

INDICATIONS FOR VATS OR OPEN DECORTICATION IN THE SURGICAL TREATMENT OF FIBRINO-PURULENT STAGE OF PARAPNEUMONIC PLEURAL EMPYEMA

**Colanceski Risto, Spirovski Zoran, Kondov Goran, Jovev Sasko,
Antevski Borce, Cvetanovski M. Vlatko**

*Clinic for Thoracic and Vascular Surgery, Clinical Center,
Skopje, R. Macedonia*

Abstract: Open and Video-Assisted Thoracoscopic pleural decortications are proved and effective surgical procedure in the surgical treatment of pleural empyema in the fibrinopurulent stage. Early referral to surgery gives a better chance of success in VATS pleural decortications than open decortications. Pleural morphology, biochemistry and biology can also affect the outcome of the surgical treatment of pleural empyema.

The aim of this paper is to compare the results of VATS and open decortications of the pleura according to the preoperative morphological and biochemical conditions of the pleura and the pleural cavity as well as postoperative morphological and functional improvement in patients with parapneumonic, fibrinopurulent pleural empyema.

Two different approaches (VATS and open pleural decortications) were analyzed in 37 patients divided into two groups. The biochemical analysis of pleural fluid (LDH, glucose, pH and albumins) and the pleural thickness of the chest CT scan were measured. The success of the operations was measured by plain chest X-ray and functional tests after 3 months postoperatively.

The group with VATS pleural decortications showed a significantly ($p < 0.001$) lower pleural LDH level and pleural thickness and significantly higher levels ($p < 0.001$) of glucose and albumins than the group with opened pleural decortications. The differences in the pleural pH were not significant. Postoperative chest X-rays at discharge were significantly better in VATS pleural decortications. FEV1 and FVC, predicted and 3 months after operation, were not significantly different between the two groups.

VATS and open decortications are safe and effective for the majority of patients. When VATS pleural decortications cannot be performed due to an obliterated pleural space, open pleural decortication still remains an effective procedure that allows

acceptable functional and morphological results. Preoperative determination of pleural LDH, glucose, and albumins, as well as the thickness of pleural peel on CT scan, enables better evaluation of the pleural condition and a more exact indication of the right procedure.

Key words: VATS decortications, pleural empyema, open decortication.

Introduction

Pleural empyema is a surgical problem and still remains a significant cause of morbidity and even mortality in modern thoracic surgery. Between 50% and 70% of pneumonia patients will develop parapneumonic effusion and 20% of them will develop pleural empyema in a fibrinopurulent or organized stage [1, 2].

If pleural empyema develops in the fibrinopurulent or organizing stage, antibiotics and thoracic drainage may be insufficient therapy which usually makes surgical decortications of the pleura the necessary treatment [1, 2, 5, 13]. An open decortication is the most usual, conventional approach for surgical treatment of pleural empyema, but is accompanied with significant operative trauma and postoperative pain and morbidity [1, 2, 9, 10].

Video assisted thoracic surgery – VATS decortication has been established as a safe and sufficient approach to many thoracic procedures as well in the surgical treatment of pleural empyema and has been shown to reduce postoperative pain and morbidity [3–6, 9, 10, 15].

There are many published studies suggesting the role of VATS as a surgical approach to decortication of pleural adhesions and peels as well as in obliteration of the pleural space of pleural empyema at a fibrinopurulent stage, but it is still controversial for effective decortications of the pleura in the organized stage of pleural empyema [5, 7–9, 13, 14, 17].

Very few studies have directly compared VATS and opened decortications as a surgical treatment at later stages of parapneumonic pleural empyema, in the sense of a primary choice, especially when the preoperative condition of the pleural space and the pleura, does not show the stage of the disease clearly, which is the reason for a number of conversions of VATS to open decortications [9, 14, 16, 17].

The aim of this paper is to compare the results of VATS and open decortications of the pleura according to the preoperative morphological and biochemical conditions of the pleura and the pleural cavity as well as the postoperative morphological and functional improvement in patients with parapneumonic, fibrinopurulent pleural empyema.

Material and Methods

This study presents 37 adult patients with pleural empyema at a fibrino-purulent stage treated operatively with VATS and open decortications at the Thoracic and Vascular Surgery Department, Clinical Centre, Skopje, between January 2007 and March 2010. Prior to surgery, all patients were diagnosed morphologically by plain chest X ray, US and CT scan of the lungs and the thickness of the pleura was measured. Glucose, pH, LDH and albumins in the pleural cavity and the biological characteristics were determined by cytology and bacteriology of the pleural fluid. All patients were classified according to Light's criteria 1995 [1].

