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RESEARCH ARTICLE

BACTERIOLOGICAL AND CLINICAL PROFILE OF COMMUNITY ACQUIRED PNEUMONIA IN PATIENTS ATTENDING A TERTIARY CARE CENTRE IN TELANGANA

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Abstract

Background: Community-acquired pneumonia (CAP) remains a major cause of morbidity and mortality worldwide, particularly among elderly individuals and patients with underlying comorbidities. Understanding the local bacterial etiology and antimicrobial susceptibility patterns is critical for guiding appropriate empirical antimicrobial therapy and optimizing clinical outcomes.

Objectives: To determine the bacteriological and clinical profile of community-acquired pneumonia and evaluate the antimicrobial susceptibility patterns of bacterial pathogens isolated from CAP patients attending a tertiary care centre in Telangana.

Materials and Methods: A cross-sectional study was conducted from March 2025 to February 2026 at the Department of Microbiology, Apollo Institute of Medical Sciences and Research General Hospital, Hyderabad. A total of 378 sputum samples from clinically suspected CAP patients meeting predefined inclusion criteria were processed. Samples were cultured on blood agar, MacConkey agar, chocolate agar, and isolates were identified using the VITEK 2 Compact system. Antimicrobial susceptibility testing was performed using VITEK 2 Compact AST cards according to CLSI 2025 guidelines.

Results: Out of 378 sputum specimens processed, 152 (40.2%) demonstrated significant bacterial growth. A male predominance was observed among CAP cases (71.7%), with a male-to-female ratio of 2.53:1, and peak incidence was noted in the 56-65 year age group. The predominant clinical features included fever (90.8%), dyspnea (82.9%), and cough (67.1%).

Hypertension and diabetes mellitus were the most frequently encountered comorbid conditions (92.1%). Microbiological analysis revealed a predominance of Gram-negative bacilli (67.1%),with *Klebsiella pneumoniae* being the most frequently isolated organism (43.4%), followed by *Staphylococcus*

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aureus (25.0%),*Pseudomonas aeruginosa* (23.7%),and *Streptococcus pneumoniae* (7.9%).Among Gram negative isolates, meropenem exhibited complete susceptibility(100%) against both *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, followed by high sensitivity to piperacillin–tazobactam and cefoperazone–sulbactam. Gram-positive isolates demonstrated highest susceptibility to cotrimoxazole, doxycycline, gentamicin, and azithromycin.
Conclusion: Community-acquired pneumonia in the present study predominantly affected elderly male patients and was largely caused by Gram-negative bacterial pathogens, with *Klebsiella pneumoniae* identified as the principal etiological agent. The observed antimicrobial susceptibility patterns highlight the need for culture-guided antimicrobial therapy and the incorporation of local antibiogram data into empirical treatment decisions. Continuous antimicrobial stewardship and ongoing surveillance of antimicrobial resistance trends are essential for optimizing the management of CAP and limiting the emergence and spread of multidrug-resistant organisms.

Introduction:-

Community-acquired pneumonia (CAP) is a major global health concern due to its high rates of illness and death[1].CAP is most common in young children and the elderly, who also face significantly higher mortality rates [2,7]. Community-acquired pneumonia (CAP) continues to be a prevalent and serious health concern, even with the advent of powerful new antibiotics and effective vaccines[3,4]. A global burden of disease study by the WHO found that lower respiratory tract infections, including community-acquired pneumonia (CAP), were responsible for 429.2 million illness episodes worldwide and resulted in 94.5 million disability-adjusted life years (DALYs) [5]. India contributes significantly to this burden, accounting for 23% of the global CAP cases and 36% of the CAP burden in the WHO South-East Asia region[5].Infectious Diseases Society of America (IDSA) defines CAP as "an acute pulmonary parenchymal infection with the presence of an acute infiltrate on the chest X-ray or auscultatory findings such as altered breath sounds or localized rales consistent with pneumonia among patients who have not been previously hospitalized for ≥14 days before the onset of symptoms" [6]. Commonly reported bacterial pathogens responsible for community-acquired pneumonia (CAP) include typical organisms such as *Streptococcus pneumoniae***,** *Staphylococcus aureus***,** *Klebsiella pneumoniae***,** and *Haemophilus influenzae***,** as well as atypical pathogens like *Mycoplasma pneumoniae***,** *Chlamydophila pneumoniae***,** and *Legionella pneumophila* [2,7,8]**.**

