

Thoracoscopic Debridement and/or Decortication for Thoracic Empyema: A Comparative Study with Open Decortication

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ABSTRACT

Objective: To compare between thoracoscopic debridement and/or decortication versus open decortication in the management of thoracic empyema.

Methods: This retrospective study was conducted out at King Hussein Medical Center, during the period of December 2006 and November 2011. Fifty-five patients with the diagnoses of stage two or three thoracic empyema were included in this study. The patients were divided in two groups. Group A included patients who underwent thoracoscopic debridement and/or decortication and group B included patients who underwent open decortication. Efficacy of the procedure, operative time, and postoperative blood loss, the need for ventilator support, postoperative complications, postoperative hospital stay and mortality were compared in both groups.

Results: Males constituted 61.8% (n=34) of the studied patients. Twenty-nine patients (52.7%); underwent thoracoscopic debridement and /or decortication while 26 patients (47.3%) underwent open decortication. Mean age (range) was 36.55±16.47 (16-70) years for group A, and 37.70±14.28 (17-67) years for group B. There was no statistical significant difference between both groups regarding postoperative hospital stay (P=0.1012) and duration of air leak (P=0.1515). Duration of the procedure was 209.29±20.93 minutes for group A patients, while it was 97.86±38.06 minutes for group B patients (P<0.001). Three out of the 26 patients (11.5%) who underwent open decortication died in the postoperative period though the fatality was zero in group A patients.

Conclusion: Thoracoscopic debridement and/or decortication should be considered as the first surgical option in the management of stage two and three thoracic empyema.

Key words: Empyema, Debridement, Decortication, Thoracoscopy

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Introduction

Pneumonia and parapneumonic effusion are still common causes of hospital admissions.⁽¹⁾ Most parapneumonic effusions resolve with appropriate antibiotic treatment with the resolution of the pulmonary infection. When bacteria invade the normally sterile pleural cavity, empyema occurs.^(2,3) According to the

American Thoracic Society, empyema thoracis is classified into three stages: The exudative stage, the fibrinopurulent stage and the organized stage.⁽⁴⁾ Options of treatment change according to the phase of the disease, ranging from antibiotic, thoracostomy tube drainage, to decortication.⁽⁵⁾ Open decortication, through open thoracotomy, is the conventional method of surgical treatment of

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stage two and three thoracic empyema, which is associated with significant post operative pain and morbidity.⁽⁶⁾ In the recent years, minimal invasive thoracic surgery has been accepted by many thoracic surgeons as a safe and efficient alternative to open surgery in the management of different thoracic diseases.⁽⁷⁾ In this study, we compared between thoracoscopic debridement and/or decortication versus open decortication in the management of thoracic empyema at the Royal Medical Services in Amman-Jordan.

Methods

This retrospective study was conducted out during the period from December 2006 through November 2011 at the Thoracic Surgery Division, King Hussein Medical Centre of the Royal Medical Services in Amman-Jordan. Approval from the Ethical Committee was obtained to carry out the study. Data were retrieved from the Thoracic Surgery Division computerized data base and from the patient's files. The cases that were subjected to minimal invasive decortication were performed when the thoracoscopic instruments and an operating theatre with enough time is available. But there was no selection according to the severity of the disease. So this is just a retrospective collection of data. All the cases were operated by two senior thoracic surgeons working as one team.

Fifty-five patients with stage two or three parapneumonic empyema were included in this study. Exclusion criteria included: patients with stage one disease, patients under the age of 14 years, and patients with empyema due to other causes than pneumonia. The American Thoracic Society classification of empyema was used to differentiate between the empyema stages. Stage 1- exudative phase, stage - fibrinopurulent phase and stage 3-organised phase. Patients were divided into two groups; those who underwent thoracoscopic debridement and/ or decortication were named group A, while patients who underwent open decortication were classified under group B. The patients were referred from the pulmonology division of King Hussein Medical Centre and from different peripheral hospitals of the Royal Medical Services. Diagnosis was based on the clinical history and physical examination, chest X-Ray, pleural fluid analysis, pleural fluid culture and chest CT scan.

Fiberoptic bronchoscopy was done by the pulmonologist prior to referral for decortication for all the cases. All patients received intravenous antibiotics and thoracostomy tube drainage was inserted as needed. The criteria for surgery were persistent septicaemia, incomplete drainage of the pleural cavity and radiologic evidence of multiloculated fluid and/ or entrapped lung. Routine Preoperative evaluation included a complete history and physical examination, complete blood count with coagulation profile, liver function and kidney function test, pulmonary function test and arterial blood gases. Surgery was carried out under general endotracheal anaesthesia using double lumen endotracheal tube for single lung ventilation. A radial arterial line, subclavian catheter, and a Foleys catheter were inserted in all patients. The patients were positioned in a complete lateral position according to the site with the arm abducted on a special support.

