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Investigation of the Clinical Characteristics of Empyema Thoracis Patients at Tertiary Care Facility

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FS conceived idea, FU FS TAC drafted the study, AM AQ collected data, FU FS AQ did statistical analysis and interpretation of data, FS TMS did critical reviewed manuscript. All approved final version to be published.

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A B S T R A C T

Background: Empyema remains a prevalent issue in both the developed and developing regions. Pulmonary infections, thoracic trauma, surgical procedures, and tuberculosis (TB) accounted for the majority of empyema thoracis cases.

Objective: The current investigation was conducted to examine the clinical characteristics of patients with empyema thoracis at a tertiary healthcare facility.

Methodology: This prospective observational study was conducted on 78 empyema thoracis patients present to the Department of Internal Medicine at Fauji Foundation Hospital, Rawalpindi from July 2020 to September 2021. Individuals diagnosed of empyema thoracis irrespective of their causes were enrolled. Clinical features, comorbidities and outcome were evaluated.

Results: The overall mean age of the patients was 42.68 ± 8.32 years with an age range of 20 to 75 years. There were 48 (61.5%) male and 30 (38.5%) females. Age distribution of patients was as follows: 40 (51.3%) in 20-45 years, 31 (39.7%) in 46 - 60 years, and 7 (9.0%) in 61-75 years. The prevailing symptom most frequently observed upon presentation was breathlessness 28 (35.9%), followed by chest pain 22 (28.2%) and fever 18 (23.1%). Pneumonia and diabetes mellitus was the most prevalent risk factor of empyema thoracis found in 25 (32.1%) and 17 (21.8%) cases.

Conclusion: The present study observed the higher prevalence of empyema thoracis in developing nations like Pakistan. Breathlessness and chest pain were the most prevalent symptoms of empyema thoracis. Among these cases, tubercular empyema's, which are most frequently encountered in young adults, represent a significant contributor to morbidity and mortality.

Keywords: Empyema Thoracis; Clinical Characteristics; Tuberculosis

Introduction

Empyema remains a prevalent issue in both the developed and developing regions.[1] Pulmonary infection, thoracic trauma, surgical procedures, and tuberculosis (TB) accounted for the majority of empyema thoracis cases.[2] The tubercular prothorax related clinical outcomes are significantly considered as poor and adverse due to a high bacillary load, prolonged disease, broncho-pleural fistulas development, fibrocavitary lesions synchronization, and requirement of complex intervention as compared to non-TB empyema.[3] Empyema thoracis is a condition with historical significance and continues to be a contemporary threat, with increasing incidence and mortality rate among adults.[4] Empyema, a serious condition marked by the accumulation of pus in the pleural cavity surrounding the lungs, progresses through three distinct stages. Firstly, in the exudative stage, pleural fluid accumulates, sometimes containing pus. This stage is characterized by the initial inflammatory response and may present with symptoms such as chest pain, fever, and difficulty breathing. As the condition advances into the fibrinopurulent stage, fibrous septa form within the pleural cavity, creating localized pockets of pus. This stage often manifests with worsening symptoms and may require more aggressive treatment, such as drainage procedures or antibiotic therapy. Finally, in the organizing stage, the pleural membranes scar, potentially impeding the lung's ability to expand properly. This stage may lead to long-term complications, including decreased lung function or recurrent infections. Effective management of empyema involves timely diagnosis and appropriate treatment tailored to the specific stage of the condition, aiming to alleviate symptoms, prevent complications, and promote recovery.[5,6]

Breathlessness, chest pain, cough, and fever are the most prevalent symptoms associated with empyema.[7] Initial diagnostic investigations typically include a chest X-ray and thoracic ultrasound, although CT and MRI scans of the thorax may also be performed. Effective treatment options for empyema in adults have been reported with antibiotics such as penicillins, ceftriaxone, metronidazole, clindamycin, vancomycin, gentamicin, and ciprofloxacin. A quick transformation of multiloculated purulent empyema from exudative para-pneumonic effusion is caused by white bacterial cell metabolism with higher levels of lactate dehydrogenase and low pH. While there has been one report that compares the clinical features of community-acquired thoracic empyema in older and younger patients, as far as we are aware, there has been no specific study in the existing literature that focuses on adults aged 20 to 75 years with thoracic empyema. Therefore, the present study was planned to conducted.

Objective

The present study was conducted with the aimed to investigate the clinical characteristics of empyema thoracis patients.

Methodology

This prospective observational study was conducted on 78 empyema thoracis patients present to the Department of Internal Medicine Fauji Foundation Hospital, Rawalpindi from July 2020 to September 2021. Individuals diagnosed of empyema thoracis irrespective of their causes were enrolled. Clinical features, comorbidities, and outcome were evaluated. Patients with age < 20 years, chest trauma, secondary empyema were excluded. Comprehensive demographic characteristics, encompassing age, gender, and symptoms were thoroughly assessed. The study also documented the presence of any underlying medical conditions or comorbidities. Aseptic collection of pleural fluid was performed via thoracentesis. Subsequently, the collected pleural fluid underwent various diagnostic processes, including gram staining, AFB (Acid-Fast Bacilli) staining, culture and sensitivity testing, as well as culture using the MGIT (Mycobacterial Growth Indicator Tube) method. Throughout the patient's hospitalization, a series of chest radiographs were obtained. These radiographs were taken at multiple time points, including upon admission, after the insertion of an intercostal drainage (ICD) tube, following the removal of the ICD, and at the time of discharge. Additionally, if deemed necessary, ultrasound (USG) and computed tomography (CT) scans were conducted to further evaluate the patient's condition.

