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Original Article

Comparison of Morbidity Associated with the use of Large Versus Small-Bore Chest Tubes in Patients Managed for Stage-I Empyema Thoracis

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ABSTRACT

Objective: To compare pain and other complications with the use of large versus small-bore chest tubes in patients managed for Stage-I empyema thoracis.

Study Design: Cross-sectional study.

Place and Duration of Study: Combined Military Hospital, Multan Pakistan, from Jan 2015 to Jan 2022.

***Methodology*:** The study was conducted at the Trauma and Surgery Department. Files and charts of patients who were managed for Stage-I empyema thoracic in our hospital during the study period were assessed in detail. Patients were divided into two groups based on the size of the chest tube inserted to manage empyema thoracic. The presence of post-operative pain, obstruction, dislodgment and tube site infection were compared in both groups.

***Results*:** Out of 90 patients of Stage-I empyema thoracic, 43(47.8%) were inserted in small-bore chest tubes, while 47(52.2%) were inserted in large-bore chest tubes. Post-procedural pain was found significantly more in patients inserted in large chest tubes than those inserted in small bore tubes (*p*-value-0.018). All other complications did not differ statistically significantly in both groups.

Conclusion: Most patients in both groups did not show significant complications after the chest tube insertion. Small chest tubes were better in terms of less post-procedural pain than large chest tubes, but other complications were not significantly different in both groups.

Key words: Chest tube, Empyema, Pain, Thoracis.

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INTRODUCTION

Empyema thoracis is one of the common indications requiring surgical or procedural intervention, and that too in the quickest possible time to save the patient from grave consequences.[1,2] Multiple treatment modalities have been used to manage empyema thoracic across the globe. The treatment option offered depends upon several factors, including the stage of illness.[3,4] Chest tube insertion is one of the most commonly used methods for patients presenting with Stage-I empyema thoracic.[5] This procedure is an efficacious and safe treatment modality for the disease, but still other procedures it carries certain morbidity.[6,7] Studies have been done to ascertain the best choice from large and small bore chest tubes for managing patients with empyema thoracic.[8,9]

Pakistan is a country where the complication rate of routine infections is high, and therefore, thoracic empyema cases are commonly encountered by clinicians. A recent local study by Hashmi *et al*.[10] highlighted common causes of dysfunctional tubes and discussed various strategies to prevent this complication. Little is published about how the tube size could be associated with pain and other complications in patients with chest tubes. We, therefore, targeted patients of Stage-I emphysema with the rationale to compare pain and other complications with the use of large versus small-bore chest tubes in these patients.

METHODOLOGY

The cross-sectional study was conducted at the Department of Surgery, Combined Military Hospital, Multan Pakistan, from January 2015 to January 2022 after approval from the Ethical Review Board Committee (IREB Letter no: 43/2022). WHO sample size calculator calculated the sample size using the population proportion of pain in patients after chest tube insertion as 19%.[11] Non-probability consecutive sampling technique was used to gather the sample from the record of the hospital.

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Inclusion Criteria: All patients of either gender, aged 18 to 65 years who underwent chest tube insertion for management of Stage-I empyema thoracic were included.

Exclusion Criteria: Patients of empyema thoracis who required surgical intervention were excluded from the analysis. Those during treatment progressed from Stage I to Stage II/III; all those patients in whom pleural irrigation was used and those pregnant women were also excluded from the study.

Files of patients from hospital records who met the criteria were collected. All those patients were recruited in which Stage-I empyema thoracic was diagnosed by a consultant general or thoracic surgeon in liaison with pulmonology or medical team with the help of clinical and radiological findings.[12] Whole team was on board to decide for insertion of chest tube, which was inserted on the affected side under aseptic techniques (Ultrasound guided in dependent most intercostal space). It was removed when the lung expanded fully on chest radiography. Pus discharge was <50ml/day.[13] Chest tube was considered large bore if the diameter was 36 Fr or more while it was considered small if it was 26 Fr or less.[14] Patients was observed for the whole period for complications like significant post-procedural pain, obstruction of the tube, dislodgment, tube site infection or any other complication.

Statistical analysis was performed using the Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Frequency and percentages were calculated for all the qualitative variables. The mean and standard deviation for the age of patients managed for Stage-I empyema thoracic were also calculated. Pearson chi-square and fischer exact test were applied to look for differences in complications in patients managed with large chest tubes versus those managed with short chest tubes. The *p*-value less than or equal to 0.05 was considered significant.