Technique of open decortication: A Standard Posterolateral thoracotomy incision was performed; layers were opened in order without serratus anterior muscle splitting. Extra-pleural dissection was carried out first to mobilize the whole lung en-block with the pleura, the pleura is opened, then drainage of the empyema cavity and drainage of any loculations till the whole lung is separate from the pleura, pleurectomy done, then peeling of the entrapped lung is carried out to assure complete lung expansion. Two chest tubes sizes 36 F were inserted then closure in layers.

Technique of Video-Assisted Thoracoscopic (VAT) decortication: Three 10mm incisions were used for the insertion of the trocars. The first trocar was inserted at the 4th-5th intercostal space anterior axillary line with blunt finger dissection technique then a 30 degree 10mm lens is introduced through this port. Dissection is carried out using the lens itself to separate the lung from the chest wall in a posterior direction towards the tip of the scapula in order to create a clear and safe tract for the insertion of the second port. The second trocar is inserted just below the tip of the scapula. A 10mm suction tube is introduced through this trocar for evacuation of loculations and for mobilization of the lung in a direction towards the diaphragm. Then the last trocar is inserted at the 8th intercostal space middle Axillary line.

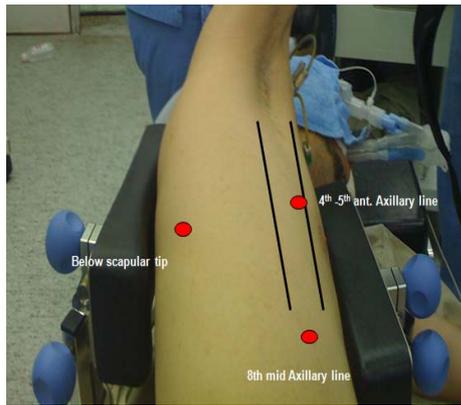


Fig. 1: Sites of trocars for Thoracoscopic Decortication

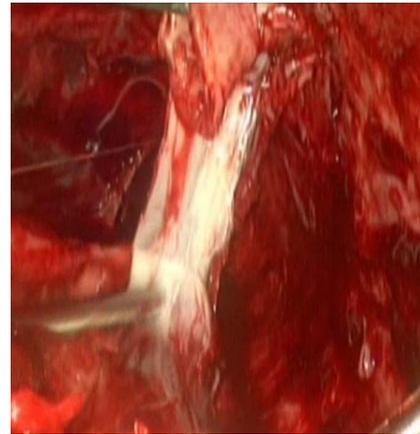


Fig. 2: Peeling of the Lung

Sites of trocars are shown in Fig. 1. Mobilization of the lung from the chest wall and evacuation of any collection were carried out from the apex down to the diaphragm. Then mobilization of the lung from the pericardium, mediastinum and diaphragm is performed. After full mobilization of the lung, peeling of the lung was done for stage 3 empyema (Fig. 2) and the fissures were opened. After that, curettage of the parietal pleura is performed. The anesthesiologist then inflates the lung and if it reaches the chest wall, the procedure is completed. Two chest tubes size 36 F were inserted through anterior two port incisions and the posterior incision was closed.

Post operative management: Post operatively the patients (in both groups) were admitted either to the ward or to the Intensive care Unit depending on the general condition of the patient. Prophylactic broad spectrum antibiotics were given to all the patients till the time of chest tube removal. Postoperative subcutaneous morphine was given for the first 48 hours regularly for all the patients and if needed after that. Intramuscular nonsteroidal anti-inflammatory drugs were used thereafter. The chest bottles were connected to a continuous negative suction of - 20 cm water till the air leak stopped. A test clamp for the chest tubes were done for 24 hours after the cessation of air leak, if the drained fluid is clear with a production of less than 100 milliliter /24 hours with full lung expansion on chest X-Ray. The chest tubes were removed thereafter if the follow-up chest X-ray showed full lung expansion with no collection.

Demographic data, co-morbidities, operative time, intraoperative details, postoperative complications, postoperative blood loss, duration

of air leak, post operative hospital stay, and mortality were documented and analyzed. Due to the retrospective nature of the study, Post operative pain was assessed by comparing the amount of morphine needed in both groups after the first 48 hours. Follow up was done for 6 months after discharge. The student's t test was used for statistical study. Continuous variables were expressed as mean \pm standard deviation, and categorical variables were expressed as percentages. The level of confidence was defined as a P value of less than 0.05.

