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CLINICAL OUTCOMES AND CHARACTERISTICS IN PATIENTS WITH PLEURAL EMPYEMA: A RETROSPECTIVE STUDY FROM JINNAH HOSPITAL, LAHORE

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ABSTRACT

Background: Pleural empyema, the accumulation of pus in the pleural cavity, is a serious complication of pneumonia and other pulmonary conditions. It is associated with significant morbidity and requires early diagnosis and prompt management. Regional studies are important to define the demographic profile, etiological spectrum, and outcomes, particularly in South Asia, where socioeconomic and microbial patterns differ from Western countries.

Objective: To evaluate the clinical presentation, risk factors, etiological agents, management strategies, and outcomes of patients with pleural empyema admitted to Jinnah Hospital, Lahore.

Methods: This observational study included 45 patients diagnosed with pleural empyema. Demographic data, comorbidities, clinical features, and radiological findings were recorded. Thoracentesis and microbiological cultures were performed. All patients were managed with chest tube drainage and empirical antibiotics, modified according to culture sensitivity. Hospital stay, need for surgical intervention, and outcomes were documented.

Results: The mean age was 42.9 ± 7.6 years, with male predominance (73%). Diabetes (46%) and hypertension (29%) were the most frequent comorbidities. All cases followed pneumonia, confirming post-pneumonic empyema as the leading cause; only two cases were post tuberculous. Fever was the most common presenting symptom (97%). The mean hospital stay was 12.6 ± 4.3 days. No mortality was recorded, and only one patient required surgical referral. Cultures were sterile in 40% of cases. Among positive cultures, Klebsiella pneumonia (26%) was the most frequent isolate, followed by Pseudomonas aeruginosa (20%) and mixed organisms (2%). Meropenem has 75% sensitivity against

klebisella and 77% against pseudomonas showing its effectiveness against these relentless gram negative bacteria.
Conclusion: Pleural empyema in our region predominantly affects middle-aged men with comorbidities, most commonly following pneumonia. Gram-negative organisms are the leading pathogens, underscoring the need for region-specific empiric therapy. Early diagnosis, chest tube drainage, and appropriate antibiotics result in favorable outcomes.

Keywords: Pleural empyema, pneumonia, Klebsiella pneumoniae, Pseudomonas aeruginosa, chest tube drainage, antibiotic resistance, Pakistan

Introduction:

Pleural empyema is a severe condition where pus accumulates in the pleural cavity remains a major challenge in respiratory medicine. Most often, it develops as a complication of bacterial pneumonia, one of the leading causes of hospitalization and death in patients with lung diseases [(1)].When empyema sets in, it signals a dangerous progression of infection, demanding aggressive treatment to prevent life-threatening complications. Delayed diagnosis or inadequate management can lead to prolonged hospital stays, invasive surgical procedures, and even death [(2)]. Treatment typically involves a combination of antibiotics, drainage procedures, and sometimes surgery, but the best approach depends on multiple factors[(2)].
The optimal treatment strategy can vary depending on the stage of empyema early vs. advanced .It also depends on the patient's overall health age, diabetes, COPD[(3)] .Microbiology of the pleural fluid Type of bacteria involved, and the time to initiation of appropriate therapy can all influence clinical outcomes. Understanding these factors and their impact on patient outcomes is crucial for improving the quality of care for patients with pleural empyema[(4)].
Understanding these factors is key to improving survival and recovery rates. This study aims to assess clinical outcomes in empyema patients treated at Jinnah Hospital, Lahore, helping clinicians refine their strategies for better patient care.

Methods: This retrospective study was conducted on forty-five patients hospitalized in tertiary care institute with confirmed pleural empyema Jinnah Hospital, Lahore from January 2023 to December 2024. Ethical clearance: The study was approved by the institutional review board of AIMC/ Jinnah Hospital via letter No. ERB 187/3 dated 24-4-2025.

