

Original Research Article

Thoracic empyema: clinical course and management in Trivandrum Medical College

Sony P. S., Vinu C. V.*, Suresh Kumar J., Kishore Lal

Department of Cardiovascular and Thoracic Surgery, Government Medical College, Thiruvananthapuram, Kerala, India

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*Correspondence:

Dr. Vinu C. V.,

E-mail: drvinucv@gmail.com

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ABSTRACT

Background: The incidence of empyema thoracis among adults is increasing steadily. It may be primary empyema (pleural infection developing without pneumonia) or secondary empyema. The common cause of secondary empyema being- community acquired pneumonia or hospital acquired pneumonia, empyema due to iatrogenic causes, secondary to trauma etc. With advancement in science and technology, early recognition of empyema in patients with symptoms is now possible. But the treatment guidelines are not unified so that each physician may treat this condition in a different way without referring to higher concerned specialties making it complicated. The objective of this study was to determine the clinical profile of thoracic empyema in Trivandrum Medical College a tertiary care centre in South Kerala.

Methods: A total of 56 patients with empyema admitted to Government Medical College, Trivandrum, Kerala in 2018-2019 were reviewed retrospectively. The demographic details, clinical presentation, etiology, microbiological findings, and management were recorded in a planned proforma, and analysis was done.

Results: The mean age was 49.1 years with peak incidence seen in 40-60 years of age. The male to female ratio was 4.6:1.0 and right pleura was more involved than left pleura. Risk factors were diabetes mellitus, chronic obstructive pulmonary disease, pulmonary tuberculosis, and smoking. Etiology of thoracic empyema was infective in 78.6% cases and traumatic in 21.4% cases. Only two cultures showed gram positive aerobe, rest of the culture was sterile. Only a few cases resolved with medical management. Decortication was needed for 52 patients (82.1%).

Conclusions: A unified protocol need to be formulated and followed up in all centres for the management of empyema before its evolution and thus reducing the incidence of empyema and its associated complications.

Keywords: Empyema, Thoracotomy, Thoracoplasty, Decortication

INTRODUCTION

Empyema thoracis is pus collection in pleural cavity. It was identified since the era of Hippocrates, but the management remains controversial.^{1,2-6}

Empyema management by closed underwater seal drainage was advocated by Gotthard Bulau in 1875. As observed by Berger et al, and Fishman et al, operative management remains as secondary treatment even for complicated parapneumonic effusion and empyema.^{7,8}

Berger et al, described that immediate surgical drainage was not advisable for every patient with parapneumonic effusion. Fishman et al, suggested that immediate decortication is needed only in a subset of patients mainly the immunocompromised patients, not as initial treatment.

The incidence of empyema thoracis among adults is increasing steadily. It may be primary empyema (pleural infection developing without pneumonia) or secondary empyema. The common cause of secondary empyema being- community acquired pneumonia or hospital acquired pneumonia, empyema due to iatrogenic causes,

secondary to trauma etc. With advancement in science and technology, early recognition of empyema in patients with symptoms is now possible. But the treatment guidelines are not unified so that each physician may treat this condition in a different way without referring to higher concerned specialties making it complicated. Owing to this general reluctance for referral of patients diagnosed as empyema for early operative management, in contrary the tendency to manage with antibiotics, intercostal drainage and thoracocentesis is still high even though the mortality from empyema is high i.e.; 6-24%.⁹⁻¹²

The objective of this study was to determine the clinical profile of thoracic empyema from a tertiary care centre from South Kerala- Trivandrum Medical College in order provide better clinical and pharmacological management for patients with empyema.

METHODS

In this retrospective cross-sectional study, medical records of 58 patients with empyema thoracis referred to and admitted in Cardiovascular and thoracic Surgery department, Trivandrum Medical College over a period of 2 years (January 2018- December 2019) were reviewed. All thoracic empyema cases except empyema after thoracic surgery was included in the study. Patients with empyema in other sites were also excluded. The data extraction sheet included information on age, sex, etiology, smoking history, presenting symptoms, culture report of pleural pus, report of chest radiographs and CT chest.

Antibiotics were given to patients and were changed based on culture and sensitivity reports. Patients were identified based on the stage of presentation. In stage 1 disease with absent loculations and pleural fluid collection, needle aspiration was done to confirm the presence of pleural fluid and intercostal drain was placed if needed that is in the absence of resolution of pleural fluid by conservative management with appropriate antibiotics.

Stage 2 disease was categorized into two: early and late stage. In early stage which included septations, thickened parietal pleura and absence of echogenic loculations, needle aspiration followed by VATS adhesiolysis was performed. In late stage 2 and stage 3, which included multiloculated empyema and lung entrapment, decortication was performed either by thoracotomy or by thoracoscope.