Results

Males constituted 61.8% (n=34) of the studied patients. Twenty-nine patients (52.7%) underwent Thoracoscopic debridement and /decortication, while 26 patients (47.3%) underwent open decortication. Mean age (range) was 36.55 \pm 16.47 (16-70) years for the patients in group A, and 37.70 \pm 14.28 (17-67) for group B patients (Table I). Pleural fluid culture results didn't show any growth in 24 patients (43.6%) in both groups (Table II). The stages of the empyema for both groups are shown in Table III (P= 0.8094). Right sided surgery was carried out in 36 patients (65.5%) in both groups (Table IV). Operative time was 209.29 \pm 20.93 (110-250) minutes for those who underwent thoracoscopic decortication while it was 97.86 \pm 38.06 (70-150) minutes for group B patients (P<0.001). Four out of the 29 patients (13.8%) who started by decortication were admitted to the intensive care unit after the thoracoscopic procedure was converted to the open technique. Twenty-one out of the 26 patients (80.8%) underwent open procedure, and 11 of them (42.3%) were kept on

Table I: Demographics and preoperative characteristics

Variable	Group A*	Group B**	P value
Number	29 (52.7%)	26 (47.2%)	
Male/female	18/11	16/10	N.S
Age	36.55+/-16.47	37.70+/-14.28	N.S
Smokers	12 (21.8%)	11 (20.0%)	N.S
Diabetes mellitus	3 (5.6%)	4 (7.3%)	N.S
Hypertension	3 (5.6%)	4 (7.3%)	N.S
Chronic renal failure	0 (0%)	1 (1.8%)	N.S
Post liver resection	0 (0%)	1 (1.8%)	N.S
Ischemic heart disease	0 (0%)	2 (3.6%)	N.S
Epilepsy	1 (1.8%)	0 (0%)	N.S

*Thoracoscopic decortication group **Open decortication group N.S= not significant

Table II: Culture results of the aspirated pleural fluid

Culture result	Group A*	Group B**	P value
No growth	14(25.6%)	10(18.2%)	N.S
Mixed growth	5(9.1%)	4(7.3%)	N.S
Staphylococcus aureus	5(9.1%)	4(7.3%)	N.S
Streptococcus pneumonia	2(3.6%)	1(1.8%)	N.S
Klebsiella species	2(3.6%)	1 (1.8%)	N.S
Pseudomonas species	1(1.8%)	4(7.3%)	N.S
Haemophilus species	0(0%)	2(3.6%)	N.S

*Thoracoscopic decortication group **Open decortication group N.S= not significant

Table III: The stages of parapneumonic empyema for the patients who underwent thoracoscopic and open decortication

Group	Stage 1	Stage 2	Stage 3	Total
Group A*	0 (0%)	18 (32.7%)	11 (20.0%)	29(52.7%)
Group B**	0 (0%)	14 (25.5%)	12 (21.8%)	26 (47.3%)
Total	0 (0%)	32 (58.2%)	23 (41.8%)	55 (100%)

*Thoracoscopic decortication group **Open decortication group

Table IV: Site of the performed surgery

Site	Group A*	Group B**	Total
Right	20 (36.4%)	16 (29.1%)	36 (65.5%)
Left	9 (16.3%)	10 (18.2%)	19 (34.5%)
Total	29 (52.7%)	26 (47.3%)	55 (100%)

*Thoracoscopic decortication group **Open decortication group

Table V: Postoperative events and complications

Variable	Group A*	Group B**	P value
Postoperative ICU admission	6/29(20.7%)	21/26(80.8%)	0.0343
Ventilator support < 48 hours	2/29(6.9%)	11/26(42.3%)	0.0452
Blood loss (ml)	390±30.0	850±85.5	< 0.0001
Air leak	5.0±2.0 (2-9 days)	4.0±2.0 (1-7 days)	0.1515
Bleeding/blood transfusion	5/29(17.2%)	8/26(30.8%)	0.5134
Bleeding/ reopening	0/29(0%)	1/26(3.8%)	0.7586
Atelectasis requiring bronchoscopy	1/29(3.8%)	2/26(7.7%)	0.7464
Ventilator dependence	0/29(0%)	3/26(11.5%)	0.6938
Arrhythmias	1/29(3.8%)	0/26(0%)	0.8781
Wound infection	0/29(0%)	1/26(3.8%)	0.7586

