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Effect of Decortication for Empyema Thoracis by Video Assisted Thoracic Surgery on Pulmonary Function

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Abstract

Background: Video-assisted thoracoscopic surgery (VATS) is the minimally-invasive procedure for decortication which may improve pulmonary function postoperatively. **Objective:** The aim of the study was to find out the long time outcome in relation to pulmonary function after VATS decortication. **Methodology:** This cohort study was conducted in the Department of Thoracic Surgery at National Institute of Diseases of the Chest and Hospital, Dhaka, Bangladesh during the period of March 2018 to July 2020. After fulfillment of enrollment criteria patients were selected. Spirometric value (FVC, FEV1, FEV1/FVC) were evaluated before and after operative procedure and during subsequent three follow ups. **Results:** FVC changes between preoperative and postoperative consecutive three follow up periods show significant difference ($p<0.001$). FEV1 changes between preoperative and postoperative consecutive three follow up periods show significant difference ($p<0.001$). FEV1/FVC changes between preoperative and postoperative consecutive three follow up periods show non-significant difference ($p=0.068$). **Conclusion:** In conclusion after VATS decortication postoperative spirometric values improve significantly compared to preoperative spirometric values in the course of treatment of empyema thoracis. *[Journal of National Institute of Neurosciences Bangladesh, January 2022;8(1): 69-72]*

Keywords: Long-term Effects; Pulmonary Function; Video-Assisted Thoracoscopic Surgery; decortication; Empyema Thoracis

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Introduction

Empyema Thoracis is the presence of pus in the pleural cavity. American Thoracic Society (ATS) divides the formation of an empyema into three stages that represent a continuous spectrum[1]. Respiratory functions severely deteriorate if pleural empyema leads to atelectasis of a compressed lung[2]. As a result of reduced oxygen penetration to alveoli, perfusion and gas exchange in the lung are decreased. Atelectasis leads to collapse of the alveoli, which directly and indirectly (hypoxia) induce the constriction of lung arteries and high resistant in lung circulation[3].

Medical management or conservative non-interventional therapy is rarely effective and often contraindicated for management of empyema. Thoracentesis and culture sensitivity based antibiotic therapy are appropriate and

gradually successful for stage I parapneumonic effusions but not stage II or stage III empyema[4]. Treatments of stage II consist of fibrinolysis via chest tube or thoracoscopic (VATS) debridement but they are not effective in chronic empyema thoracis, which requires formal decortication by thoracotomy[5]. Video-assisted thoracoscopic surgery (VATS) is the minimally-invasive decortication procedure which would be effective, would decrease the patients hospital stay, may improves pulmonary function, shorten operation time, causes less post-operative pain, gives greater satisfaction with wound. No mortality was reported[6].

Decortication is a term derived from Latin which literally means stripping off the bark from the lung. It is a surgical procedure that consists of removing a restricting membrane from the lung. Re-expansion of the lung with obliteration of the space is almost always achieved if the underlying parenchyma is normal. This result is always permanent and is accompanied by subjective improvement particularly if decortication takes place early in the process of empyema[7].

Pulmonary function depends on respiratory muscle function, ventilation perfusion and alveolar epithelial permeability[3]. The primary characteristics that affect pulmonary function are the patient's age, height, weight and gender. Among functional studies in patient with empyema thoracis, spirometry is the most common investigation[3]. Spirometry is a method of assessing lung function by measuring the volume of air that the patient is able to exhale from the lungs after a maximal inspiration. Spirometry is the most common and useful lung function test. Its clinical utility is well accepted; it is the least expensive and most widely available method. This study was aimed to determine the initial long term effects of pulmonary function after VATS decortication.

Methodology

Study Settings & Population: This prospective cohort study was conducted in the Department of Thoracic surgery at National Institute of Diseases of the Chest and Hospital, Mohakhali, Dhaka, Bangladesh from March, 2018 to July, 2020 for a period of more than 2 years. Patients undergoing VATS decortication for empyema thoracis in the department of Thoracic surgery at NIDCH after fulfillment of inclusion and exclusion criteria were taken as study population. Purposive sampling technique was applied to collect the sample. Ethical permission was taken from the Institutional Thesis Committee of NIDCH for conducting this study. Patients presented with severe parenchymal lung disease, post resectional empyema, severely injured lung parenchyma, flail chest requiring mechanical ventilation or, fibrosis of lung were excluded from this study. Pre-operative forced vital capacity (FVC) and FEV1 were measured.