Inclusion Criteria:

Patients of(≥18 years) with empyema from pneumonia or other infections with confirmed diagnosis which meet on one of following criteria[(5)].
• Frank pus
• Serum LDH>1000
• Pleural fluid PH < 7
• Gram staining or culture positive
Demographic, clinical, and laboratory data were collected

Exclusion Criteria:

• Empyema caused by cancer

Results: 45 patients were included in the study. Mean age of the patients was 42.9+-7.6, and 73% of the patients were male. All the causes of empyema were post pneumonic in origin except two which were post tuberculous. Average stay of Patients was 12.6+-4.3 days. Empyema was suspected on Chest Xray and confirmed after visual inspection of frank pus on thoracocentesis. All the cases of empyema resolved with chest tube intubation except one which was referred to thoracic surgery. There was no in-hospital mortality.

Variables		Value (N=45)
Age (Mean±SD) (years)		42.9±7.6
Gender	Male	33 (73%)
	Female	12 (27%)
TLC		12,445±3973
Albumin		3.28±0.28
CRP		5.6±3.8
Complaints	Fever	44 (97%)
	Dyspnea	35 (78%)
	Cough	35 (78%)
	Chest pain	25 (56%)
	Weight loss	2 (5%)
Comorbidities	Type 2 Diabetes mellites	21 (46%)
	Hypertension	13 (29%)
	Smoker	12 (27%)
	Past TB infection	4 (16%)
	Ischemic heart disease	4 (16%)
	Chronic kidney disease	4 (16%)
	Hepatitis C	2 (8%)
	Hepatocellular carcinoma	1 (4%)
	Pregnancy	1 (4%)

Table 1. Baseline demographic, clinical, and laboratory characteristics of patients at admission

At the time of admission, fever was the most common presenting complaint, reported in 97% of patients, while weight loss was the least common, observed in only 5%. Among comorbidities, diabetes mellitus (46%) and hypertension (29%) were the most frequent.

The most common culture outcome of empyema was a sterile culture (n=18, 40%). Among positive cultures, Klebsiella species were the most frequently isolated organisms (n = 12, 26%), followed by Pseudomonas species (n = 9, 20%), E. coli (n = 3, 6%), Mycobacterium tuberculosis (n = 2, 4%), and mixed cultures (n = 1, 2%).

If we consider only positive cultures an exclude mixed cultures, the most common sensitive Antibiotic in the culture was amikacin (80%), followed by meropenem (73%).

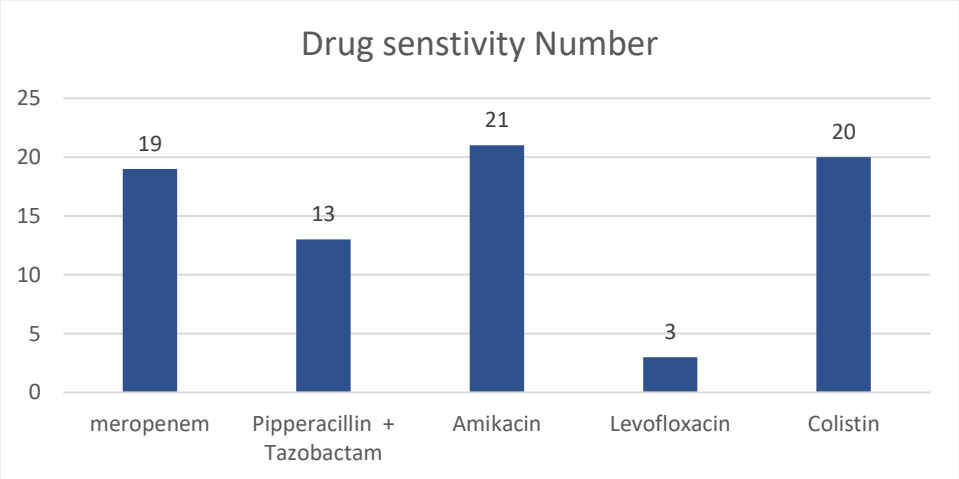

Figure 1. Total Antibiotic sensitivity of Isolated organism on culture. Total organisms isolated with culture after excluding mixed culture were n=26

Empiric antibiotic was started at the time of admission after thoracocentesis based on history and presentation. Most common empiric antibiotic was ceftriaxone (51%) followed by flagyl (17%) and pipercillin-tazobactam (25%).
Klebisela was sensitive to meropenem and colistin 75% cases while 60% were resistant to piperacillin-Tazobactam and 90% to levofloxacin.
Pseudomonas aeruginosa was sensitive to colistin in 90% of case, meropenem and amikacin in 77% of cases. Levofloxacin was totally resistant in pseudomonas while Piperacillin-Tazobactam was 66% resistant. The culture-sensitive antibiotics for the most frequently isolated organisms are summarized in Table 2.

