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Original Article

Video-Assisted Thoracoscopic Surgery versus Open Decortication in Chronic Pleural Empyema

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Abstract

Background: The role of video-assisted thoracoscopic surgery (VATS) for managing organized empyema is still limited. This study compared VATS versus open decortication in patients with chronic pleural empyema.

Methods: This randomized controlled trial included 58 patients with stage III empyema. Patients were divided into two groups. Group A (n= 30) included patients who had decortication through an open thoracotomy, and Group B (n= 28) included VATS decortication patients. Two patients in the VATS group were converted to the open approach and were excluded from the analysis.

Results: The mean age in Group A was 48.23 ± 8.44 years and 49.79 ± 7.85 years Group B (p= 0.47). There were 16 males (53.3%) in Group A and 15 (63.6%) in Group B (p= 0.99). The operative time was 336.0 ± 67.60 min in Group A and 291.07 ± 56.66 min in Group B (p= 0.01). There was no difference in intraoperative complications between groups. Postoperative hospital stay (p= 0.23) and ICU admission (p= 0.24) did not differ between groups. In Group A, the pain scale was 8 (6- 8), and it was 4 (2- 4) in Group B (p< 0.001). No difference was recorded in the postoperative complications between groups.

Conclusion: The outcomes of VATS in managing stage III empyema are comparable to the open approach. VATS has the advantage of lower postoperative pain. VATS could be an alternative to open decortication in patients with stage III pleural empyema.

KEYWORDS

Empyema; Video-assisted thoracoscopic surgery (VATS); Open decortication; Pain scale

Article History

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Introduction

Bacterial pneumonia is the most common cause of pleural empyema, and other causes include previous operation, thoracic interventions, abdominal sepsis, and esophageal diseases [1]. The American Thoracic Society classifies empyema into the early exudative, fibrinopurulent, and late organized stages [2]. In the exudative stage, the pleural fluid has a pH of <7.20, glucose level of <60 mg/dl, lactic acid dehydrogenase (LDH) level lower than three times the normal upper limit of serum, and the bacteria culture is negative [3]. The exudative stage could progress to the fibrinopurulent stage with deposition of thick fibrin on the pleura [4]. In addition to stage II criteria, the late organizing stage (stage III) is characterized by a thick fibrous peel and scar formation, and usually, symptoms start from 3 weeks or more [5].

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Treatment varies according to the empyema stage. Patients with stage I empyema can be managed by controlling the septic focus and evacuation of the purulent material. Surgery could be an option in advanced and chronic empyema [6]. Surgery can be performed through the conventional open approach or video-assisted thoracoscopic surgery (VATS) [6]. The role of VATS in chronic empyema is limited, and the superiority of one approach over the other is still controversial. Therefore, we aimed to compare VATS versus open decortication in patients with chronic pleural empyema.

Patients and Methods

Design and patients

We performed a randomized controlled trial that included 58 patients with stage III empyema. The Local Ethical Committee approved the study (Reference number 11/2018CARS2), and consent was taken from each patient before participating in the study. We grouped the patients into Group A (n= 30), which included patients who underwent an open thoracotomy decortication, and Group B (n= 28) included patients with VATS decortication. Blocked randomization was used to assign the patients to each group.

We included patients with stage III pleural empyema with failure of lung expansion despite functioning chest tube or negative aspiration of inspissated effusion. We excluded patients with bilateral disease, tuberculosis, recurrent disease, decompensated end-stage hepatic or renal failure, and patients who were not fit for surgery. Two patients in the VATS group were converted to the open approach and were excluded from the analysis.

Study data and outcomes:

All patients in this study had preoperative comprehensive clinical history and examination, laboratory investigations, pleural fluid analysis, and radiological investigations (Ultrasound, chest X-ray, computed tomography (CT) chest scan).

Study outcomes were intraoperative time, operative complications, postoperative hospital stay, postoperative pain scale, and postoperative complications.