Initially, the surgical treatment of all patients started with pleural drainage with clinically performed thoracoscopy followed by aspiration of the pleural effusion detoxication, substitution and symptomatic therapy. Prior to surgery a control plain X ray or CT scan of the chest were performed and indications for VATS or open decortications were established.

According to the type of operation, all the patients were separated into two groups. The first group with 17 patients was operated with VATS decortication and the second group of 20 patients with open decortication.

The indications for VATS decortications were established for the patients with nonloculated, noncapsulated, low pleural LDH grade with thin pleural peel and pleural empyema in the fibrinopurulent stage, and open decortication was performed on patients with multilocular, encapsulated, thick pleural peel and inter lobar and diaphragmatic adhesions pleural empyema in the fibrinopurulent stage.

Postoperatively, a plain X ray of the chest was performed at discharge from the hospital and the evaluation of the expansion of the lungs and obliteration of the pleural cavity was made by the same radiologist, classifying them in the following groups:

1. unchanged, 2. minimal improvement, 3. low improvement, 4. moderate improvement and 5. complete resolution.

The group characteristics and the differences between the two examined groups were determined. Descriptive statistical analysis was expressed in terms of frequency, mean and standard deviation with 95.00 Confidential interval minimal and maximal value of analysed parameters. The Test of Normality (p) was used for distribution of the data. The difference of values of the analyzed parameters between the two groups, on a series with no deviation from normal distribution was tested with t – test for independent samples (t). The difference in values of the analysed parameters between the two groups within the series with deviation from the normal distribution was tested with the Mann-Whitney U test (U/Z). The results are presented in Tables.

Results

The results are presented according to the surgical treatment.

VATS decortication (Table 1)

The results from descriptive statistics are shown in patients who were treated with VATS decortication for pleural empyema in the fibrinopurulent stage. The mean value, interval of confidence, minimum and maximum values with the standard deviation for lactate dehydrogenase, glucose, albumin and pH, The thickness of the preoperative pleural peel, X-ray of the chest and the values of measured FEV1 and FVC predicted and 3 months after surgery are given in Table 1.

Table 1 – Табела 1

Descriptive statistics of group 1 operated with VATS decortication
Дескриптивна статистика на I. групата оперирана со VATS декортикација

Group 1	Valid N	Mean	Confidence -95,00%	Confidence +95,00%	Minimum	Maximum	Std. Dev.
LDH IU/l	17	5247,05	4295,51	6198,61	2500,00	9000,00	1850,72
GLUCOSE	17	1,46	1,271	1,65	0,90	2,00	0,37
Albumins	17	17,88	16,49	19,28	12,00	22,00	2,71
pH	17	7,03	7,01	7,04	7,00	7,10	0,03
Pl. thick.	17	2,08	1,76	2,41	0,50	3,20	0,63
X ray	17	4,71	4,46	4,95	4,00	5,00	0,47
FEV1 before	17	3592,05	3469,57	3714,55	3260,00	4060,00	238,24
Fev1 aft. 3m.	17	2823,52	2667,87	2979,19	1930,00	3250,00	302,76
FVC before	17	4731,17	4562,41	4899,95	4210,00	5270,00	328,25
FVC aft. 3m.	17	3658,23	3161,64	4154,83	2160,00	4720,00	965,86

LDH – Pleural Lactat dehydrogenase, X-ray of chest at discharge from hospital, FEV1 before. – Forced expiratory volume predicted preoperatively, FEV1 aft. 3m. – postoperatively after 3 months, Pl. thic. – Pleural thickness in mm

LDH – Плеврална лактате дехидрогеназа, RTG на белите дробови при испис од болница, FEV1 пред. – предоперативно претпоставен, FEV1 по 3 м – 3 месеци постоперативно мерен, пл. дебелина – дебелина на плеврата предоперативно

Our results for the patients treated by open decortication are given in Table 2.