Antibiotics	Klebsiella (N=12)	Pseudomonas (N=9)	E.coli (N=3)
Meropenem	9	7	3
Piperacillin + Tazobactam	5	4	4
amikacin	8	7	6
linezolid		0	
levofloxacin	1	0	2
Colistin	9	8	3

Table 2. culture-sensitive antibiotics for the most frequently isolated organisms

Discussion

Pleural empyema, defined as "pus in the pleural cavity", remains a serious complication of pneumonia and other pulmonary infections. It contributes to significant morbidity worldwide and requires early diagnosis and effective management to achieve favorable outcomes. Our study from Jinnah Hospital, Lahore, provides valuable insights into the demographic profile, clinical presentation, microbiological patterns, and treatment outcomes of empyema in our region. The mean age of patients in our study was 42.9 ± 7.6 years, with a strong male predominance (75%). This aligns with findings from other South Asian countries. Chattergi et al. in Bangladesh reported a mean age of 38 ± 10.94 years and a male-to-female ratio of 2:1, with one-third of cases occurring in patients 18–30 years old[6]. Male predominance in such studies likely reflects both greater occupational exposure and cultural barriers limiting women's access to tertiary care facilities.
In contrast, western studies report an older patient population. Hassan et al. in the USA found a mean age of 66 years with only slight male predominance (55%)[7]. This suggests that empyema in South Asia disproportionately affects younger, working age adults thus increasing its socioeconomic burden.
More than half of our patients (53%) had diabetes and one-third (33%) had hypertension, conditions known to compromise immunity and predispose to severe infections[8]. The growing burden of chronic illnesses in South Asia may contribute to the higher incidence and severity of empyema in this population.
In all patients, empyema followed pneumonia, confirming post-pneumonic empyema as the leading etiology. This is consistent with global literature as Abdulelah et al. emphasized para pneumonic effusion as the most common cause[9]. Only two of our patients had post-tuberculous empyema, a trend showing early detection and prompt treatment of tuberculosis in Jinnah Hospital Lahore. Umar et al. in Lady Reading Hospital reported 72.2% post-pneumonic empyema and 11.2% post-surgical empyema, illustrating some institutional variation[10].
Fever was the most common symptom, seen in 98% of cases, elaborating its value as a red-flag sign for empyema. Weight loss was rare (5%), supporting the evidence that postpnumonic empyema usually presents acutely rather than with chronic systemic features. Other symptoms such as cough, chest pain, and dyspnea, though not detailed in our study, are well described in the literature. Radiology played a central role in initial suspicion, with chest X-rays as the first-line diagnostic tool. Definitive diagnosis was confirmed by thoracentesis and demonstration of frank pus, which remains

the diagnostic gold standard.

The mean hospital stay was 12.6 ± 4.3 days, a moderate duration that compares favorably with international data. Hassan et al. reported a median length of stay of 10 days (IQR 6–15) in the USA [7]. Importantly, outcomes in our cohort were excellent as no mortality occurred, and only one patient required surgical referral. This underscores the effectiveness of timely tube thoracostomy combined with antibiotics. In contrast, Hassan et al. observed a 12.4% mortality rate, particularly among elderly patients, underscoring differences in patient age and comorbidities across regions[7]. One of the challenges in empyema management is frequent culture negativity. In our study, 40% of cultures were sterile. This was likely due to prior antibiotic use, sampling issues, or infection with atypical bacteria. Comparable frequency of sterile culture have been reported as Towe et al. found positive cultures in 43% of cases, while Meyer et al. observed culture negativity more often in younger patients with fewer comorbidities[11, 12].