VATS Decortication technique: Standard anesthetic technique was used for all patients using double lumen endobronchial tube. After skin preparation and sterilization about 2-3 cm oblique antero-lateral standard single port VATS incision was given in 4th or 5th intercostal space. A wound protector was placed for maximum exposure. Initial assessment was done after dissection and adhesiolysis. Evacuation of pus, fluid, organized materials was done. Lung was mobilized all over, from hilum to hilum and from base to apex. Decortication was done by using forceps, suction nozzle and scissors. Proper pleural cavity wash and haemostasis was achieved. Wound was closed in layers after keeping 2 chest drain tube for drainage. After completion of VATS decortication patient was shifted to postoperative ward.

Follow up of Patient: Follow up was done on early postoperative period, during hospital stay and after discharge each month for 3 consecutive months . On each visit the patient was assessed clinically and by doing spirometry. Postoperative variables were measured like postoperative forced vital capacity (FVC), FEV1, FEV1/FVC, drain tube collection, postoperative pain, postoperative dyspnea and postoperative chest expansion.

Statistical Analysis: Data was analyzed by the software statistical program for social science (SPSS 26.0 Inc). Categorical variables were present as frequency & percentage and continuous variables were shown as mean ± SD. Statistical analyses were performed by Chi-square test and/or Fisher's exact test where it as applicable for comparing qualitative variables and for quantitative variables using unpaired t-test & Mann-Whitney U test for comparing between the groups. A p-value of <0.05 was considered as significant for all analytical tests. The summarized data was presented in the form of tables.

Results

A total number of 30 patients were recruited for this study. Among 30 patients most were in 21 to 50 years group. There was 25 male and 5 female patient and there was no significant difference between the two groups (p=0.582) (Table 1).

Table 1: Distribution of the Patients by Age and Gender

Age Group	Gender		P value
	Male	Female	
≤20 Years	5 (20.0%)	3 (60.0%)	
21 to 30 Years	6 (24.0%)	0 (0.0%)	
31 to 50 Years	10 (40.0%)	1 (20.0%)	
More Than 50 Years	4 (16.0%)	1 (20.0%)	
Total	**25 (100.0%)**	**5 (100.0%)**	
Mean±SD	35.40±16.00	30.80±21.25	0.582*

*Unpaired t test was done to measure the level of significance

The mean spirometric value of FVC was measured at preoperative (56.4±12.07) and 1st follow up (64.77 ± 4.07), 2nd follow up (67.4 ± 5.73) and 3rd follow up (72.6 ± 8.10) period. The results showed that there was a gradual increase of FVC value from pre-operative value with the follow up period. The difference between two groups was statistically significant (P=0.0001). Again the mean with SD spirometric value FEV1 at preoperative (55.2±11.76) and 1st follow up (70.0±10.26), 2nd follow up (68.3±7.85) and 3rd follow up (75.7±22.42) period and the difference between two groups was statistically significant (P=0.0001). The mean with SD of spirometric value of ratio of FEV1 and FVC at preoperative (98.2±12.21) and 1st follow up (105.0±15.30), 2nd follow up (101.9±11.92) and 3rd follow up (100.9±9.73) period and the difference between two groups was not statistically significant (P>0.05) (Table 2).

Table 2: Distribution of the Patients by FVC in Different Follow up Period (Mean ± SD)

Time Period	FVC	FEV1	FEV1/FVC
Preoperative	56.4±12.07	55.2±11.76	98.2±12.21
Post-operative			
• 1st Follow Up	64.8 ± 4.07	70.0±10.26	105.0±15.30
• 2nd Follow Up	67.4 ± 5.73	68.3±7.85	101.9±11.92
• 3rd Follow Up	72.6 ± 8.10	75.7±22.42	100.9±9.73

Paired t test was done to measure the level of significance between the pre- and postoperative FVC, FEV1 and the ratio of FEV1 & FVC values

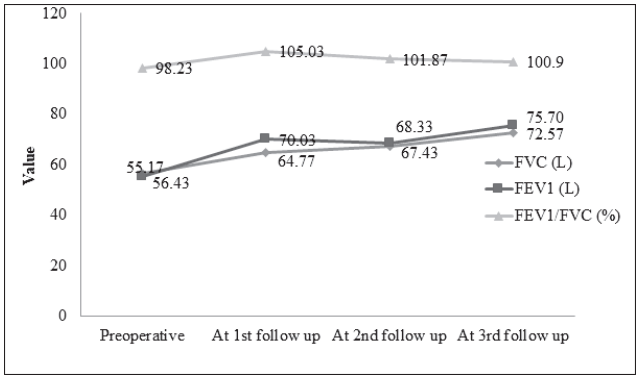

Figure 1: Line chart of the patients according to spirometric value

Discussion

This study was conducted in the Department of Thoracic surgery in National Institute of Diseases of the Chest and Hospital and study period was from March 2018 to July 2020. The aim of this study was to determine the function of the re-expanded lung on different functional level by spirometry before and after VATS decortication in patients with empyema thoracis.