Table 2 – Табела 2

Descriptive statistics of group 2 operated with open decortication
Дескриптивна статистика на 2. група оперирана со отворена декортикација

Grupa 2	Valid N	Mean	Confidence -95,00%	Confidence +95,00%	Minimum	Maximum	Std. Dev.
LDH IU/l	20	12595,00	11500,51	13689,49	9500,00	18200,00	2338,57
GLUCOSE mmol/l	20	0,55	0,46	0,65	0,30	0,90	0,19
Albumins mmol/l	20	25,40	24,04	26,76	22,00	34,00	2,91
pH	19	7,01	7,00	7,01	7,00	7,03	0,01
Pl. thick.	20	5,15	4,92	5,37	4,20	6,00	0,49
X ray	20	3,45	3,03	3,87	1,00	4,00	0,89
FEV 1 before	20	3594,50	3501,04	3687,96	3280,00	3940,00	199,69
Fev 1 aft. 3m.	20	2857,00	2706,45	3007,55	2240,00	3360,00	321,68
FVC before	20	4709,50	4551,48	4867,52	4140,00	5270,00	337,63
FVC aft. 3m	20	3766,00	3298,19	4233,81	2170,00	4720,00	999,57

Abbreviations as in Table 1.

Скратеници како во табела 1.

The differences of the analysed parameters between the two groups of patients are shown in Table 3.

The value of LDH in group 2 for $t = -10.46$ and $p < 0.001$ ($p = 0.000$) is significantly higher than in group 1. In patients from group 1 the glucose level for $t = 9.60$ and $p < 0.001$ ($p = 0.000$) is significantly higher than in group 1. For $Z = 1.81$ and $p > 0.05$ ($p = 0.07$) there is no significant difference between two groups. The value of the pleural thickness in group 2 for $t = -16.66$ and $p < 0.001$ ($p = 0.000$) is significantly higher than in group 2. For $Z = 4.19$ and $p < 0.001$ ($p = 0.000$) X-ray findings in group 1 have a significantly higher value than in group 2. For $Z = -0.26$ and $p > 0.05$ ($p = 0.97$) there is no significant difference in the values of FEV 1 predicted between the two groups. For $Z = -0.26$ and $p > 0.05$ ($p = 0.79$) there is no significant difference in values of FEV1 after 3 months between two groups. For $Z = 0.19$ and $p > 0.05$ ($p = 0.85$) there is no significant difference in values of FVC predicted between two groups. For $Z = -0,51$ and $p > 0.05$ ($p = 0.62$) there is no significant difference in values of FVC1 after 3 months between the two groups.

Table 3 – Табела 3

Differences among analysed parameters
Разлики између анализираних параметри

Parameter	Mean 1 gr.	Mean 2 gr.	t-value		p-level
LDH IU/l	5247,06	12595,00	-10,46	35	0,000***
Glucose mmol/l	1,46	0,55	9,60	35	0,000***
	Rank Sum	Rank Sum	U	Z	p-level
Albumins	154,00	549,00	1,00	-5,15	0,000***
pH	371,50	294,50	104,50	1,81	0,07
	Mean	Mean	t-value		p-level
	1 gr.	2 gr.			
Pl. thick. mm	2,08	5,15	-16,66	35	0,000***
	Rank Sum	Rank Sum	U	Z	p-level
X-ray	460,50	242,50	32,50	4,19	0,00003***
	Mean	Mean	t-value		p-level
	1 gr.	2 gr.			
FEV 1 before	3592,06	3594,50	-0,03	35	0,97
	Rank Sum	Rank Sum	U	Z	p-level
Fev1 aft. 3m	314,50	388,50	161,50	-0,26	0,79
	Mean	Mean	t-value		p-level
	1 gr.	2 gr.			
FVC before	4731,18	4709,50	0,19	35	0,85
	Rank Sum	Rank Sum	U	Z	p-level
FVC aft. 3m	306,50	396,50	153,50	-0,51	0,62

p < 0,001***

Abbreviations as in Table 1.

Скратеници како во табела 1.

No patients from either group showed early or late postoperative complications.

Discussion

Our study confirms that VATS and open decortications are effective operative methods in the surgical treatment of pleural empyema. The surgical treatment of the pleural infection can reconstitute the patient's previous function and morphological function by pleural decortication. The indications for VATS or open decortications are still often set down to the surgeon's choice, based on preoperative findings of the condition of the pleura, pleural cavity and surrounding lung parenchyma [1–9, 11–14].

There are many studies which describe conditions which can give a safer ground for choice of the adequate type of operation for certain preoperative pleural conditions.

In the last decade, VATS decortication of the pleura has been set apart as a surgical method which gives the opportunity for surgical treatment of pleural empyema at a fibrinopurulent stage. It gives a shorter treatment, less trauma and morbidity for the patient, it is less costly and gives good postoperative functional and morphological outcomes [3, 4, 9, 11, 12]. Nevertheless, there are studies which describe how the final outcome of the surgical treatment of pleural empyema, despite the surgical method used, depends mostly on the stage of the disease which is proportionate with the time from the appearance of the symptoms of disease [5, 9, 13, 14, 16, 17].