For those who were planned for operative intervention, patients were anaesthetized, and rigid bronchoscopy was done for excluding the presence of foreign body, to perform lavage of bronchus, to rule out structural abnormality and for taking specimens for examination. The aim of the operative procedure was complete debridement, achievement of lung re-expansion and absence of air leak. With postero-lateral thoracotomy, pleural cavity was entered.

Pleura was separated from diaphragm and chest wall by blunt dissection. The parietal pleura which was thickened was incised. Plane was created between the thickened pleura and the underlying encased lung. Excision of thickened pleura done. The thick fibrinopurulent material was removed completely and the thickened visceral peel was removed to release the underlying entrapped lung.

After thorough saline wash of pleural cavity, air leak was checked. Air leaks identified and parenchymal breach sutured with polypropylene. After achieving satisfactory re-expansion of lung and absence of air leak, chest wall was closed in layers after inserting intercostal drainage tube. Patients were extubated on the operating room itself. Chest radiography was done in the intensive care unit for assessing complete lung expansion. Adequate analgesia given post-operatively.

Statistics

Categorical and quantitative variables were expressed as frequency (%) and mean±SD respectively. Comparison of quantitative parameters were carried out using independent sample t test. Comparison of qualitative parameters were carried out by Chi square test. P<0.05 was considered as the threshold for statistical significance. Statistical analysis was performed using a R statistical software.

RESULTS

A total of 56 patients were included in the study- male: 46 (82.1%), female: 10 (17.9%). The male to female ratio was 4.6: 1.0. Majority of the patients were in the age group 40-60 years. The mean age in our study was 49.1 years. Diabetes mellitus was identified as the most common comorbidity in the study population (57.1%). Other comorbidities were systemic hypertension, chronic obstructive pulmonary disease, and coronary artery disease. History of pulmonary tuberculosis was seen in 8 patients (14.2%). The commonest cause of empyema in our study was secondary to chest infections (78.6%). The other cause was trauma to chest (21.4%). Smoking was found to have significant association with empyema in 40 patients (p<0.001).

Table 2 describes the clinical characteristics of empyema. Most common symptom was chest pain (46.4%) followed by dyspnoea and cough. Other symptoms like cough, expectoration, fever, and hemoptysis were also present. Constitutional symptoms like malaise, anorexia and weight loss were present in 25 patients (44.6%). The organism isolated from pleural fluid was *Streptococcus Viridans* (18.2%) that too only in 2 patients. 54 patients (81.8%) had frank pus, but no bacteria were isolated from pleural fluid (Table 3). The right lung was involved in 37 patients (66%) out of which 30 patients were identified to have involvement of right lower lobe. Empyema in left lung was seen in 19 patients- left upper lobe in 5 patients and left lower lobe in 14 patients. 4 patients were treated

conservatively with antibiotics alone. 52 patients required decortication. Among them 6 patients underwent VATS.

Table 1: Demographic and clinical features of patients.

Variables	Present study (%)
Sex	
Male	46 (82.1)
Female	10 (17.9)
Mean age (years)	49.1
Etiology	
Infective	46 (78.6)
Traumatic	12 (21.4)
Smoking	
Yes	40 (71.4)
No	16 (28.6)
Comorbidities	
DM	32 (57.1)
HTN	16 (28.6)
CAD	2 (3.57)
COPD	10 (17.9)
TB	8 (14.2)

Table 2: Clinical presentation of empyema thoracis.

Symptoms	Values (%)
Chest pain	26 (46.4)
Fever	7 (12.5)
Dyspnoea	22 (39.3)
Cough	21 (37.5)
Expectoration	14 (25)
Hemoptysis	1 (1.79)
Constitutional symptoms	25 (44.6)

Table 3: Bacteriological profile.

Bacteriological profile	Present study (%)
Strep. viridans	2 (18.2)
Sterile	54 (81.8)

Table 4: Lobes affected by pneumonia.

Symptoms	Values (%)
Right upper lobe	7 (12.5)
Right lower lobe	30 (53.6)
Left upper lobe	5 (8.93)
Left lower lobe	14 (25)

Table 5: Various interventions used.