RESULTS

After going through hospital records for the last eight years, we included 90 patients of Stage-I empyema thoracis who met the criteria for the study. of these 90 patients managed with chest tubes, 43(47.8%) were inserted with small chest tubes, while 47(52.2%) were inserted with large chest tubes (Table-I). The mean age of Stage-I empyema thoracic patients in our study was 42.64±7.81 years. Out of the total patients, 25 (27.8%) had significant pain, 5(5.5%) had obstruction, and 2(2.2%) had dislodgment in our study. Post-procedural pain was found significantly more in patients who were inserted with large chest tubes than those who were inserted with small tubes (*p*-value-0.018). All other complications included in the study, like obstruction (*p*-value-0.184), dislodgment of the tube (*p*-value-0.949) and infection at the tube site (*p*-value0.910), did not differ statistically significantly in both the study groups (Table-II).

Table-I: Characteristics of Patients with Stage-I Empyema Thoracis (n=90)

Study Parameters	n(%)
Age (years)	
Mean±SD	42.64±7.81
Range(min-max)	21-64
Gender	
Male	60(66.7%)
Female	30(33.3%)
Mean stay in hospital	6.234±5.51 days
Size of Tube	
Small	43(47.8%)
Large	47(52.2%)
Complications in Patients	
Significant pain	25(27.8%)
Obstruction	5(5.5%)
Dislodgment	2(2.2%)
Infection	5(5.5%)
Others	2(2.2%)

Table-II: Complications in Patients with Large Versus Small Chest Tube Used for Management of Stage-I Empyema Thoracis (n=90)

Complications	Short Tube (n=43)	Large tube (n=47)	*p*-value
Significant pain			
No	36(83.7%)	29(61.7%)	0.018
Yes	07(16.3%)	18(38.3%)	
Obstruction			
No	42(97.7%)	43(91.4%)	0.184
Yes	01(2.3%)	04(8.6%)	
Dislodgment			
No	42(97.7%)	46(97.8%)	0.949
Yes	01(2.3%)	01(2.2%)	
Infection of Tube Site			
No	40(93.1%)	44(93.6%)	0.910
Yes	03(6.9%)	03(6.4%)	

DISCUSSION

Thoracic surgeons usually manage empyema thoracis in tertiary care centres, but where this expertise is unavailable, emergency physicians or general surgeons intervene by inserting a chest tube. Chest tube insertion risks certain short-term or long-term complications, which can be minimized by taking several steps. In this study, we tried to look for the impact of the size of the tube on early post-procedural complications of chest tube insertion in patients

managed for Stage-I empyema thoracic. The pain was reported less by patients who were managed with short chest tubes than those who were managed with long chest tubes for Stage-I empyema thoracic. A previous study concluded that chest tubes were not different in terms of efficacy and safety when compared based on size.[15] Authors, therefore, were unable to recommend any one type of chest tube to be used more frequently based on the size in patients with different diseases of the thoracic cavity. Our study revealed similar findings except for post-procedural pain; no other statistically significant difference was observed in complications in patients with large or small chest tubes. Another similar study by Inaba *et al*.[16] compared chest tubes of different sizes to look for "if size matters".

They revealed that no outcome parameter statistically significantly differed in patients who were managed with different sizes of chest tubes. We studied patients with Stage-I empyema thoracis and concluded that short chest tubes were better in terms of less post-procedural pain than long chest tubes. However, other complications were similar in both groups. A multicenter randomized controlled trial concluded that both large and small-bore chest tubes were equally effective, but patients tolerated small tubes better than large ones.[17] Clinicians and researchers from Taiwan came up with an interesting question is it time to replace large chest tubes with small ones? They conducted an observational study and concluded that the length of hospital stay was significantly less in patients with small chest tubes than those with large tubes.[18] We did not compare hospital stays. However, obstruction, dislodgment, and infection rates were not statistically significantly different in patients with large or small chest tubes.

LIMITATIONS OF STUDY

Retrospective study design remains the main limitation of this study. Pain threshold may differ in each patient included in the study, and assessing it via notes of patients by different clinicians managing patients at different times pose much bias. More studies with prospective designs or randomized controlled trials comparing both chest tube types may give us a better comparison.

CONCLUSION

Most patients in both groups did not show significant complications after the chest tube insertion. Short chest tubes were better in terms of less post-procedural pain than long chest tubes, but other complications were not significantly different in both groups.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

MU & AW: Data acquisition, data analysis, critical review, approval of the final version to be published.

ABM & FA: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

KR & RH: Critical review, conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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