

PLEURAL EMPYEMA MENAGEMENT: A BRIEF REVIEW OF LITTERATURE

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LEČENJE EMPIJEMA PLEURE: PREGLED LITERATURE

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ABSTRACT

Pleural empyema, defined as the presence of purulent material within the pleural space, is the consequence of a suppurative process involving the serous pleural layers. Thoracic empyema is a dynamic process, inflammatory in origin and taking place within a preformed space bordered by both the visceral and parietal pleura. It is a complex clinical entity, neither a sole clinical, laboratory, nor a radiological diagnosis. The primary therapeutic aim: 'ubi pus evacua' — if you find pus remove it—has not changed since the age of Celsus. Therefore, treatment of the acute empyema of the pleura is directed to early and complete evacuation of empirical fluid and content, achieving full re-expansion of the lungs and eradication of the infection using appropriate surgical procedures, antibiotics and other supportive procedures. The optimum method of treating empyema should be adjusted to the condition of the patient and the stage of the disease in which the patient is located. The method of treatment depends on the etiology (pneumonic or traumatic), the general condition of the patient and the stage of disease development. By reviewing the available literature, it can be concluded that treating the pleural empyemas is a demanding procedure, in which it is necessary for the treating physician to apply all of his knowledge, and that there is good cooperation with the patient.

Keywords: *Empyema, treatment, pleura*

SAŽETAK

Empijem pleure, koji se definiše kao prisustvo gnojnog sadržaja unutar pleuralnog prostora, predstavlja posledicu gnojnog zapaljenja seroznih opni unutar grudne duplje. To je inflamatorni dinamičan proces koji se odvija unutar grudne duplje, sa nekad nedovoljno jasnim kliničkim, radiografskim i laboratorijskim manifestacijama. Osnovni terapijski princip „ubi pus evacua“ se nije promenio od vremena Celzusa. Stoga, evakuacija gnojne nakupine unutar pleuralnog prostora uz kompletnu eradikaciju infektivnog agensa i obliteracije pleuralnog kavuma, tokom rane faze razvoja bolesti, predstavlja primarni cilj lečenja. Optimalni metod lečenja empijema pleure bi trebalo da bude prilagodjen fazi razvoja bolesti, kao i opštem stanju pacijenta.

Pregledom dostupne literature, dolazimo do zaključka da lečenje pleuralnog empijema zahteva punu kooperaciju pacijenta, uz upotrebu svog medicinskog znanja i iskustva lekara, a u cilju postizanja izlečenja, što predstavlja izazov za lekara.

Ključne reči: *Empijem, tretman, pleura*



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INTRODUCTION

Pleural empyema, defined as the presence of purulent material within the pleural space, is the consequence of a suppurative process involving the serous pleural layers (1). The first case of empyema was described by Hippocrates about 2,400 years ago (2). Nowadays, the increased incidence of nosocomial infections, acquired immunodeficiencies and antibiotic-resistant germs reflects in a dramatic increase of pleural empyema cases resulting in a challenging management and therapeutic approach.

Considering that in 47-56% of cases no direct infectious agent of the empyema is known, and because of the need to treat it as soon as possible and in the best possible way, it is most effective to keep Light and Muers criteria for the diagnostics of contents from the pleural space (3, 4).

The most common microorganisms that lead to the formation of the empyema of pleura are: pneumococcus, streptococcus, staphylococcus and tuberculosis bacillus. Infections with coliform bacilli, *Proteus vulgaris*, various fungi and mixed microorganisms is a rare occurrence. The pathophysiological invasion of the pleural space can occur in several ways: the direct spread of the infection from the pneumonic focus (parapneumonic empire) (4), rupture of a pyogenic or tuberculous lung abscessus, a contamination resulting from an operation or trauma (5, 6), the direct spread of an infection that is primarily subdiaphragmatic and hematogenous dissemination within a generalized infection (sepsis) (7). Empyema pleura to the clinical course can be: acute and chronic.

Thoracic empyema is a dynamic process, inflammatory in origin and taking place within a preformed space bordered by both the visceral and parietal pleura. It is a complex clinical entity, neither a sole clinical, laboratory, nor a radiological diagnosis (8).

The diagnosis of empyema pleura is not difficult to set because clinical presentation is often obvious. Local symptoms of empyema include thoracic pain, cough, weakness, fever and leukocytosis. Acute empyema with a high amount of purulent effusion are manifested clinically by dyspnoea and signs of intoxication. A physical finding is characteristic of pleural effusion, and chest radiography and MSCT scan are considered “gold standards” in imaging diagnostics of pleural empyema. Positron emission tomography (18F-FDG-PET/CT) does not appear to be a diagnostic tool in evaluating patients with pleural effusion due to its low specificity and subsequent difficulty in differentiating between inflammatory and neoplastic disease (9-11).