Results

The overall mean age of the patients was 42.68 ± 8.32 years with an age range 20 to 75 years. There were 48 (61.5%) male and 30 (38.5%) females. Age distribution of patients were as follows: 40 (51.3%) in 20 - 45 years, 31 (39.7%) in 46 - 60 years, and 7 (9.0%) in 61 - 75 years. The prevailing symptom most frequently observed upon presentation was breathlessness 28 (35.9%), followed by chest pain 22 (28.2%) and fever 18 (23.1%). Pneumonia and diabetes mellitus was the most prevalent risk factor of empyema thoracis found in 25 (32.1%) and 17 (21.8%) cases. Out of 78 empyema thoracis patients, there were 56 (71.8%) tubercular empyemas and 22 (28.2%) non-tubercular empyemas. Sputum positive and Sputum positive and Pleural fluid positive were the most prevalent causative organisms found in 14 (25%) each. Demographic details of patients are shown in Table-I. Figure-1 illustrates the various symptoms of empyema thoracis

Table 1. Demographic details of study cases (N=78)

Causative organism	N (%)
Tubercular empyema	N = 56
Sputum positive Sputum and Pleural fluid positive Pleural fluid Clinico-radiologically Culture by MGIT method	14 (25) 14 (25) 12 (21.4) 9 (16.1) 7 (12.5)
Non-Tubercular empyema	N = 22
Staphylococcus aureus Sterile Gram negative bacilli Mixed pyogenic Anaerobic	9 (40.9) 5 (22.7) 3 (13.6) 3 (13.6) 2 (9.1)

patients. Risk factors for empyema thoracis are depicted in Figure-2. Table-II presents the causative organism of empyema thoracis in tubercular and non-tubercular patients.

Discussion

The present study mainly focused on the investigation of the clinical characteristics of empyema thoracis patients and found that tubercular empyema, which are most frequently encountered in young adults, represent a significant contributor to morbidity and mortality. Co-existing conditions such as pneumonia, diabetes, and drug abuse exacerbate the complexity of treating this condition. Timely diagnosis, comprehensive diagnostic assessments, and prompt intervention can significantly improve the prognosis and outcome of these patients. Surgical trauma and community-acquired pneumonia along with lung abscess are the most prominent causes of empyema in Western World.[8,9] In contrast, in Pakistan, tuberculosis contributes to majority of empyema cases.[10-12] Tubercular empyema accounted for the majority, comprising 56 out of 78 cases, which translates to 71.8% of all empyema cases in this investigation. Interestingly, a significant proportion of these empyema cases were found in individuals aged 20-45 years. This observation is consistent with findings from earlier studies,[13-16] possibly reflecting the higher prevalence of tuberculosis in this specific age group.

This observation may be attributed to the fact that males, typically characterized by taller stature and engagement in strenuous work, are generally more susceptible to mechanical stresses. Moreover, conditions such as tuberculosis and chronic obstructive pulmonary disease (COPD) tend to be more prevalent among males. A study conducted by Majeed[17] reported that cough was the most prevalent symptom, affecting 94% of patients. These findings align with those reported by Ho. YL et al.[18]

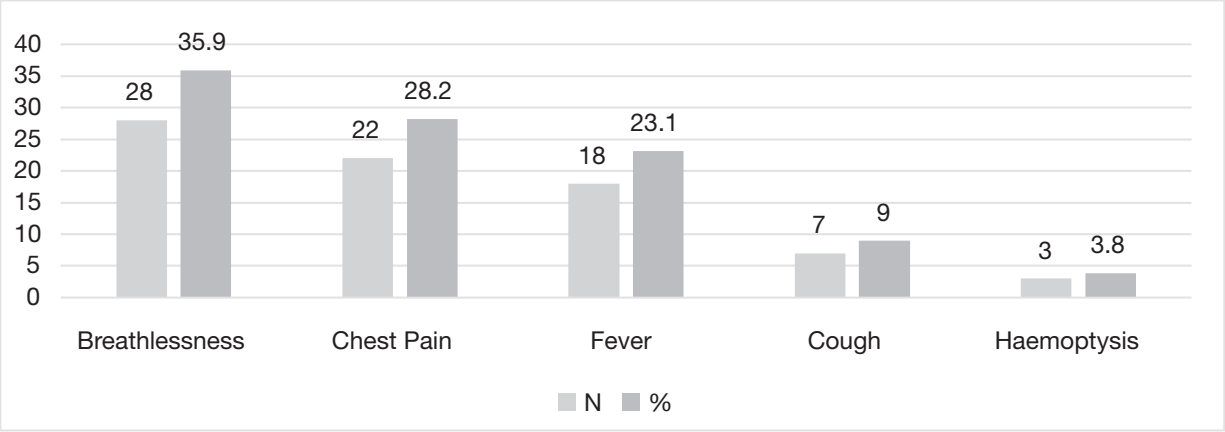

Figure 1. Symptoms of empyema thoracis (N=78).