Interventions	Present study (N)	Percentage (%)
Medical management	4	7.14
Thoracotomy/decortication	46	82.1
VATS/decortication	6	10.7

DISCUSSION

Empyema thoracis is pus collection in pleural cavity. The frank pus that develops before the effusion is also described as empyema. The American Thoracic Society, about 50 years ago, described the course of empyema in 3 stages- the exudative phase, fibrinopurulent phase and organizing phase.¹³ Initially the empyema may be freely lying in the pleural cavity, later it becomes encapsulated with fibrinous adhesions of pleura. When the fluid content is absorbed, it will become more viscous. Within 7-10 days after the onset of the effusion, a thickened peel is formed on the surfaces of pleura by fibrin deposits. Full expansion of lung without any functional disability is possible if adequate treatment is given at this stage. Even with the advancement of management strategies in the initial phase itself, empyema remains to be prevalent in developing countries.

The mean age of patients in our study was 49.1 years with male predominance (82.1%). The incidence of empyema is high in the age group of 40-60. This is consistent with earlier study of Geha et al and Sherman.^{14,15} Similar picture of male predominance is seen in various studies about empyema thoracis. In a study by Lindstrom et al (67%), Bar et al (73%), Vaziri et al (83.9%) were males. This may be due to increased smoking habit and COPD among males.

Most common symptom in the present study was chest pain (46.4%) followed by dyspnoea and cough. Other symptoms like cough with expectoration, fever and hemoptysis were also present. Constitutional symptoms like malaise, anorexia and weight loss were present in 25 patients (44.6%). The clinical features of effusion may vary as per the underlying infection. It can present as acute fever, chest pain which is pleuritic in nature, sputum, and elevated leukocyte count. This picture is mostly seen in aerobic infections. In anaerobic infections, we get a slightly different picture with less fever and more pronounced systemic features like weight loss and poor appetite. These anaerobic infections are more common in alcoholics, with poor oral hygiene and those with periods of unconsciousness which can lead to gastric content aspiration.

In patients presenting initially as pneumonia, empyema should be suspected if there is no clinical response with proper antibiotic therapy and with persistence of fever, increased leukocyte count and C-reactive protein. But it is for our surprise that elderly and immunocompromised patients can even present with mild symptoms even though the severity of pleural infection is high. The causative agent in community-acquired cases and hospital-acquired cases are different, with hospital acquired infection carries worse outcome. The mortality rate is also high in hospital-acquired infection requiring urgent and aggressive management. Various predisposing conditions contribute to empyema- the commonest being, viral and bacterial pneumonias with complicated parapneumonic effusions

and blunt trauma to chest. Out of 56 patients in the present study, 44 patients (78.6%) had infective pathology whereas 12 patients had trauma as etiology. It is in concurrence with other studies (Bar et al, Vaziri et al). Tubercular empyema predominates in developing countries, but in the present study even the tuberculosis history was observed only in 14.2%.¹⁶ This can be attributed to the increased awareness programs and strategies in developing countries for elimination of tuberculosis. Aerobic bacteria predominates in community acquired empyema. This includes *Streptococcus pneumoniae* and *Staphylococcus aureus*.¹⁷

Gram negative bacteria, anaerobic bacteria and mixed aerobes are also present.^{17,18} In the present study, culture was positive in only two patients (18.2%). The pleural aspirate was sterile in 54 patients. The yield of culture was lower when compared to studies from developing countries. This may be due to the usage of antibiotics even before the surgery and late referral.

For many decades, *Streptococcus viridans* is being isolated from culture from lung abscess and empyema in humans. Recent studies also found that different strains of *Streptococcus viridans* is seen in 3%-15% in patients with empyema thoracis and 18% of patients with lung abscess. But in various studies, the *Streptococcus viridans* that is isolated from chronic lung disease patients is now considered as contaminants not as true pathogens. The anaerobes are found in various samples as co-isolates. Though the anaerobic bacteria are also known as a causative agent in lung abscess and empyema, it is noted that *Streptococcus viridans* is frequently isolated with anaerobes in patients with empyema. This suggests that the infection is by aspiration or oropharyngeal source. *Streptococcus milleri* may also act with anaerobic organisms causing damage to tissues and infection spread. *Streptococcus viridans* has also been isolated in patients who undergoes chemotherapy. It is seen in about 39% cases in neutropenic patients with chemotherapy.

British Thoracic Society (BTS) and ACCP published two guidelines for managing the pleural space infections in adult population. In BTS guidelines: use of appropriate antibiotics, analysis of effusions, drainage by chest tube, intra pleural fibrinolysis and early surgical referral if the patient shows no improvement. ACCP guideline is based on a table for evaluation of the risk of outcome in patients presenting with effusion. The three variables assessed are, anatomy of pleural space (pleural fluid amount, thickened pleura - parietal, presence of effusions that are loculated), bacteriology of pleural fluid (presence of pus or analysis by culture or gram stain) and chemistry of pleural fluid (pH of pleural fluid is measured). Based on these the patients are categorized into four different risk levels: high risk, moderate risk, low risk and very low risk.

