

## MICROBIOLOGICAL PREVALENCE IN EMPYEMA THORACIS IN A TERTIARY CARE CENTRE

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### Abstract

**Background:** Pleural effusions are one of the most common presentations in the chest clinics and are also very common to the Physician and Medical floors. There are wide range of aetiologies leading to its development and on the basis of etio-pathophysiology it can be broadly divided into transudative and exudative effusion. **Materials and Methods:** This study was conducted in Department of Respiratory medicine at Dr S. N. medical college, Jodhpur, Rajasthan. The duration of study was over a period of one year. **Result:** This study included total 53 cases of highly suspicious of empyema thoracis. This study found that two categories: tubercular and non-tubercular. The study reveals that non-tubercular empyema is predominantly caused by Gram-negative bacteria than the gram positive bacteria. **Conclusion:** Empyema thoracis remains a significant public health concern in our country, particularly among individuals of lower socioeconomic status. Contributing factors include delays in seeking medical care, inappropriate antibiotic use, and inadequate dosage or duration of treatment.

## INTRODUCTION

Pleural effusions are a common clinical presentation encountered in chest clinics, as well as by physicians and medical teams on general wards. Their development can arise from a wide range of etiologies and, based on pathophysiology, they are broadly categorized into transudative and exudative effusions.<sup>[1,2]</sup> Infections are among the leading causes of exudative neutrophilic pleural effusions, and in severe cases, this process can advance to pus formation, resulting in empyema thoracis.

The initial approach often involves empirical drug therapy, which proves effective in many cases. However, for resistant effusions and empyema thoracis, diagnostic aspiration becomes essential. Over time, the spectrum of organisms associated with empyema has evolved. While Gram-positive bacteria were historically the most commonly isolated pathogens, recent trends indicate an increasing prevalence of Gram-negative bacteria, including resistant strains.<sup>[3,4]</sup>

The advent of antibiotics initially led to optimistic declarations, such as that by William H. Stewart, the U.S. Surgeon General, who famously stated in 1967, "It is time to close the book on infectious diseases."

Yet, this prediction proved overly optimistic, as the microbial world has demonstrated remarkable adaptability, evolving to withstand modern antibiotics.<sup>[4,5]</sup>

## MATERIALS AND METHODS

**Study Area:** This study was conducted in Department of Respiratory medicine at Dr S. N. medical college, Jodhpur, Rajasthan.

**Study duration:** The duration of study was over a period of one year.

**Data collection:** In this study, cases with a strong suspicion of empyema thoracis, regardless of duration, were selected. Participants included adults of all age groups and both genders. However, individuals with an immunocompromised state or undergoing chemotherapy were excluded. Pleural fluid samples obtained through aspiration were analyzed using Gram staining, culture, ZN staining, and CBNAAT, and the data were subsequently collected

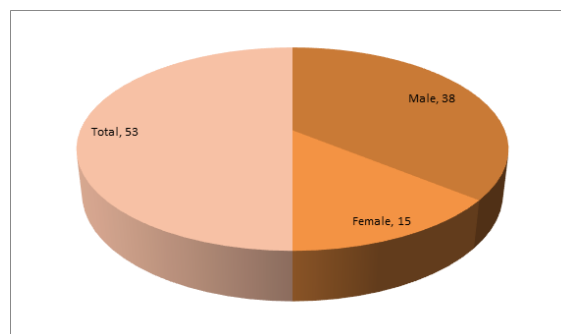
**Data Analysis:** Data were analyzed by using Microsoft Excel.

## RESULTS

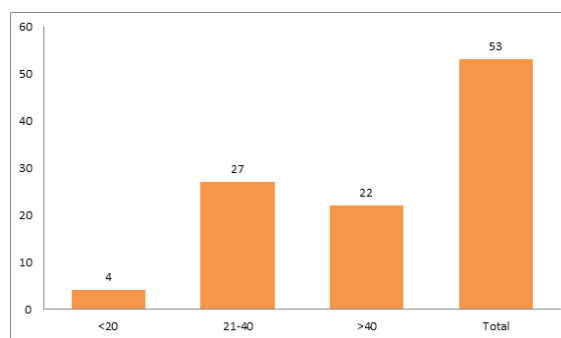
This study included total 53 cases of highly suspicious of empyema thoracis. The chart1 illustrates the composition of a total population of 53 individuals, divided into two categories: males and females. Males constitute the majority, with 38 individuals, while females account for the remaining 15. The bar chart illustrates the distribution of a total population of 53 individuals across three age groups: under 20, between 21 and 40, and above 40. The majority of the population, consisting of 27 individuals, falls within the 21-40 age group, making it the largest category. The second-largest group includes 22 individuals aged above 40, while only 4 individuals are in the under-20 age group, representing the smallest segment. This visualization emphasizes that the 21-40 age group forms the largest proportion of the population, followed by those above 40, with the under-20 group being significantly smaller.