Viral pathogens including rhinovirus, influenza A and B, parainfluenza virus, coronavirus, and respiratory syncytial virus have been identified in 15% to 32% of adult patients with community-acquired pneumonia (CAP)[2,8,15]. In regions with a high burden of disease, data on the etiology of pneumonia remain limited [9].Despite advancements in diagnostic tools and sophisticated molecular techniques, accurately identifying the causative agents of community-acquired pneumonia (CAP) from blood or sputum samples remains a challenge. The rising emergence of new and multidrug-resistant pathogens worldwide poses a significant threat to the effective antibiotic management of CAP[10].In India, although the annual incidence of CAP is estimated at 4 million cases, with mortality rates reaching up to 25% among patients admitted to intensive care units, there is a notable scarcity of reports detailing the microbial etiology of the disease [8,11,12,13]. Microbial patterns of CAP vary significantly based on geographic location and the types of microbiological investigations employed [8,10,13,14].Understanding common microbial patterns in community-acquired pneumonia (CAP) is essential for guiding initial empiric antimicrobial therapy. This study was aimed to determine the bacteriological and clinical profile of pathogens in community acquired pneumonia and to study their antibiotic susceptibility pattern in patients attending a tertiary care centre in Telangana.

Materials and Methods:-

This cross sectional study was carried out from March 2025 to February 2026 at Central Laboratory, Department of Microbiology, Apollo Institute of Medical Sciences and Research General Hospital, Hyderabad with prior approval from the Institutional Ethics Committee. A total of 378 sputum samples were received during this period.

Inclusion Criteria:-

In-patient and outpatients, with a clinical suspicion of community-acquired pneumonia were included if they met at least two of the following criteria:

- Fever (Temperature > 37.8°C)
- Cough
- Purulent sputum production
- Dyspnea
- Pleuritic chest pain
- Leukocytosis (WBC >10,000/cumm)

- New pulmonary infiltrate on chest radiograph
- Patients who had not received prior antibiotic therapy.

Exclusion Criteria:-
- Patients who had received prior antibiotic therapy
- Patients unwilling or unable to provide informed consent
- Patients diagnosed with pulmonary infarction, pulmonary oedema, or interstitial lung disease
- Patients undergoing immunosuppressive therapy
- Patients with confirmed HIV infection
- Patients who were previously hospitalized within the last 14 days
- Age < 18 years of age

Sample Collection and Processing:-
All sputum samples were inoculated onto blood agar, chocolate agar, MacConkey agar and incubated at 37°C for 18–24 hours. Identification of pathogen was done with VITEK 2 Compact ID Cards and antibiotic sensitivity of the pathogen was analyzed and confirmed by VITEK 2 Compact AST Cards as per CLSI guidelines 2025.

Results and Discussion:-

A total of 378 sputum samples were processed in the present study. Out of these, 152 (40.2%) were culture positive for community-acquired pneumonia (CAP), while 226 (59.8%) showed no growth. The culture positivity rate observed in the present study was comparable with findings reported by Gupta *et al.* and Sarah *et al.* [17,20].Variations in culture positivity may be attributed to prior antibiotic exposure and differences in microbiological detection methods, as reported by Wunderink *et al.* and Gadsby *et al.* [10,15].Among the 152 culture-positive CAP cases, 109 (71.7%) were males and 43 (28.3%) were females, with a male-to-female ratio of 2.53:1. Among all 378 study participants, 276 (73.0%) were males and 102 (27.0%) were females, resulting in an overall male-to-female ratio of 2.7:1.

These findings indicate a clear male predominance among CAP cases. This finding is consistent with reports by Sarah *et al.* and Shah *et al.* [20,13]. The higher susceptibility among males may be attributed to increased exposure to risk factors such as smoking, alcohol consumption, and occupational hazards, as described by Lim *et al.* and Mandell *et al.* [16,6].The most commonly affected age group was 56–65 years. A similar age distribution has been reported by Yadav *et al.,* Shah *et al.,* Chintaman *et al.* and Sarah *et al.,* [5,13,19,20], who also observed higher incidence in older age groups. Age-related immune decline and a higher burden of comorbidities likely contribute to increased susceptibility in this population, as also highlighted by Troeger *et al.* [9].