According to ACCP guidelines, patients with moderate and high risk should undergo drainage. It may be by using tube thoracostomy or therapeutic thoracocentesis. But in

most patients, other treatment modalities may be needed such as fibrinolysis, video assisted thoracoscopic procedure or open thoracotomy and drainage of empyema/decortication. The subset of patients who need the above-mentioned procedures include, those with large amount of effusion, loculated effusion, with thickened pleura, pH<7.20, with positive gram stain or culture, or pleural space loaded with pus.

Infection control and infected material evacuation are the principal aims in management of empyema. Cefuroxime and metronidazole combination or co-amoxiclav was used in community acquired empyema and in hospital acquired infections vancomycin plus meropenem is used as per BTS (British Thoracic Society) guidelines.²² Intercostal drainage, intrapleural therapy with fibrinolytics, surgery are different options. If chest tube drainage and antibiotics shows failure in improvement and if infective symptoms persist, surgery is preferred via VATS or open thoracotomy and drainage.²³⁻²⁶

For all patients diagnosed as pleural infection, antibiotic therapy should be started based on culture and sensitivity of pleural fluid. Other factors affecting the choice of antibiotic are the presence of hepatic or renal impairment and the ability of the drug to penetrate the pleural space. If the culture report is negative, antibiotics should be given which should cover all the possible organisms that can cause infection in pleural space. The duration of antibiotic therapy is variable. It depends upon the response of the patient. When there is adequate drainage through chest tube, treatment for long term is not required. Large bore intercostal drainage tubes were needed to drain thick pus of empyema in earlier days. But recent trails showed that even small catheters inserted under image guidance can provide adequate drainage.

Intrapleural fibrinolytics is in use since the last 60 years. The lysis of fibrinous septations in the pleural space is the main aim of this therapy. Streptokinase is one of the commonest agents used for this purpose. However, the septations are lysed by intrapleural streptokinase, certain combinations are used to reduce the viscosity of pus and to break down the loculations for more effective drainage of pus. The possible candidate used is intrapleural DNase combined with thrombolytics.

Regarding the next modality in management of empyema that is the surgical management, various options are available. This includes debridement by decortication, video assisted thoracoscopic surgery, open window thoracostomy and thoracoplasty. If patients fail to improve with conservative management like chest tube drainage and antibiotics, it is essential to consider surgical management. From the early mid 1990s VATS was in practice for debridement of empyema. VATS success rate depends on the stage of empyema and the expertise of the operating surgeon. However, the morbidity is less when compared to other surgical methods and small incision, less pain and early hospital discharge are the advantages in

performing VATS. When there is failure of the underlying lung to expand because of the presence of thick inflammatory covering, the appropriate option will be decortication. Most used is the posterolateral thoracotomy. Decortication is needed when there is much delay in identifying the conversion of effusion to empyema. It improves the forced expiratory volume and vital capacity substantially. Thoracoplasty is rarely done now a days. It involves remodeling the osteomuscular wall. Open window thoracostomy is yet another surgical procedure. It is a procedure done in debilitated patients when VATS or thoracoplasty has failed. It can even be performed as an initial definitive procedure intended to cure the condition.

Limitations

In the current study, majority of patients underwent decortication. This was because the referral to cardiothoracic surgery is for unresolved empyema treated conservatively and multi loculated empyema. The cause for non-resolution of pleural effusion may be due to inappropriate use of antibiotics. The small sample size and duration of study were the limitations in the current study.

CONCLUSION

This was a study conducted at Government Medical College Trivandrum, a prestigious medical educational institution in South Kerala aimed at describing the clinical profile of empyema. The occurrence of empyema is increasing even in this modern era of technological advancement in medical field. The management of empyema is based on the clinical condition and the underlying etiology and is strictly adherent to BTS and ACCP guidelines.

The changing trends in bacteriological profile and decline in tubercular cases are observed in the study. This may be due to the prior use of appropriate antibiotics and the effective application of tuberculosis eradication programs implemented in our country. Smoking is observed to have associated with empyema. Most patients who underwent surgical management was referred from peripheral centres or other departments in our institution itself. It is observed that a few patients could be managed conservatively itself, after assessing the response to antibiotics even when they were referred to cardiothoracic department for surgical management.

It is suggested that a unified protocol need to be formulated and followed up in all centres that is from peripheral centres to tertiary care centres, so that the management of empyema before its evolution is done appropriately, thus reducing the incidence of empyema and its associated complications. Thus, optimum utilization of facilities can be done in a developing country like India. More studies are needed in similar population for better understanding of the clinical profile, management, and outcome of empyema.

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