The [Table 1] outlines the distribution of empyema cases into two categories: tubercular and non-tubercular. The majority of cases, 44 (83.1%), are classified as non-tubercular empyema, while only 9 cases (16.9%) are identified as tubercular empyema. This indicates that non-tubercular empyema is significantly more prevalent compared to its tubercular counterpart. The study reveals that non-tubercular empyema is predominantly caused by Gram-negative bacteria (30 cases), with *Acinetobacter baumannii* complex being the most common (43.4%), followed by *Pseudomonas*

(23.4%), *Klebsiella pneumoniae*, and *Escherichia coli* (16.7% each). Gram-positive bacteria were found in 12 cases, mainly *Staphylococcus aureus* (91.7%). Two cases showed no bacterial growth. In tubercular empyema (9 cases), *Mycobacterium tuberculosis* was detected in all cases, with 66.7% identified using both ZN smear and CBNAAT, 22.3% by CBNAAT alone, and 11.2% by ZN smear alone. Gram-negative bacteria dominate non-tubercular cases, while molecular methods are key for tubercular detection.



**Figure 1: Gender distribution**



**Figure 2: Age distribution**

**Table 1: Distribution of cases according to symptoms Tubercular and non Tubercular empyema.**

	Number of cases	Percentage
Tubercular empyema	9	16.9%
Non-Tubercular empyema	44	83.1%

**Table 2: ORGANISM isolated from EMPYEMA THORACIS**

Organisms	Number of cases	Percentage
Non-Tubercular empyema		
Gram positive bacteria	12	
<i>Staphylococcus aureus</i>	11	91.7%
<i>Streptococcus pneumoniae</i>	1	8.3%
Gram negative bacteria	30	
<i>Acinetobacter baumannii</i> complex	13	43.4%
<i>Pseudomonas</i>	7	23.4%
<i>Klebsiella pneumoniae</i>	5	16.7%
<i>Escherichia coli</i>	5	16.7%
No growth	2	
Tubercular empyema		
<i>M. tuberculosis</i>	9	
Only Smear positive with ZN staining	1	11.2%
Only MTB detected with CBNAAT	2	22.3%
Both ZN smear positive and CBNAAT MTB detected	6	66.7%

## DISCUSSION

This study analyzed 53 cases of suspected empyema thoracis, with a male predominance (38 cases)

compared to females (15 cases). Similar trends were reported by Tan et al. (2000), who found that 58% of empyema cases occurred in males, and Eastham et al. (2004), who observed a 2:1 male-to-female ratio. Rodriguez and Catalan (2006) also reported a similar

ratio, while Satish et al. (2003) noted equal incidence rates in both genders.<sup>[6-9]</sup>

The most affected age group was 21–40 years (27 cases), followed by those over 40 years (22 cases), and the least affected group was under 20 years (4 cases). Studies by Ghosh et al. (1990), Asindi et al. (1992), and Satish et al. (2003) also reported the highest incidence in the 21–40-year age group, though they observed peak incidence in individuals younger than 5 years. Finley et al. (2008) noted a significant increase in pleural infection incidence, with an Incidence Rate Ratio (IRR) of 2.2 among 19-year-olds during a study conducted from 1995 to 2003.<sup>[9-12]</sup>

The cases were classified as non-tubercular empyema (83.1%) and tubercular empyema (16.9%). Among non-tubercular cases, Gram-negative bacteria were predominant, with *Acinetobacter baumannii* complex being the most frequent (43.4%), followed by *Pseudomonas* (23.4%), *Klebsiella pneumoniae*, and *Escherichia coli* (16.7% each). *Staphylococcus aureus* accounted for 91.7% of Gram-positive bacteria, while two cases showed no bacterial growth. For tubercular empyema, *Mycobacterium tuberculosis* was detected in all 9 cases, with 66.7% identified using both ZN smear and CBNAAT, 22.3% using CBNAAT alone, and 11.2% by ZN smear alone.

Tubercular empyema was frequently observed in previous Indian studies, with *Staphylococcus aureus* and *Pseudomonas* being common pathogens in non-tubercular cases. Research by Mayer J.A., Peter R.M., and others emphasized tuberculosis's role in empyema cases. Pleural fluid smear positivity for AFB was noted in 11.2% of tubercular empyema cases, with 66.7% confirmed by both pleural fluid smear and CBNAAT and 22.3% detected by CBNAAT alone.<sup>[13,14]</sup> These findings align with Goyal et al., who reported high AFB smear positivity (71.69%), and Malhotra et al., who identified smear positivity in 20 cases of tubercular empyema.

Contrastingly, Mavroudis et al. (1981) identified *Streptococcus* as the most common organism (31%), followed by *Staphylococcus* (21%) and *Bacteroides* (15%). Other studies noted that post-pneumonic pyothorax was often polymicrobial, involving both aerobic and anaerobic organisms, while post-surgical pyothorax tended to be monomicrobial, with *Staphylococcus aureus* and Gram-negative bacilli being the most common pathogens.<sup>[15,16]</sup>

## CONCLUSION

Empyema thoracis remains a significant public health concern in our country, particularly among individuals of lower socioeconomic status. Contributing factors include delays in seeking medical care, inappropriate antibiotic use, and

inadequate dosage or duration of treatment. This condition is a major cause of morbidity and mortality, with tubercular and non-tubercular empyema differing in age profiles, clinical presentations, and management approaches.

Empyema thoracis is a potentially life-threatening disease if not managed properly. Empirical therapy targeting Gram-positive aerobes, the most common cause, is recommended while continuing investigations for other potential etiologies. Cases with no organism growth may be attributed to anaerobic infections, highlighting the need for comprehensive diagnostic evaluations.

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