In 1962, the American Thoracic Surgery (ATS) defined three different stages according to clinical evolution of pleural effusions: (I) exudative phase (Stage I), characterized by an increase in the permeability of serous layers with exudate production. Despite of fibroblasts and angioblastic cells proliferation with fibrin deposition, no thickenings or pleural remodeling can be identified; (II) fibrinopurulent phase (Stage II), characterized by a massive deposition of fibrin predominantly on the parietal pleura. The purulent exudate exhibits a high concentration of polymorphonu-

cleated lymphocytes. Septa begin to form in a reversible condition; (III) organized Phase (Stage III), with massive fibroblastic proliferation and consensual formation of diffuse septa on both the serous membranes and leading to lung incarceration with an impaired re-expansion (12, 13).

Taking into account the clinical findings, the criteria for diagnosing the pleura empires are as follows:

1. Obtained pure pus with pleural puncture and / or directly / indirectly confirmed presence of bacteria in the punctate (Gram stain, microbiological analysis)
2. The pH of the content is less than 7, 2, the glucose concentration is less than 400 mg / l, values of LDH punctate over 1000 IU / ml, protein level above 3 g / ml and WBC over 15 000 cells / mm³
3. Clinical and radiographic findings that point to the existence of an inflammatory process in the lungs(3).

Muers criteria includes also glucose level in pleural effusio, as well as its relation with serum glucose (3).

Chronic empyemas represent a long-term phase of the development of acute pleura empires. When the empyema becomes chronic, the visceral pleura thickens and is firmly glued to the encapsulated collection. Empyema becomes chronic for several reasons, some of which are late diagnosis, or inadequate treatment of acute empyema, the existence of a bronchopleural fistula, tuberculosis or actinomycosis infection, the presence of a foreign body in the pleural area, osteomyelitis of the rib, a lung disease that prevents and prevents re-expansion and possibility of malignant disease. Chronic empyemas today are rarely meet in clinical practice. Its treatment is long lasting and complicated, and is aimed at the sterilization of the pleural cavity and eventually surgical treatment, that is, the decortication of the lungs and the possible resection of the devastated part of the lungs (due to abscess, bronchiectasis, bronchopleural fistulae, etc.).

DISSCUSION

The primary therapeutic aim: ‘ubi pus evacua’ — if you find pus remove it—has not changed since the age of Celsus. Therefore, treatment of the acute empyema of the pleura is directed to early and complete evacuation of empirical fluid and content, achieving full re-expansion of the lungs and eradication of the infection using appropriate surgical procedures, antibiotics and other supportive procedures (8, 12-18).

The 2017 pleural effusion management guidelines of American Association for Thoracic Surgery (AATS) suggest management schemes based on the “risk-benefit” relationships and, according to the increase in this ratio, three classes have been identified; Class III has a poorly-rated treatment given the high risk factors compared to benefits; Class II has likely better rated treatment given risk factors over the benefits, but not enough trial data; Class I has highly rated benefits than risk factors (17).

The success of treatment depends on the stage in which the development of the empyema is initiated. When therapy begins at an early stage of the disease, parapneumonic



effusions and/or early stage empyema can be successfully cured using thoracic drainage and antibiotics.

Therapeutic drainage, video-assisted thoracoscopic surgery (VATS), fibrinolytic (enzymatic) decortication, open decortication of pleura, thoracoplasty and open thoracotomy are used in treating empyema pleuralis.

I. Thoracic chest tube placement

Thoracentesis is a useful tool in the management of uncomplicated pleural effusion and a recommended step in the diagnosis of complicated effusion (12, 13). However, in the setting of known pleural infection, ongoing pleural drainage is regarded as a requirement for adequate treatment and thoracentesis alone, without pleural drain placement, is not recommended (17).

Drainage of infected material from the pleural space is a fundamental part of empyema treatment. Traditionally tube thoracostomy has been performed with large bore catheters, but no consensus exists regarding ideal drain size (11, 12, 13, 14, 17).

Expert opinion holds that small-bore catheters are ineffective in draining thick pus or extensively septated effusions; however, absent any randomized trials, the role of empyema stage in the success or failure of image-guided drain placement is unclear. Existing data are mixed. In an unblinded trial, the presence of sonographic septations was predictive of more aggressive treatment, but did not specifically address the success or failure of tube drainage in this population (19).

II. Fibrinolytic (enzymatic) decortication

The removal of fibrin septes that occur during the second phase of empyema development is one of the key factors that Tilet and associates first dealt with in 1951. (20) Studies comparing the effect of drainage in the treatment of the empyema and the effect of drainage with the use of fibrinolytic, argue in favor of the use of fibrinolytic in the treatment of empyemas during the second phase of the disease with a success rate of 87.7% (21).

