UDK: 616.25-002.3-08(497.7)
DOI: https://www.doi.org/10.55302/MJA2373064k

ORIGINAL ARTICLE

DEVELOPMENTS IN SURGICAL TREATMENT OF PLEURAL EMPYEMA

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Abstract

Thoracic empyema is the accumulation of pus within the pleural cavity. The most frequent cause is direct contiguous spread of infection, the most frequent from lung infection. Current management of empyema is based on local empirical practice as there is no consensus on an optimal regimen. It is estimated that 40% (7-57%) of pneumonia, results with parapneumonic effusion, out of which 10% develop empyema of pleural space.

Treatment covers antibiotics, pleural drainage, pleural drainage and use of fibrinolytics, VATS early debridement, VATS decortication, open decortication, open pleural window and thoracoplasty. The choice of adequate treatment is according to stage of empyema: I (exudative stage) - thoracic drainage, II (fibrinopurulent stage) - thoracic drainage with fibrinolytics and VATS debridement or VATS early decortication and for III (empyema in organization stage) - VATS or open decortication or later thoracoplasty. Early VATS debridement effectively manages simple parapneumonic effusions. VATS decortication has efficacy for managing early-stage empyema.

In the past (2011-15) period 234 patients with empyema were treated, out of which 124 (52.99%) of empyema were treated with pleural drainage, 105 (44.87%) were treated with open decortication and 5 (2.14%) with thoracoplasty.

In the last 6 months of 2023, 21 patients were treated, 19 (90.5%) male and 2 (9.5%) female. Unfortunately, in the last 6 months only 5 (23.8%) of the patients were treated only with pleural drainage, 4 (19%) patients were treated with VATS debridement or early decortication and 12 (57.14%) patients were treated with pleural drainage that finished with open decortication. This situation suggests that, unfortunately, empyema was detected in advanced stage that needed aggressive surgical treatment.

Early detection of parapneumonic effusion and treatment in this stage will prevent development of empyema and need of aggressive treatment.

Key Words: *opens decortication, pleural empyema, thoracic drainage, VATS decortication.*

Introduction

Thoracic empyema is the accumulation of pus in the pleural cavity. The cause of empyema is direct contiguous spread of infection, the most frequent from lung infection. Thoracic empyema remains a significant medical problem. Patients in whom empyema develops suffer significant morbidity, frequently require prolonged hospitalizations, and are at an increased risk of death (1,2).

Current management of empyema is based on local empirical practice as there is no consensus on an optimal regimen (2).

The development of new diagnostic procedures, especially the application of ultrasonography in daily clinical practice, enables early diagnosis of pleural empyema and appropriate aggressive therapy (3).

The aim of this paper is to analyze therapeutic approach to pleural empyema, according to stage of the disease. Also, the aim is to analyze therapeutic approach in two different periods of treatment of empyema in the clinic for thoracic and vascular surgery.

Material and Methods

At the Clinic for Thoracic and Vascular Surgery, in the period of 6 months (01.03 to 01.09.2023) 21 patients were treated with pleural empyema. Out of them 19 were male and 2 females. Mean age was 54+4.1 years.

In 3 patients, empyema was a consequence after COVID 19 pneumonia. 4 patients were detected diabetes mellitus insulin dependent and in 2 patients condition after coronary stenting was detected.

The past period that was analyzed, was five-years period from 2011-2015, in which 234 patients with empyema were treated. The mean age was 51.94 years.

We used standard statistical methods, and for comparing methods in two different periods we used the chi–square statistic, using standard statistical programs SPSS.

Results

Treatment was based according to the stage of the disease: 5 (23.8%) patients were treated with only pleural drainage, 4 (19%) patients were treated with VATS decortication and 12 (57.14%) patients were treated with open thoracotomy decortication (in 9 patients after unsuccessful thoracic pleural drainage and in 3 with unsuccessful primary open thoracotomy decortication) (Table 1).

Among the 12 patients with decortications, the presence of a bronchopleural fistula was detected in 4, which closed spontaneously after 3-6 days. In 1 patient, there was no complete re-expansion on the control X-ray after 2 days, in whom with physical therapy, the lungs expanded completely in the following days. At the control 2 weeks after discharge from hospital in 10 patients there was complete re-expansion and orderly transparency of the decorticated side. In this group we have only one death.

In this group average hospitalization was 7.76 days. In that with thoracic drainage average hospitalization was 4.8 days, in that with VATS decortication 5.4 days and in that with open thoracotomy decortication 11.43 days (Table 2).

These results were quite different, statistically significant, compared to results of treatment of pleural empyema in the past (2011-2015), when out of 234 patients with empyema 52.99% (124) were treated with pleural drainage only, 44.87% (105) with open thoracotomy decortication and 2.14% (5) with thoracoplasty (Table 1).

Table 1. Results of surgical treatment in patients with empyema.

	2011-2015	**2011-2015**	**03-09-2023**	**03-09-2023**	
Surgery	**Patients**	**%**	**Patients**	**%**	**p**
Pleural drainage	124	52.99	5	23.80	<0.05 S
VATS decortication	0	0	4	19.00	<0.05 S
Decortication	105	44.87	12	57.14	0.15 NS
Thoracoplasty	5	2.14	0	0	0.01 S
Total	234	100	21	100	

The chi-square statistic is 48.0262. The p-value is <0.00001. The result is significant at p<0.05.