Among positive cultures, Klebsiella (26%) was the most common isolate, followed by Pseudomonas (20%**)** and mixed organisms (20%). This predominance of Gram-negative bacteria is consistent with findings from Umar et al., Atif et al., and Karmakar et al., although specific distributions varied[10, 13, 14]. Yovi et al. in Indonesia also reported Gram-negative organisms in 79.7% of cases, mainly Klebsiella, E. coli, and Pseudomonas[15].

By contrast, Western studies report a different microbial pattern. Brims et al. in Australia found Streptococcus species, particularly viridians streptococci, as the leading pathogens in community acquired empyema, while hospital acquired cases were more often associated with Staphylococcus aureus and Gram-negative bacteria[16]. Khuwar et al. in GMMMC hospital in Sukkur Pakistan reported a broader range of organisms, including Streptococcus pneumoniae, S. aureus, E. coli, and Klebsiella[17].

These differences emphasize the importance of local microbiological surveillance when selecting empiric antibiotics. Empirical antibiotics in our study were most often ceftriaxone (51%), followed by piperacillin-tazobactam (25%). However, resistance patterns are a growing concern. Atif et al in a study in BVH hospital found that Klebisela is sensitive to pipercillin-Tazobactam 60% cases while 60% of resistance to meropenem and 14.2%to levofloxacin. Pseudomonas showed 85.6% sensitive to meropenem and pipercillin-Tazobactam while 21.4% resistance to levofloxacin[13].

This is all different from our study finding in which Klebisela is sensitive to meropenem and collistin in 75% cases while 60% of resistance to pipercillin+Tazobactam and 90% to levofloxacin.

Pseudomonas aurigonas is sensitive to collistin in 90% and meropenem,amikacin 77% of cases.Levofloxacin is totally resistant to pseudomonas while Piperacillin+Tazobactam is 66% resistant. Yovi et al. documented the resistance of Klebsiella pneumoniae, Escherichia coli, and Pseudomonas aeruginosa to carbapenems as 8.0%, 13.0%, and 53.0%, respectively showing more resistance to carbapenem as compared to our result.Whereas Gram-positive organisms retained good sensitivity to linezolid, tigecycline, and vancomycin[15].

These findings highlight the need for antibiotic stewardship and culture-guided therapy. While antibiotics are essential, our results reaffirm that empyema cannot be treated successfully without adequate drainage, making chest tube thoracostomy the cornerstone of management.

Conclusion:

Our study reinforces several important points: pneumonia remains the most common predisposing factor for empyema, Gram-negative organisms predominate in South Asia, and outcomes can be excellent with timely diagnosis and drainage. However, the high burden of comorbidities and the emergence of multidrug-resistant organisms pose ongoing challenges. Empiric therapy must be tailored to local resistance patterns, and preventive strategies should focus on early pneumonia treatment. Strengthening microbiological surveillance and infection control practices will be critical in improving outcomes further.

Limitations:
This study has several limitations that should be acknowledged. First, the sample size was relatively small (45 patients), limiting the generalizability of our findings. A larger cohort would provide more evidence based estimates of demographic trends, microbial distribution, and treatment outcomes. Second, this was a single-center study conducted at a tertiary care hospital, which may not reflect patient profiles in community or rural healthcare settings where access to advanced care is limited. Third, a significant proportion of cultures were sterile, likely due to prior antibiotic use, which may have underestimated the true microbial diversity and resistance patterns. Fourth, follow-up after hospital discharge was not included, so long-term outcomes such as recurrence, chronic morbidity, or post-surgical complications could not be assessed. Finally, the study did not employ molecular diagnostic methods, which may have provided better pathogen detection, especially in culture-negative cases.