Open pleural decortication in the fibrinopurulent stage of pleural empyema, as many studies have shown, is equally effective in the functional and morphological sense as VATS decortication [9]. Nevertheless it brings greater operative trauma and morbidity to the organism, and is longer-lasting and more expensive in the treatment of pleural empyema [10, 15]. The latest studies show a greater use of VATS decortication of the pleura with more and more extension of indications, especially in patients with earlier referral to surgical treatment in the early phases of fibrinopurulent or even the catharal stages of pleural empyema.

The problem arises when preoperative findings suggest an organized stage of pleural empyema. Studies show 10–15% of cases converted from VATS to open pleural decortication [3, 9, 11–14, 16, 17]. The success of VATS pleural decortication often depends on the surgeon's skills and the thickness of the pleural peel and also of pleural fibrosis with hard adherences to the diaphragmal or interlobular recessuses which mechanically enables the success of the VATS approach. Saccular, circumscript pleural empyemas often enable the collapse of the lung and technically narrows the possibility for adequate VATS decortication. Still, a number of studies suggest that early referral to surgery of a patient with fibrinopurulent pleural empyema, where the pleura is still covered with thin fibrinous pleural peel, have a better chance for decortication with VATS than with open pleural decortication [13, 14, 16, 17].

Our study shows that no patient was converted from VATS to open decortication, the patients with VATS pleural decortication had significantly lower pleural LDH and pleural amount of albumins, and a significantly higher amount of pleural glucose. The pleural thickness in mm, which is the main sign for the surgeon in choosing the type of operation, was significantly lower in patients with VATS pleural decortication than in open pleural decortication. There was no significant difference of pH between the two operations.

The results of the functional condition of the lungs 3 months after the operation showed no significant difference between VATS and open pleural

decortication which enables the surgeon to convert more freely to open surgery if necessary because of good functional results later, postoperatively.

The radiological findings show significantly better results within group one, with VATS pleural decortication, which is understandable because of the lower operational trauma and better preoperative pleural condition due to an earlier referral to surgery.

Conclusions

Based on our data we can conclude that surgical therapy of parapneumonic fibrinopurulent pleural empyema both with VATS and open decortications is safe and effective for the majority of patients. When VATS pleural decortication cannot be performed due to an obliterated pleural space, open pleural decortication still remains an effective procedure that allows acceptable functional and morphological results. Preoperative determination of pleural LDH, glucose and albumins as well as the thickness of the pleural peel on CT scan allows better evaluation of the pleural condition and a more exact indication of the right procedure.

REFERENCES

1. Colice G.L., Curtis A. (2000): Medical and surgical treatment of parapneumonic effusions: an evidence-based guideline. *Chest*; 118: 1158–1171.
2. Molnar T.F. (2007): Current surgical treatment of thoracic empyema in adults. *Eur J Cardiothorac Surg*; 32: 422–430.
3. Striffeler H., Gugger M. (1998): Videoassisted thoracoscopic surgery for fibrinopurulent pleural empyema in 67 patients. *Ann Thorac Surg*; 65: 319–323.
4. Luh S-P., Chou M-C. (2005): Video-assisted thoracoscopic surgery in the treatment of complicated parapneumonic effusions or empyemas, outcome of 234 patients. *Chest*; 127: 1427–1432.
5. Rzyman W., Skokowsky A. (2004): Decortication for chronic parapneumonic empyema: results of a prospective study. *World J Surg*; 28: 488–493.
6. Nakahara K., Ioka S. (1989): Postoperative preservation of pulmonary function in patients with chronic empyema thoracis: a one-stage operation. *Ann Thorac Surg*; 47: 848–852.
7. Swoboda L., Laule K. (1990): Decortication in chronic pleural empyema. Investigation of lung function based on perfusion scintigraphy. *Thorac Cardiovasc Surg*; 38: 359–361.
8. Rzyman W., Skokowski J. (2005): Lung function in patients operated for chronic pleural empyema. *Thorac Cardiovasc Surg Aug*; 53: 245–249.