full ventilator support for less than 48 hours in the immediate postoperative period. Postoperative blood loss was less in group A ($P < 0.0001$). The duration of air leak was more in group A patients (5.0 ± 2.0 days, $P = 0.1515$). Postoperative bleeding requiring blood transfusion and/or reopening, postoperative Atelectasis requiring fiberoptic bronchoscopy, wound infection and ventilator dependence were more in group B patients although no significant statistical difference were found. One out of the 29 patients who underwent thoracoscopic decortication developed postoperative atrial fibrillation that was managed medically. The total amount of morphine needed after the first 48 hours (as requested by the patients to control their pain) was 7.88 ± 5.32 mg (0-25mg) in group A patients, while it was 13.85 ± 7.25 mg (5-30 mg) in group B patients ($p = 0.0014$). Post operative hospital stay were 9.0 ± 3.2 days for group A patients while it was 7.9 ± 4.5 days for group B patients ($P = 0.1012$). Postoperative complications and events are shown in Table V. Three out of the 26 patients (11.5%) who underwent open decortication died in the postoperative period due to adult respiratory distress syndrome though the fatality was zero in group A patients. At three and six months follow up, all the patients in both groups showed full lung expansion with no residual space or collection.

Discussion

The term empyema, according to medical dictionaries, is a Greek word meaning in or within accumulation of pus.⁽⁸⁾ In general, treatment of empyema thoracis is achieved by draining the pus from the pleural cavity to achieve full lung expansion and to treat the infection with antimicrobial agents.⁽⁹⁾ In the organized stage of empyema thoracis, fibrin is deposited on pleural surfaces, forming a thick peel that restricts the underlying lung from expansion. At this stage, the aim of treatment is to increase the lung expansion by peeling the trapped lung (surgical removal of the thick peel).^(10,11) In the mid eighties and early nineties many reports had been published discussing the use of Video-Assisted Thoracic Surgery (VATS) in the management of early stages of empyema.^(12,13) In the year 2001, Waller and Rengarajan described

the use of VATS successfully for the management of stage three empyema thoracis.⁽¹⁴⁾ In our study males constituted most of the studied population, which is an agreement with many other authors,^(5,7,14) though, most of our patients were in the fourth decade of life, which doesn't match the results of other authors studies,⁽¹⁰⁻¹⁵⁾ which showed a 6th decade predominance, and this is attributed to the fact that, as a military hospital, a lot of our insured patients are a military personnel in a relatively young age groups. Although Tong *et al.*, Waller *et al.* and Shahin *et al.*^(7,14-15) reported a shorter operative time in patients who underwent thoracoscopic decortication as compared to the open method, in our study, there was a statistical significant difference regarding the operative time in favor of the open decortication group. Our explanation for this discrepancy in this result is that it was our early experience in doing thoracoscopic decortication, in addition we included stage 3 empyema in our study, in which, peeling of the lung was mandatory, and this needed an extra time. Our rate of conversion from Thoracoscopic procedure to open decortication was comparable to others such as Solaini *et al.* and Cardillo *et al.*^(16,17) The postoperative course showed marked advantages of thoracoscopic decortication over open decortication, in which, postoperative pain was less in patients underwent the thoracoscopic procedure (as confirmed by the amount of morphine needed), less patients needed a postoperative intensive care unit admission and less patients needed a ventilator support for the first 48 hours (with a statistical significant difference). Also, the post operative blood loss was significantly less in patients underwent thoracoscopic decortication. These results were comparable to the results of many other authors.^(7,9,12,15-18) The need of blood transfusion postoperatively or reopening due to bleeding, respiratory complications (mainly atelectasis requiring bronchoscopy), ventilator dependence and wound infection were higher in patients underwent open decortication (though not statistically significant), and these results were an agreement with the results of Cardillo *et al.* and Melloni *et al.*^(17,18)

Shahin *et al.*, Luh *et al.* and Bhatnagar *et al.*^(15,19,20) emphasized the value of thoracoscopic

decortication in means of less air leak post operatively and less hospital stay. In our study, the duration of air leak and hospital stay was slightly higher in patients underwent thoracoscopic decortication (although, not statistically significant). And this is attributed to the fact that during our early experience, minor lung injury occurred during peeling of the lung, and this caused more air leak and therefore more hospital stay. One patient out of the 29 patients who underwent thoracoscopic decortication developed slow atrial fibrillation in the first postoperative day, which was managed medically, and this complication was attributed to mobilization of the adherent lung from the pericardium during surgery. Although no mortality was reported in the thoracoscopic decortication group, three fatalities occurred among patients who underwent open decortication; and all fatalities were attributed to Adult Respiratory Distress Syndrome after prolonged ventilator dependence.