Table 1: Age and Sex wise distribution of total cases (n=378)

Age	No: of cases	Males	Females
18-25	12	8	4
26-35	42	32	10
36-45	72	54	18
46-55	50	36	14
56-65	134	98	36
66-75	66	46	20
76-85	2	2	0
86-95	0	0	0
Total	378	276	102

Figure 1:

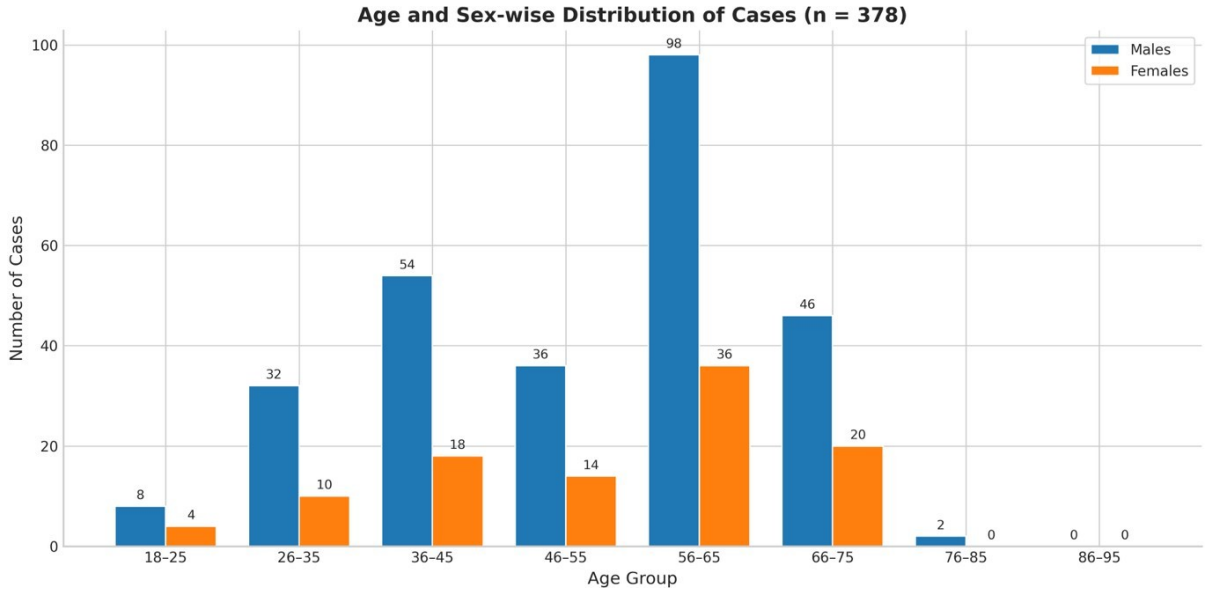
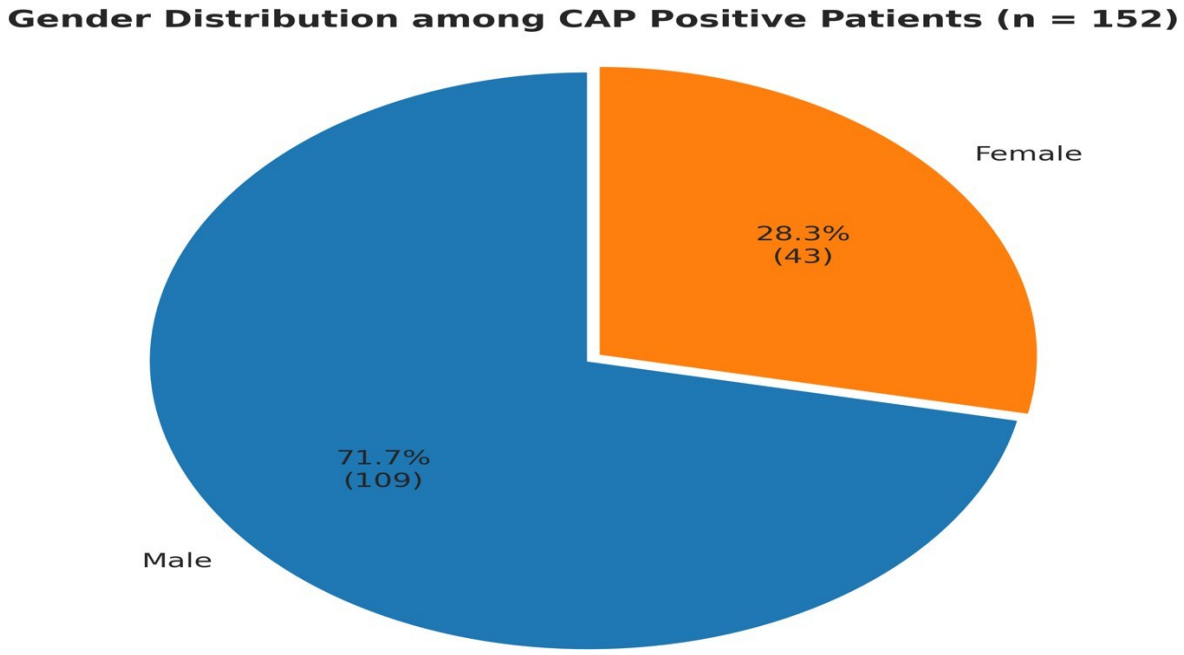