By developing more modern fibrinolytics, the fibrinolysis efficiency can be extended to a later period in the development of the empyema (21-23).

A thorough meta-analysis on the utility of intrapleural fibrinolytic therapy published in 2012 concluded that fibrinolytic therapy is potentially beneficial in the management of parapneumonic effusions and empyemas in adults but that there is insufficient evidence to support the routine use of this therapy for all patients with parapneumonic effusions/empyemas (23).

III. Use of video - assisted thoracoscopic surgery (VATS) in the treatment of empires

Since the mid-1990s, the thoracoscopic evacuation of the empirical bag has gained great popularity as a treatment method (24).

Subsequent studies supported the original conclusions and made certain remarks on the limitations of this procedure in the treatment of empires (25). The effectiveness of the treatment of empyema by this method varies between 68 - 93%, but very often correlates with the patient group examined. Namely, the longer the disease lasts, the failure is more frequent. In patients with a disease lasting up to 4 weeks, the effectiveness of the VATS method is higher (26).

Also, in the early stages of the posttraumatic empiric emission, VATS is for now the sovereign method of success (27).

The choice of open vs. thoracoscopic strategies must be made by considering a complete evacuation of potentially infected fluid and a complete lung re-expansion. Moreover, with either approach, the main technical considerations include safe access into the chest, drainage of pleural space and maneuvers to allow full expansion of lung. Potential contraindications and drawbacks of VATS include the inability to tolerate single lung ventilation, severe coagulopathy and operative time with increased costs (28).

IV. Decortication of pleura

Decortication of pleura is a method of choice in cases where it is not possible to achieve complete lung re-expansion ("captured lungs") due to already formed thick fibrin deposits on the visceral pleura, and the patient is in a sufficiently good general condition for great intervention in general anesthesia. The procedure was originally used for the treatment of tuberculous and posttraumatic empyema (29), and relies on the elasticity of the lung parenchyma that needs to fill the pleural space, leading to obliteration of the pleural space. In the event that the illness itself lasts for more than 6 weeks, which is equivalent to Phase III of the disease, recommendations are to apply decortication if the patient is capable of carrying out the operation (30).

In patients with long-standing post-tuberculous collapse of the lungs with minimal lung perfusion, decortication can be attempted, but the outcome is uncertain (29). In patients subjected to VATS for the treatment of empyema, conversion to open procedure (decortication) can occur in 3, 8 - 40% (30, 31).

V. Toracoplasty

Thoracoplasty ("collapse therapy") represents a partial resection of the chest wall in order to control the underlying inflammatory process, was among the first effective chest surgical interventions (32). Nowadays, the aim of this method is to fill the pleural cavity with connective tissue and / or fill the empirical cavity with tissue (omentum, muscle transposition). This procedure can be performed alone or in combination with other treatment methods. Despite the development of modern technology, there are no available reports on non-



biological materials that can be used to obliterate the pleural space (33).

In cases where there is no improvement within less aggressive treatment procedures, toracomyoplasty may be the only option (34, 35). This method may be a sovereign for the treatment of empyemas following pneumonectomy caused by bronchopulmonary and / or esophagus - complicated fistula after pneumonectomy (36).

VI . Open thoracic window

In advanced stages of the disease, in patients in severe general condition, operative thoracostomy (fenestration of the pleural space) is the first, and often the only method of treating empyema (36, 37).

The advantage of this method is the establishment of a wide opening through which the infectious substance is dried, but the quality of life of such patients is very bad. This method is most commonly applied to the empyema of pleura produced by the existence of a bronchopleural fistula after pneumonectomy, when all other options for controlling the infection are exhausted. In itself, the method of open thoracostomy can be the ultimate solution in treating the empyema of the pleura, but often represents the first phase of treatment, which “buys the time” until the conditions for closing the thoracostomy and reconstructing the chest wall are achieved (37, 38).

CONCLUSIONS

The optimum method of treating empyema should be adjusted to the condition of the patient and the stage of the disease in which the patient is located. The method of treatment depends on the etiology (pneumonic or traumatic), the general condition of the patient and the stage of disease development. By reviewing the available literature, it can be concluded that treating the pleural empyemas is a demanding procedure, in which it is necessary for the treating physician to apply all of his knowledge, and that there is good cooperation with the patient.

Regardless of the stage of the disease and the applied methods, the goals of the treatment must always be the same:

1. Complete removal of infectious contents from the pleural cavity
2. Achieve complete obliteration of the pleural space
3. Infection control
4. Applying good physical rehabilitation at the very beginning of the therapy

The way of achieving these goals, as can be seen in the reviewed literature, is not rigid and narrowly limited, but is based on the experience of doctors as well as on active monitoring of the development of the disease, where the doctor must provide himself with a working width, with the best intention for the patient.

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