Limitation of the Study

1. The number of the studied sample is relatively small as compared to other international studies.
2. No other local or regional studies were found discussing the same subject to be compared with.
3. The retrospective nature of the study.

Conclusion

Both thoracoscopic and open decortication are efficient in the treatment of stage two and three parapneumonic empyema. Thoracoscopic decortication should be considered as the first surgical option in the management of these stages as it results in less postoperative morbidity and mortality.

References

1. **Restrepo M, Mortensen E, Rello J, et al.** Late Admission to the ICU in Patients With Community-Acquired Pneumonia Is Associated With Higher Mortality. *Chest* 2010; 137: 552-557.
2. **Mandal A, Thadepalli H, Mandal A, et al.** Outcome of Primary Empyema Thoracis: Therapeutic and Microbiologic Aspects. *Ann Thorac Surg* 1998; 66:1782–1786.

3. **Colice GL, Curtis A, Deslauriers J, et al.** Medical and surgical treatment of parapneumonic effusions: an evidence-based guideline. *Chest* 2000; 118:1158–1171.
4. **Light R.** Parapneumonic effusions and Empyema. *Proc Am Thorac Soc* 2006; 3: 175-180.
5. **Wurnig P, Wittmer V, Pridun N, et al.** Video-Assisted Thoracic Surgery for Pleural Empyema. *Ann Thorac Surg* 2006;81:309–313.
6. **Renner H, Gabor S, Pinter H, et al.** Is aggressive surgery in pleural empyema justified? *Eur J Cardiothorac Surg* 1998; 14: 117–122.
7. **Tong B, Hanna J, Toloza E, et al.** Outcomes of Video-Assisted Thoracoscopic Decortication. *Ann Thorac Surg* 2010; 89:220–225.
8. **Christopoulou-Aletra H, Papavramidou N.** “Empyemas” of the Thoracic Cavity in the Hippocratic Corpus. *Ann Thorac Surg* 2008; 85:1132–1134.
9. **Molnar T.** Current surgical treatment of thoracic empyema in adults. *Eur J Cardiothorac Surg* 2007; 32 (3): 422-430.
10. **Weissberg D, Refaely Y.** Pleural empyema: 24-year experience. *Ann Thorac Surg* 1996;62:1026-1029.
11. **Gokce M, Okur E, Baysungur V, et al.** Lung decortication for chronic empyema: effects on pulmonary function and thoracic asymmetry in the late period. *Eur J Cardiothorac Surg* 2009; 36(4): 754–758.
12. **Hutter J, Harari D, Braimbridge M.** the Management of Empyema Thoracis by Thoracoscopy and Irrigation. *Ann Thorac Surg* 1985;39:517-520
13. **Ridley P, Braimbridge M.** Thoracoscopic debridement and pleural irrigation in the management of empyema thoracis. *Ann Thorac Surg* 1991 ;51(3):461-464.
14. **Waller D, Rengarajan A.** Thoracoscopic decortication: a role for video-assisted surgery in chronic postpneumonic pleural empyema. *Ann Thorac Surg* 2001; 71(6):1813-1816.
15. **Shahin Y, Duffy J, Beggs D, et al.** Surgical management of primary empyema of the pleural cavity: outcome of 81 patients. *Interact CardioVasc Thorac Surg* 2010; 10 (4): 565-567.
16. **Solaini L, Prusciano F, Bagioni P.** Video-assisted thoracic surgery in the treatment of pleural empyema. *Surg Endosc* 2007; 21:280–284.
17. **Cardillo G, Carleo F, Carbone L, et al.** Chronic postpneumonic pleural empyema: comparative merits of thoracoscopic versus open decortication. *Eur J Cardiothorac Surg* 2009; 36:914–918.
18. **Melloni G, Carretta A, Ciriaco P, et al.** Decortication for chronic parapneumonic empyema: results of a prospective study. *World J Surg* 2004; 28:488–493.

19. **Luh SP, Chou MC, Wang LS, et al.** Video-assisted thoracoscopic surgery in the treatment of complicated parapneumonic effusions or empyemas: outcome of 234 patients. *Chest* 2005; 127:1427–1432.
20. **Bhatnagar R, Maskell NA.** Treatment of complicated pleural effusions in 2013. *Clin Chest Med* 2013; 34: 47-62.