Figure 2:



Clinical presentation was characterized predominantly by fever, which was observed in 138 patients (90.78%), followed by dyspnea in 126 (82.89%) and cough in 102 (67.10%). Less common symptoms included chest pain in 22 patients (14.47%) and hemoptysis in 18 (11.84%).These findings are consistent with those reported by Lim *et al.* and Mandell *et al.* [16,3], who described them as classical manifestations of community-acquired pneumonia.

Comorbid conditions were frequently observed among CAP patients. Hypertension and diabetes mellitus were present in 140 (92.10%) cases. This pattern is similar to findings reported by Mahendra *et al.*, who demonstrated that comorbidities significantly influence the severity and outcome of CAP[14].Chronic lung diseases such as COPD, asthma and bronchiectasis were present in 48 (31.57%) cases. Heart disease was observed in 34 (22.36%) cases, chronic kidney disease in 18 (11.84%) cases and malignancy in 16 (10.52%) cases.

Table 2:

Symptom	Number of Patients (n)	Percentage (%)
Fever	138	90.78
Dyspnea	126	82.89
Cough	102	67.10
Chest Pain	22	14.47
Hemoptysis	18	11.84

Figure 3:

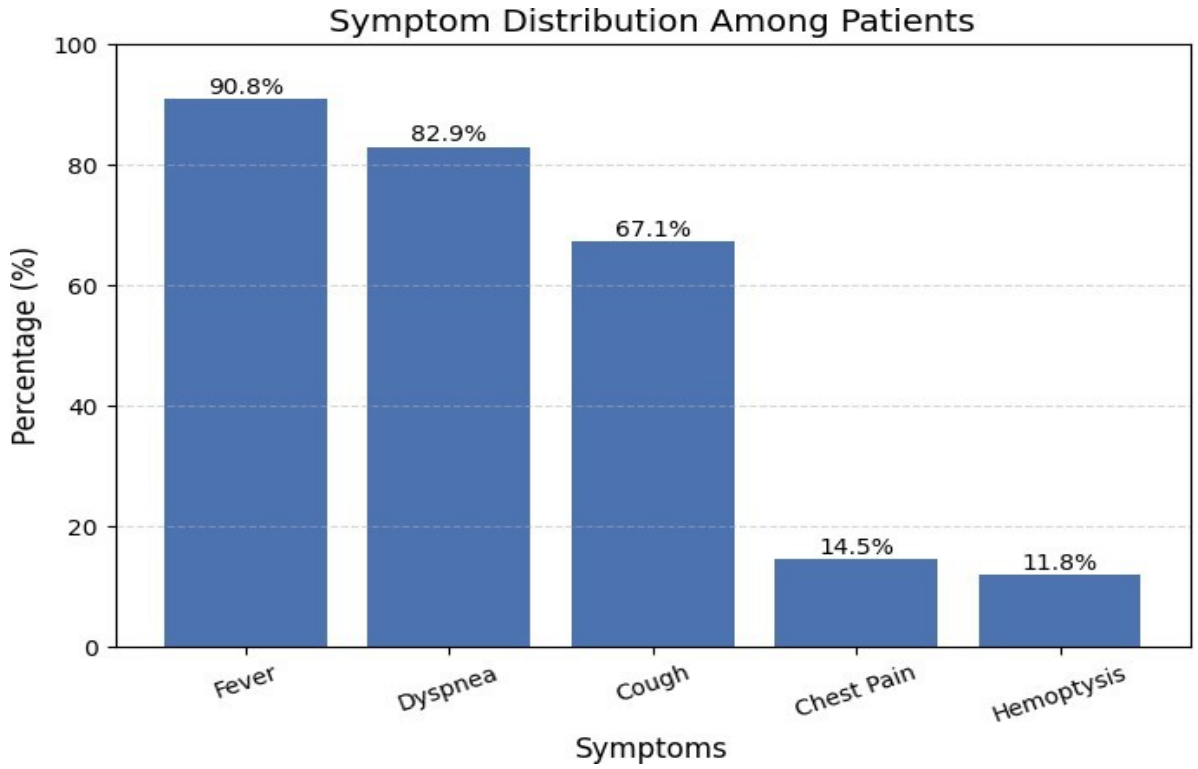