Figure 2. Risk factors for empyemas thoracis (N=78)

Causative organism	N (%)
Tubercular empyema	N = 56
Sputum positive Sputum and Pleural fluid positive Pleural fluid Clinico-radiologically Culture by MGIT method	14 (25) 14 (25) 12 (21.4) 9 (16.1) 7 (12.5)
Non-Tubercular empyema	N = 22
Staphylococcus aureus Sterile Gram negative bacilli Mixed pyogenic Anaerobic	9 (40.9) 5 (22.7) 3 (13.6) 3 (13.6) 2 (9.1)

Wen et al[19] found that pleural fluid higher rate was the main causative organism for empyema. Similarly, the present study observed that positive sputum smear and pleural fluid had similar contribution to empyema. Among the cases that were not attributed to tuberculosis, pleural fluid cultures were positive. Staphylococcus aureus was the most prominent organism in non-tubercular cultures followed by sterile and gram-negative organisms. Similar findings were reported by the earlier studies.[20-22]

The risk factors associated with the development of thoracic empyema encompass a range of conditions, including diabetes mellitus, aspiration, inadequate dental hygiene, gastroesophageal reflux, chronic lung disease, and intravenous drug abuse (IVDA).[23,24] In elderly individuals, concomitant medical issues such as central nervous system (CNS) diseases, diabetes mellitus, or being bedridden were found to be most prevalent.[25]

Hegade et al[26] investigated the tubercular and non-tubercular empyema and showed that a cure rate of 84.5%, a failure rate of 13.5%, and a mortality rate of 3.4% among the cases studied. The current study's findings lead to the conclusion that males in the age range of 20 to 45 years are more frequently affected by empyema thoracis. Coexisting conditions such as pneumonia and diabetes add to the complexity of treating empyema thoracis. Timely diagnosis, comprehe-

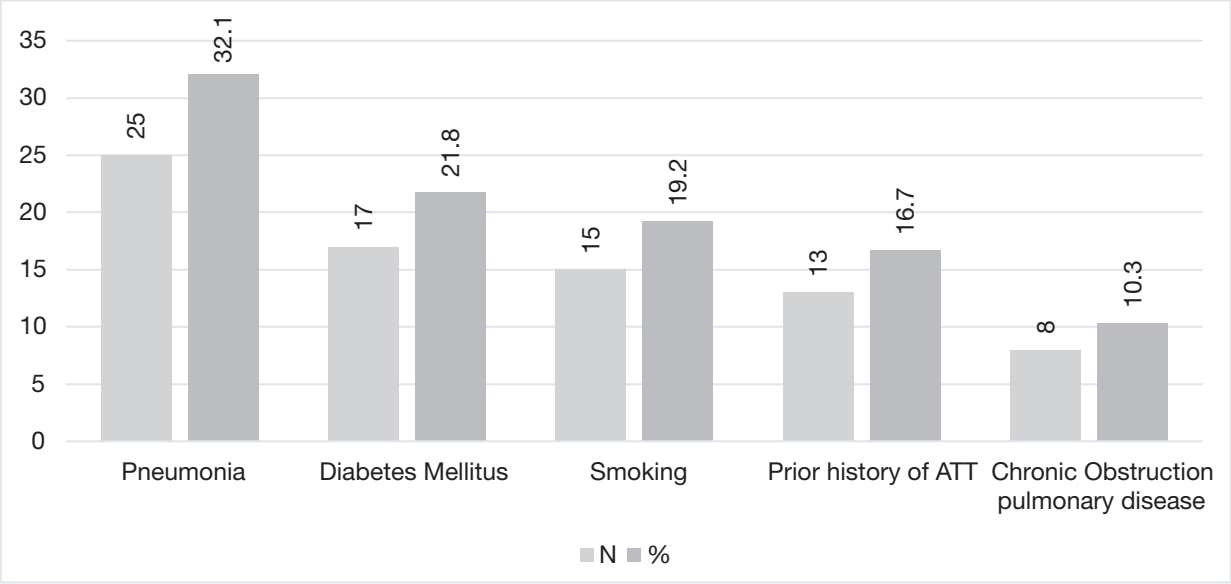

Figure 2. Risk factors for empyemas thoracis (N=78)

nsive diagnostic assessments, and early intervention are crucial factors that can significantly improve the overall outcomes for patients with this condition.

Conclusion

The present study observed the higher prevalence of empyema thoracis in developing nations like Pakistan. Breathlessness and chest pain was the most prevalent symptoms of empyema thoracis. Among these cases, tubercular empyema, which are most frequently encountered in young adults, represent a significant contributor to morbidity and mortality.

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