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Conflicts of Interest: None

References:
1. Shebl E, Paul M. Parapneumonic Pleural Effusions and Empyema Thoracis. StatPearls. Treasure Island (FL): StatPearls PublishingCopyright © 2025, StatPearls Publishing LLC.; 2025.
2. Brims FJ, Lansley SM, Waterer GW, Lee YC. Empyema thoracis: new insights into an old disease. Eur Respir Rev. 2010;19(117):220-810.1183/09059180.00005610.
3. Zhong M, Ni R, Zhang H, Sun Y. Analysis of clinical characteristics and risk factors of community-acquired pneumonia complicated by parapneumonic pleural effusion in elderly patients. BMC Pulm Med. 2023;23(1):35510.1186/s12890-023-02649-4.
4. Elsheikh A, Bhatnagar M, Rahman NM. Diagnosis and management of pleural infection. Breathe. 2024;19(4):23014610.1183/20734735.0146-2023.
5. Light RW. Parapneumonic effusions and empyema. Proc Am Thorac Soc. 2006;3(1):75-8010.1513/pats.200510-113JH.
6. Chatterjee M, Islam N, Hasan Rasel M, et al. Bacteriological Etiology of Empyema Thoracis Patients Admitted in a Tertiary Care Hospital. Bangladesh Medical Journal. 2024;52(3):27-3410.3329/bmj.v52i3.77122.
7. Hassan S, Ahmed Z, Agha S, et al. The Updated Estimate of Prevalence, Mortality and Hospital Length of Stay in Patients with Parapneumonic Empyema in the Us: Distribution of Health Outcomes across Various Demographic Groups. Chest. 2019;156(4):A425-A610.1016/j.chest.2019.08.456.
8. Arnold DT, Hamilton FW, Morris TT, et al. Epidemiology of pleural empyema in English hospitals and the impact of influenza. Eur Respir J. 2021;57(6)10.1183/13993003.03546-2020.
9. Abdulelah M, Abu Hishmeh M. Infective Pleural Effusions—A Comprehensive Narrative Review Article. Clinics and Practice. 2024;14(3):870-81, https://www.mdpi.com/2039-7283/14/3/68
10. Umar M, Khan SA. Antibiotic resistance in empyema thoracis: clinical outcomes and contributing factors in a tertiary care setting in Pakistan. IJID Reg. 2025;15:10065810.1016/j.ijregi.2025.100658.
11. Meyer CN, Armbruster K, Kemp M, et al. Pleural infection: a retrospective study of clinical outcome and the correlation to known etiology, co-morbidity and treatment factors. BMC Pulmonary Medicine. 2018;18(1):160,
12. Towe CW, Srinivasan S, Ho VP, et al. Antibiotic Resistance Is Associated With Morbidity and Mortality After Decortication for Empyema. Ann Thorac Surg. 2021;111(1):206-1310.1016/j.athoracsur.2020.06.056.

13. Atif M, Naseem M, Sarwar S, et al. Spectrum of Microorganisms, Antibiotic Resistance Pattern, and Treatment Outcomes Among Patients With Empyema Thoracis: A Descriptive Cross-Sectional Study From the Bahawal Victoria Hospital Bahawalpur, Punjab, Pakistan. Front Med (Lausanne). 2021;8:66596310.3389/fmed.2021.665963.
14. Karmakar S, Karmakar S, Prasad R, et al. Clinical and microbiological characteristics of thoracic empyema: retrospective analysis in a tertiary care centre. International Journal of Advances in Medicine. 2017;4(5):1309-1210.18203/2349-3933.ijam20174166.
15. Yovi I, Safari D, Syah NA, et al. Bacterial Profile and Antimicrobial Resistance Patterns of Pleural Empyema in Pekanbaru Hospitals. Jurnal Respirologi Indonesia. 2024;44(1):36-4410.36497/jri.v44i1.590.
16. Brims F, Popowicz N, Rosenstengel A, et al. Bacteriology and clinical outcomes of patients with culture-positive pleural infection in Western Australia: A 6-year analysis. Respirology. 2019;24(2):171-810.1111/resp.13395.
17. khuhawar SM, Kumar J, Sanghro KA, et al. Culture and Sensitivity Patterns of the Causative Organisms Isolated from the Patient of Empyema Thoracis. Journal of Population and Therapeutics and Clinical Pharmacology. 202410.53555/jptcp.v31i3.5271.