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Original article

# Predictors of conversion from thoracoscopic to open surgery in management of postpneumonic empyema

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**Abstract**

*Background:* Video-assisted thoracoscopic surgery (VATS) has an important role in management of pleural empyema. The objective of this study was to assess the predictors for conversion from VATS to open thoracotomy in an assumed stage II postpneumonic empyema.
*Methods:* This prospective randomized study included 120 patients admitted to cardio-thoracic surgery department, Benha University, between 2011 and 2016. All cases were enrolled for thoracoscopic debridement for an assumed stage II postpneumonic empyema. If stage III empyema was diagnosed during thoracoscopy, conversion to thoracotomy became indicated. Predictors for conversion to thoracotomy were assessed in a univariate, a bivariate correlation and a multivariate analysis using several variables like age, sex, associated comorbidities, duration of symptoms, pleural fluid analysis, and pleural thickness measured by CT scan.
*Results:* Out of 120 patients, thoracoscopic management was successful in 82 (68%) patients, while conversion to thoracotomy was done in 38 (32%) patients. Conversion to thoracotomy was higher in patients with long duration of symptoms ($p < 0.001$) with cutoff value at 18.1 days, increased pleural thickness ($p < 0.001$) with cutoff value at 3.95 mm, increased LDH with cutoff value at 1854 IU/L, and Gram-negative infection of pleural fluid ($p < 0.001$). Multivariate analysis identified that the duration of symptoms, gram-negative bacteria, LDH and pleural thickness were the significant predictors for conversion from VATS to thoracotomy.
*Conclusion:* Predictive factors for conversion to thoracotomy in an assumed stage II postpneumonic empyema include long duration, Gram-negative bacterial infection, increased LDH, and increased pleural thickness.


*Keywords:* Pleura; Thoracoscopy; VATS; Open surgery; Empyema

## 1. Introduction

Parapneumonic effusion is a pleural fluid accumulation in the presence of pulmonary infection. 10–20% of cases with parapneumonic effusion develop complicated parapneumonic effusion or postpneumonic empyema [1]. Postpneumonic empyema has high morbidity in spite of its low incidence because of the effective antibiotic management

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[2]. The mainstay of management of postpneumonic empyema is the eradication of ongoing infection and the prevention of recurrent infection and subsequent restrictions. Inadequate drainage of this empyema with persistent signs of infection is the indication for surgery. Any delay in this surgical management will increase the morbidity and mortality [3].

Guidelines for management of empyema depend upon the stage of empyema. During stage I empyema, there is an exudative fluid without any encystations which usually responds to antibiotics and thoracocentesis or chest tube drainage. The fibrinopurulent phase or stage II disease is characterized by turbid or frankly purulent pleural fluid associated with fibrin deposits over visceral and parietal pleurae. CT scan findings include pleural enhancement and encysted effusion without any restriction. Stage II empyema can be managed by fibrinolytic therapy or video-assisted thoracoscopic debridement. In stage III empyema, there is an increased thickness of pleura with signs of restriction on CT scan. Freeing the trapped lung with prevention of recurrence or late restriction can be achieved by decortication [3].

Recently, VATS pleural adhesiolysis and decortication have also been proven to serve as an effective treatment modality in the early stages of empyema, especially during the fibrinopurulent stage [4–6]. Although still in debate, many authors have reported that the effectiveness of VATS drainage and decortication is at least equivalent to that of open decortication in terms of resolution, even in the advanced stages of empyema [7–10]. New technical advances in endoscopic instruments have increased the role of VATS in management of many thoracic surgical diseases which were previously treated by thoracotomy only [11,12]. Choosing the best surgical approach is a confusing clinical problem due to lack of specific clinical, radiological and laboratory indicators for a precise preoperative staging of empyema [3].

## 2. Patients and methods

This prospective study included 120 patients admitted to cardiothoracic surgery department, Benha University, between 2011 and 2016. All patients were informed that a VATS approach will be attempted and informed consent was obtained to proceed to thoracotomy if a stage III empyema was found at exploration by VATS. Samples of pleural fluid were collected for biochemical, cytological and bacteriological examination. The predictors for conversion from VATS to open thoracotomy in an assumed stage II postpneumonic empyema were evaluated.

### 2.1. Patient selection

According to the American Thoracic Society, patients with assumed stage II empyema and history of recent pneumonia (postpneumonic empyema) were enrolled in this study. Enrollment criteria consisted of the presence of encysted pleural effusion with pleural enhancement on CT scan in addition to the presence of signs of infection, weight loss and chest pain. Pleural fluid was examined after either thoracocentesis or chest tube drainage. Any item of the following criteria [13,14] was applied for the diagnosis of thoracic empyema:

1. Frank pus obtained by thoracocentesis.
2. Presence of bacteria detected by Gram stain or by culture.
3. Or pleural fluid analysis with all of the following: pH below 7.2, glucose level less than 40 mg/dl, LDH above 1000 IU/L, protein level above 30 gm/L and WBC over 15,000 cells/mm$^3$.

Exclusion criteria for a primary VATS approach were:

1. Other causes of empyema (other than postpneumonic empyema).
2. An assumed stage III empyema with signs of lung restriction on CT scan.
3. Suspicion of bronchopleural fistula, lung abscess, or tumor.

### 2.2. Data collection

All patients were studied for the following variables: age, sex, associated comorbidities (diabetes mellitus, hypertension, liver and kidney diseases), duration between onset of symptoms and surgery, laboratory analysis of pleural fluid (pH, LDH, protein, glucose and involved bacteria), and pleural thickness measured by CT scan.