Table 2. Mean hospitalization of surgically treated patients with empyema.

	2011-2015	**2011-2015**	**03-09-2023**	**03-09-2023**	
Surgery	**Patients (%)**	**mean hospitalization days**	**Patients (%)**	**mean hospitalization days**	**P**
Pleural drainage	124 (52.99)	11.4	5 (23.80)	4.80	<0.05 S
VATS decortication	0		4 (19.00)	5.40	<0.05 S
Decortication	105 (44.87)	23.3	12 (57.14%)	11.43	<0.05 S
Thoracoplasty	5 (2.14)	42.2	0	0	<0.05 S
Total	234	17.4	21	7.76	<0.05 S

The chi-square statistic is 48.0262. The p-value is <0.00001. The result is significant at p<0.05.

Discussion

Infection of pleural space occurs according to the spread of infection from nearest tissues and organs. 40% of pneumonia results with parapneumonic effusion, out of which in 10% results with empyema of pleural space. Because of non-intervention or inadequate intervention in the stage of parapneumonic effusion, the process develops into the development of empyema (1,2).

Moreover, the development of pleural empyema proceeds through a three-stage development
1. Exudative phase - during which the space is filled with rare pus with few cells. After removing the pus, the lung easily expands and fills the space.

2 Fibrinopurulent phase - the space is filled with thick pus, with numerous cells and fibrin deposition on the surface of the lung. Fibrin adhesives make it impossible for the lung to expand after removing the purulent content.

3 Organizing phase - there is an organization of fibrin stickers, growth of fibroblasts and blood vessels for the parietal and visceral pleura. An attempt to release this covering from the pleura, especially at a later stage, leads to injury of the lung covering with the formation of bronchopleural fistulas (2).

Although the 3rd stage (the organizing stage) of pleural empyema in some way represents a self-healing process, limiting the infection, it still represents a seat of infectious material, and entrapment of the lung drastically reduces respiratory capacities. That is the reason for applying surgical treatment at this stage of the disease (4,5).

Despite the administration of an appropriate antibiotic -according to isolates, type of infection (intrahospital or community-acquired pneumonia), epidemiological data- it is still insufficient in the treatment of pneumonia complicated by parapneumonic effusion, and even less the existence of pleural empyema (1).

But, it must be emphasized that the detection of parapneumonic effusion in the first stages according to the Light classification, the use of antibiotics combined with minimally invasive techniques such as thoracentesis, pleural drainage with or without the use of fibrinolytic therapy, can completely repair the process, preventing the development of pleural empyema.

The application of VATS debridement, i.e. VATS decortication, methods which, as less invasive, are more often applied recently, could give an effect in the treatment of class 5 and 6 according to the Light classification, i.e. stage 2 (fibrinopurulent stage) and early stages of stage 3 (organizing stage) according to the AATS (American Association of Thoracic Surgeons) classification. The application of VATS debridement, i.e. VATS decortication, in an appropriate stage of the disease, gives better results, compared to open thoracotomy decortication, in terms of a shorter hospital stay, less postoperative pain and less blood loss (6,7).

Treatment of more advanced stage 3 disease (organizing stage) with VATS decortication does not provide an advantage over open thoracotomy decortication. Hereby, VATS decortication takes longer and the effect is not the same as with open intervention, and very often requires conversion to open intervention (6-8).

Unfortunately, in our series, 12 patients out of 21 patients came to the clinic with stage 3 of the disease (organizing stage), with thick fibrous patches on the parietal and visceral pleura, thickening more than 5mm, with the existence of a trapped lung, in which the only possible approach was the application of open thoracotomy decortication (9-11).

The difference in the percentage of patients treated with pleural empyema at the thoracic surgery clinic in the past (from 2011 to 2015) and in the last 6 months (from March to September 2023) is statistically significant (thoracic drainage 52.99% vs 23.18%, VATS decortication 0% vs 19%, open thoracotomy decortication 44.87% vs 57.14%), which , is probably due to an advanced stage of the disease (the advanced stage of the organizing stage, accompanied by thick fibrous

plaques on the parietal and visceral pleura, with trapped lung). This should be an incentive to consider parapneumonic effusion more often, when the pneumonia does not respond to antibiotic therapy, and to detect it and treat it invasively (with thoracocentesis or thoracic drainage) in the earliest stage (12).

Today, the application of ultrasonography of the pleura, which is an easily available and non-invasive method, allows early diagnosis of pleural effusion and the possibility of early intervention. The application of chest CT accurately locates the changes, existence of thickening of parietal and visceral pleura, location of effusion, lung entrapment (3,13)

The appearance of pus in the pleural space - pleural empyema, should be aggressively treated immediately with VATS debridement or VATS decortication, preventing the development of an organizing stage (2-3 weeks are enough for it to transform from a fibrinopurulent stage to an organizing stage) (7,8).

Conclusion

Early detection of pleural effusion, secondary to pneumonia, should prompt punctuation to determine the stage and appropriate treatment as soon as possible. Early stages (parapneumonic effusion) can be treated with less invasive procedures (thoracentesis, thoracic drainage), while more advanced stages, especially the presence of empyema, must be treated with more aggressive procedures (VATS debridement, decortication, thoracoplasty).

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