Techniques:

All patients underwent general anesthesia using a double-lumen endotracheal tube with single lung ventilation. In Group A, a posterolateral thoracotomy incision was done in the fifth intercostal space. The sac of empyema was opened with the evacuation of the content, followed by decortication. In Group B, we used either uniport or multiport VATS decortication. The incision was done at the area of the fluid collection identified by preoperative radiology, and the pocket was entered directly with the evacuation of the content and peeling the thickened visceral, parietal, diaphragmatic and mediastinal pleura, and sometimes we entered extrapleural. We inserted two chest tubes in every patient in Group A and one tube in Group B. Patients who needed close monitoring or mechanical ventilation were admitted to ICU.

Postoperative follow-up:

On day zero, a chest X-ray and complete blood counts were done. Once the lung was fully inflated and the chest tube showed less than 100 mL of serous fluid with no air leak, the chest tube was removed. We assessed the pain in all patients using the Wong-Baker Faces Pain Scale [7]. Pain control in both groups was achieved by epidural insertion, parental and oral analgesic, and muscle relaxant.

All patients were discharged home when their chest drains were removed and their general condition allowed. Prolonged air leak cases were discharged home with a portable drainage system using a flutter bag or a Heimlich valve system. Patients discharged home with chest drains were followed up in our out-patient clinic.

Statistical analysis:

We used IBM SPSS software package version 20.0. (IBM Corp, Armonk, NY, USA) for data analysis. The expression of qualitative data was by number and percentage. The test of Kolmogorov-Smirnov was used to validate the normality of the distribution. Quantitative data description was by mean and standard deviation, or median and interquartile range (IQR).

We used the Chi-square test for categorical variables or Fisher's exact or chi-square correction when the predicted count was less than five. Quantitative variables were compared with the Mann Whitney test or t-test when appropriate. A p-value of 0.05 was considered statistically significant.

Results

Preoperative data:

The mean age in the open decortication group (Group A) was 48.23 ± 8.44 years and 49.79 ± 7.85 years in the VATS group (Group B) (p= 0.47). There were 16 males (53.3%) in Group A and 15 (63.6%) in Group B (p= 0.99). There were no significant differences in the comorbidities, pleural fluid characteristics, and radiological features between groups (Table 1).

Operative and postoperative data:

The operation time was 336.0 ± 67.60 min in Group A and 291.07 ± 56.66 min in Group B (p= 0.01). There was no difference in intraoperative complications between groups.

Postoperative data showed no statistically significant difference between the two groups in the length of hospital stay and ICU admission. In Group A, the pain scale was 8 (6- 8), and it was 4 (2- 4) in Group B (p< 0.001). Postoperative complications were comparable between groups, with no difference in the incidence of prolonged air leak bleeding and wound infection. (Table 2)

Discussion

Pleural empyema treatment depends on the pathological stage. It mainly begins with fluid drainage under antibiotics coverage, but surgery should be considered if the control of the infectious source or lung inflation were not achieved [8]. VATS pleurectomy is an effective way to successfully manage the early stage of empyema after failure to achieve treatment goals with tube thoracostomy [9].

The debate about the efficiency of VATS drainage and decortication in the advanced stages of empyema is still existing [10]. Full reexpansion of the trapped lung must be the main goal with slight postoperative mortality and morbidity [11]. The enthusiasm for a minimally invasive option (VATS) should never neglect the above treatment goals. The surgeon should consider conversion to open surgery from VATS at an accurate time [10].

Table 1: Comparison of the preoperative data between open (Group A) and video-assisted thoracoscopic (VATS) decortication (Group B). Continuous data were presented as mean and standard deviation and categorical data as numbers and percentages

	Group A (n= 30)	Group B (n= 28)	p
Males	16 (53.3%)	15 (63.6%)	0.99
Age (years)	48.23 ± 8.44	49.79 ± 7.85	0.47
Diabetes	10 (33.3%)	5 (17.9%)	0.18
Hypertension	7 (23.3%)	5 (17.9%)	0.61
Rheumatoid	0	1 (3.6%)	0.48
Etiology			
Esophageal rupture	1 (3.3%)	0	>0.99
Parapneumonic	24 (80%)	24 (85.7%)	
Rupture lung abscess	5 (16.7%)	4 (14.3%)	
Pleural fluid analysis (Biochemical)			
Exudative	17 (56.7%)	15 (51.9%)	0.72
Pus-like effusion	13 (43.3%)	13 (48.4%)	
Positive culture	19 (63.3%)	16 (57.1%)	0.63
Radiology			
Loculated fluid	17 (56.7%)	19 (67.9%)	0.38
Thick pleura with free fluid	21 (70%)	19 (67.9%)	0.86
Right side effusion	19 (63.3%)	15 (53.6%)	0.45