9. Chan D.T.L., Sihoe A.D.L. (2007): Surgical treatment for empyema thoracis: is video-assisted thoracic surgery 'better' than thoracotomy? *Ann Thorac Surg*; 84: 225–231.
10. Bestall J.C., Paul E.A. (1999): Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. *Thorax*; 54: 581–586.
11. Solaini L., Prusciano F. (2007): Video-assisted thoracic surgery in the treatment of pleural empyema. *Surg Endosc*; 21: 280–284.
12. Cassina P.C., Hauser M. (1999): Videoassisted thoracoscopy in the treatment of pleural empyema: stagebased management and outcome. *J Thorac Cardiovasc Surg*; 117: 234–238.
13. Waller D.A., Rengarajan A. (2001): Delayed referral reduces the success of video-assisted thoracoscopic debridement for post-pneumonic empyema. *Respir Med*; 95: 836–840.
14. Luh S.P., Hsu G.J. (2008): Complicated parapneumonic effusion and empyema: pleural decortication and video-assisted thoracic surgery. *Curr Infect Dis Rep*; 10: 236–240.
15. Rogers M.L., Duffy J.P. (2000): Surgical aspects of chronic postthoracotomy pain. *Eur J Cardiothorac Surg*; 18: 711–6.
16. Waller D.A., Rengarajan A. (2001): Thoracoscopic decortication: a role for video-assisted surgery in chronic postpneumonic pleural empyema *Ann Thorac Surg*; 71: 1813–1817.
17. Cheng Y.J., Wu H.H., Chou S.H. (2002): Video-assisted thoracoscopic surgery in the treatment of chronic empyema thoracis. *Surg Today*; 32: 19–25.

Резиме

ИНДИКАЦИИ ЗА VATS ИЛИ ОТВОРЕНА ДЕКОРТИКАЦИЈА ВО ХИРУРШКИОТ ТРЕТМАН НА ФИБРИНОПУРУЛЕНТНИОТ СТАДИУМ НА ПАРАПНЕВМОНИЧНИОТ ПЛЕВРАЛЕН ЕМПИЕМ

**Чоланчески Ристо, Спиrowsки Зоран, Кондов Горан, Јовев Сашко,
Антевски Борче, Цветановски М. Влатко**

*Клиника за торакална и васкуларна хирурџија,
Клинички центар, Скопје, Р. Македонија*

Апстракт: Отворената и видеоасистираната торакоскопска плеврална декортикација се докажани и ефективни хируршки процедури во хируршкиот третман на плевралниот емпием во фибринопурулентна фаза. Раното јавување на хирургија дава подобри шанси за успех на VATS, отколку на отворената плеврана декортикација. Плевралната морфологија, биохемија и биологија може да влијаат врз исходот од хируршкиот третман на плевралниот емпием.

Целта на овој труд е да ги спореди резултатите од VATS и отворената плеврална декортикација според предоперативните морфолошки и биохемиски состојби на плеврата и плевралниот простор како и постоперативните морфолошки и функционални подобрувања кај пациентите оперирани заради фибринопурулентен парапневмоничен плеврален емпием.

Двата различни приоди (VATS и отворена плеврална декортикација) беа анализирани врз 37 пациенти поделени според операцијата во две групи. Беа мерени предоперативните биохемиски карактеристики на плевралната течност (LDH, гликоза, рН и албумини) како и дебелината на плевралните нарастоци на КТ на белите дробови. Успехот од операциите беше одредуван со нативни RTG на белите дробови и функционални белодробни тестови 3 месеци пооперативно.

Групата со VATS плеврална декортикација покажа значително помали ($p < 0.001$) вредности на LDH и помала дебелина на плеврата ($p < 0.001$) и значително поголеми ($p < 0.001$) вредности на гликоза и албумини отколку во групата со отворена декортикација. Немаше разлика во плевралниот рН меѓу групите. Постоперативните нативни RTG на белите дробови при исписот на болните беа значително подобри кај групата со VATS плеврална декортикација. FEV 1 и FVC претпоставените и по 3 месеци од операциите не беа значително различни помеѓу двете групи.

VATS и отворената плеврална декортикација се сигурни и ефективни операции за поголемиот број на пациенти. VATS плевралната декортикација не е употреблива кај облитерираниите плеврални шуплини, отворената плеврална декортикација сè уште останува ефективна операција со која се добиваат задоволителни функционални и морфолошки резултати. Предоперативното одредување на плевралните: LDH, гликоза и албумини, како и дебелината на плевралните нарастоци на КТ на белите дробови, овозможуваат подобра процена на состојбата на плеврата и плевралната шуплина и за поточна индикација за избор на права хируршка процедура.

Клучни зборови: VATS декортикација, плеврален емпием, отворена декортикација.

Corresponding Author:

Dr. V. Risto Colanceski Mr. Csi.
Thoracic and Vascular Surgery Clinic
Clinical Centre
Vodnjanska 17
1000 Skopje, R. Macedonia
Tel: +389 2 147 030, +389 70 220 456

E-mail: Colanceski@hotmail.com