study has found that ICD removal post-surgery was much earlier in VATS as compared to open decortication. Not only was ICD removal earlier in VATS, it also offered an advantage in terms of reduced number of days of hospitalization for the patient. Early detection of the disease can lead to better outcome with minimal access intervention (VATS) and lesser complications post-surgery and faster recovery. We can safely conclude that VATS may present itself as the most appropriate surgical choice in cases of Empyema thoracis.

REFERENCES

1. Li, S.T.T. and D.J. Tancredi, 2010. Empyema hospitalizations increased in us children despite pneumococcal conjugate vaccine. Pediatrics, 125: 26-33.
2. Lewis, K.T. and D.A. Bukstein, 1992. Parapneumonic empyema in children: Diagnosis and management. Am. Fam. Phys., 46: 1443-1455.
3. Francois, P., A. Desrumaux, C. Cans, I. Pin, P. Pavese and J. Labarere, 2010. Prevalence and risk factors of suppurative complications in children with pneumonia. Acta Paediatr., 99: 861-866.
4. Elemraid, M.A., M.F. Thomas, A.P. Blain, S.P. Rushton and D.A. Spencer *et al.* 2015. Risk factors for the development of pleural empyema in children. Pediatr. Pulmonol., 50: 721-726.
5. Sonnappa, S. and A. Jaffe, 2007. Treatment approaches for empyema in children. Paediatr. Respir. Rev., 8: 164-170.
6. Nie, W., Y. Liu, J. Ye, L. Shi, F. Shao, K. Ying and R. Zhang, 2014. Efficacy of intrapleural instillation of fibrinolytics for treating pleural empyema and parapneumonic effusion: A meta-analysis of randomized control trials. Clin. Respir. J., 8: 281-291.
7. Chung, J.H., S.H. Lee, K.T. Kim, J.S. Jung, H.S. Son and K. Sun, 2014. Optimal timing of thoracoscopic drainage and decortication for empyema. Ann. Thoracic Surg., 97: 224-229.
8. Ekpe, E. and M. Akpan, 2013. Outcome of tube thoracostomy in paediatric non-traumatic pleural fluid collections. Afr. J. Paediatr. Surg., 10: 122-126.
9. Alexiou, C., A. Goyal, R.K. Firmin and M.S.J. Hickey, 2003. Is open thoracotomy still a good treatment option for the management of empyema in children?. Ann. Thoracic Surg., 76: 1854-1858.
10. Sakran, W., Z.E.D. Ababseh, D. Miron and A. Koren, 2014. Thoracic empyema in children: Clinical presentation, microbiology analysis and therapeutic options. J. Infec. Chemother., 20: 262-265.
11. Sehitogullari, A., F. Sayir, Y. Aydemir, R. Anbar and H. Sayhan, 2019. Managing postpneumonic empyema thoracis in children: Comparison of different treatment options. Iran. J. Pediatr.s, Vol. 29. 10.5812/ijp.86897.
12. Avansino, J.R., B. Goldman, R.S. Sawin and D.R. Flum, 2005. Primary operative versus nonoperative therapy for pediatric empyema: A meta-analysis. Pediatrics, 115: 1652-1659.
13. Kurt, B.A., K.M. Winterhalter, R.H. Connors, B.W. Betz and J.W. Winters, 2006. Therapy of parapneumonic effusions in children: Video-assisted thoracoscopic surgery versus conventional thoracostomy drainage. Pediatrics, 118:

14. Fuller, M.K. and M.A. Helmrath, 2007. Thoracic empyema, application of video-assisted thoracic surgery and its current management. Curr. Opin. Pediatr., 19: 328-332.
15. Albal, M., P.Y. Bansod and D. Mashru, 2021. Pediatric empyema thoracis: Our surgical experience. Int. Surg. J., 8: 1275-1279.
16. Ho, Y.L., M.F. Jamaluddin, S. Krishinan, A. Salleh, A.Y. Khamis and B.A.A. Kareem, 2020. Pediatric empyema thoracis: Roles and outcomes of surgery in advanced disease. Asian Cardiovasc. Thoracic Ann., 28: 152-157.