Table 2: Comparison of the operative and postoperative data between open (Group A) and video-assisted thoracoscopic (VATS) decortication (Group B). Continuous data were presented as median and interquartile range and categorical data as numbers and percentages

	Group A (n= 30)	Group B (n= 28)	p
Operative time (min)	336.0 ± 67.60	291.07 ± 56.66	0.01
Lung tear	7 (23.3%)	8 (28.6%)	0.65
Diaphragmatic tear	1 (3.3%)	0	>0.99
Esophageal tear	1 (3.3%)	0	>0.99
Bleeding	1 (3.3%)	0	>0.99
ICU admission	3 (10%)	0	0.24
Hospital stay (days)	6 (5- 9)	6 (4- 8)	0.23
Pain scale	8 (6- 8)	4 (2- 4)	<0.001
Prolonged air leak	5 (16.7%)	4 (14.3%)	>0.99
Wound infection	7 (23.3%)	3 (10.7%)	0.30
Recurrent empyema	4 (13.3%)	3 (10.7%)	>0.99
Bleeding	1 (3.3%)	0	>0.99

Our study included 58 patients divided into two groups; Group A had open thoracotomy and group B had VATS. Regarding the etiology, the most common cause in our study was the parapneumonic effusion with 24 patients (80%) in group A and 24 patients (85.7%) in group B. In other studies; parapneumonic effusion was the most common cause [10, 12].

Concerning operative time in our study, Group A had a longer time than B as in the former was 340.0 (290.0 – 400.0) and 285.0 (250.0 – 325.0) minutes in the latter. In Reichert and associates' study, the median operative time in the thoracotomy group was 160 (53–386) minutes and 140 (41–385) minutes in the VATS group, which is similar to our study. In general, time in both groups was lower than ours. That may be due to the timing of diagnosis and delayed seeking medical advice in our community. Additionally, other factors are related to the minimally invasive technique, such as the number of pores used, type of camera and available instruments, surgeon experience [13].

We used the Wong-Baker faces pain scale for pain assessment in which a lower pain score was noticed in the VATS group than the thoracotomy group, which is considered one of the advantages of VATS [7]. Pain control is critical as it helps early return to daily activities. It affects their psychological and physical condition, so we should not underestimate this point in comparing VATS and open thoracotomy. In Chan and colleagues' study, the mean pain score in the VATS group was significantly lower than that in the thoracotomy group using a 10-point numeric scale [14]. Using the later score in Cardillo and coworkers, the video thoracoscopic approach showed statistically significantly better results in postoperative (day one and day seven) pain [15].

There was no significant difference between the thoracotomy and VATS groups in postoperative complications. one case of esophageal tear in Group A occurred as there were very thickened pleural and adhesions in this area. One case of bleeding in Group A was due to intercostal artery injury and large lung tear. In Reichert and coworkers' study, (15%) in the thoracotomy group and (12.7%) in the VATS group had intraoperative complications, with no significant difference between their groups [13].

The most common complication in our study was persistent air leak, which was managed conservatively in most VATS cases especially small tears. Wound infection in the thoracotomy group was managed by daily dressing and swab from the wound. Recurrent empyema was managed in both groups by chest tube drain with updating fluid culture. In Thori and colleagues' study, (50%) had postoperative atelectasis, (40%) had an air leak more than five days, and (10%) had wound infection [10].

The conversion rate was 2 cases (6.7%). One case was due to multiple lung tears that required good control. The other case was due to difficulty in achieving the main goal of peeling the thickened visceral pleura and getting inflated lung by VATS so converted to open. In Reichert colleagues' study, the conversion rate was (4.5%) due to the lack of surgical progress in three and pulmonary arterial bleedings in two cases, which is lower than our rate [13].

Conclusion

The outcomes of VATS in managing stage III empyema are comparable to the open approach. VATS has the advantage of lower postoperative pain. VATS could be an alternative to open decortication in patients with stage III pleural empyema.

Conflict of interest: Authors declare no conflict of interest.

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