In this study among 30 patients, 5 male and 3 female patients age were less than 20 years. 6 male patients were between 21-30 years, 5 male and 1 female were between 31-40 years, 5 male were 41-50 years, 4 male and 1 female were more than 50 years. Total 25 male and 5 female patients. Mean ± SD value were 35.40 ± 16.00 and 30.80 ± 21.25 respectively between male and female and the difference between two groups was statistically not significant (p=0.582). In previous study by Molnar et al[8] patient's age was significant (p<0.001) between the groups which contradicts with our study.

In this study among 30 patients Mean ± SD of preoperative FVC was 56.43 ± 12.07 with Min-Max was 44.00-98.00. Mean ± SD of preoperative FEV1was 55.17 ± 11.76 with Min-Max was 42.00-83.00. Mean ± SD of preoperative FEV1/FVC was 98.23 ± 12.21 with Min-Max was 82.00-125.00. Almost similar value found in a previous study done by Nakaoka et al[9] which correlate with this study.

In this study among 30 patients the mean with SD of preoperative FVC was 56.43 ± 12.07 and postoperative 1st follow-up FVC was 64.77 ± 4.07 and the difference between two groups was statistically significant (p= 0.001). In previous study by Rzyman et al[3] patient's FVC was significant (p<0.001) between the groups which correlate with our study. Mean ± SD of preoperative FVC was 56.43 ± 12.07 and postoperative 2nd follow-up FVC was 67.43 ± 5.73 and the difference between two groups was statistically significant (p<0.001). In previous study by Rzyman, et al[3] patient's FVC was significant (p<0.001) between the groups which correlate with our study. Mean ± SD of preoperative FVC was 56.43 ± 12.07 and postoperative 3rd follow-up FVC was 72.57 ± 8.10 and the difference between two groups was statistically significant (p<0.001). In previous study by Rzyman et al[3] patient's FVC was significant (p<0.001) between the groups which correlate with our study.

In this study among 30 patients Mean ± SD of

preoperative FEV1 was 55.17 ± 11.76 and postoperative 1st follow-up FEV1 was 70.03 ± 10.26 and the difference between two groups was statistically significant (p<0.001). In previous study by Choi et al[2] patient's FEV1 was significant (p<0.001) between the groups which correlate with our study.

The mean with SD of preoperative FEV1 was 55.17±11.76 and postoperative 2nd follow-up FEV1 was 68.33±7.85 and the difference between two groups was statistically significant (p<0.001). In previous study by Choi et al[2] patient's FEV1 was significant (p<0.001) between the groups which correlate with this present study.

The mean with SD of preoperative FEV1 was 55.17 ± 11.76 and postoperative 3rd follow-up FEV1 was 75.70 ± 22.42 and the difference between two groups was statistically significant (p<0.001). In previous study by Choi et al[2] patient's FEV1 was significant (p<0.001) between the groups which correlate with this present study.

In this study among 30 patients the mean with SD of preoperative FEV1/FVC was 98.23±12.21 and postoperative 1st follow-up FEV1/FVC was 105.03±15.30 and the difference between two groups was not statistically significant (p=0.068). In previous study by Choi et al[2] patient's FEV1 was not significant (p<0.001) between the groups which correlate with this present study.

The mean with SD of preoperative FEV1/FVC was 98.23±12.21 and postoperative 2nd follow-up FEV1/FVC was 101.87±11.92 and the difference between two groups was not statistically significant (p=0.221). In previous study by Choi et al[2] patient's FEV1 was not significant (p<0.001) between the groups which correlate with this present study.

The mean with SD of preoperative FEV1/FVC was 98.23±12.21 and postoperative 3rd follow-up FEV1/FVC was 100.90 ± 9.73 and the difference between two groups was not statistically significant (p=0.045). In previous study by Choi et al[2] patient's FEV1 was not significant (p<0.001) between the groups which correlate with this present study.

Conclusion

In patients with empyema thoracis, preoperative values of FVC, FEV1, FEV1/FVC were reduced. After VATS decortication, FVC, FEV1, FEV1/FVC significantly improved. Fast patient recovery in postoperative period were observed after VATS decortication. VATS decortication should be used widely as first line operative procedure for treatment of early stage of empyema thoracis. It is an initial stage of long term study of pulmonary function. Long term study is needed for better outcome.

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