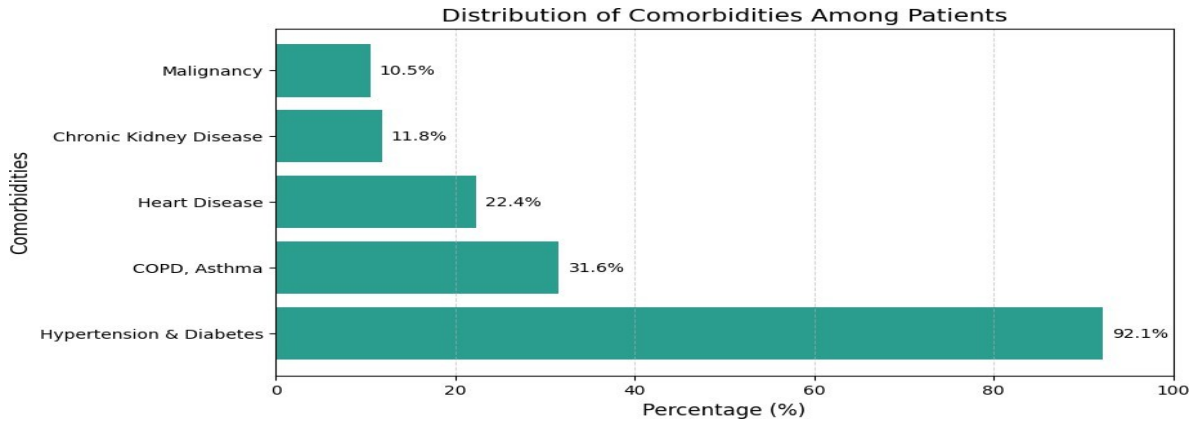


Table 3:

Comorbidity	Number of Patients (n)	Percentage (%)
Hypertension & Diabetes	140	92.10
COPD, Asthma	48	31.57
Heart Disease	34	22.36
Chronic Kidney Disease	18	11.84
Malignancy	16	10.52

Figure 4:



Microbiological analysis revealed that among the 152 culture-positive cases of community-acquired pneumonia (CAP), *Klebsiella pneumoniae* was the most frequently isolated pathogen, accounting for 66 cases (43.42%) correlating with the study by Chintaman *et al.*(2017) and Sarah *et al.*(2019)[17,12]. This was followed by *Staphylococcus aureus* in 38 cases (25%),*Pseudomonas aeruginosa* in 36 cases (23.68%) and *Streptococcus pneumoniae* in 12 cases (7.89%).Gram-negative organisms were more frequently isolated than Gram-positive organisms. Peto *et al.* also reported a rising prevalence of Gram-negative pathogens in Asia [7].

Table 4: Culture results and distribution of bacterial isolates in CAP positive samples

Organism	Number of Isolates	Percentage (%)
Klebsiella pneumoniae	66	43.42%
Staphylococcus aureus	38	25.0%
Pseudomonas aeruginosa	36	23.68%
Streptococcus pneumoniae	12	7.89%
Total	152	100%

Figure 5:

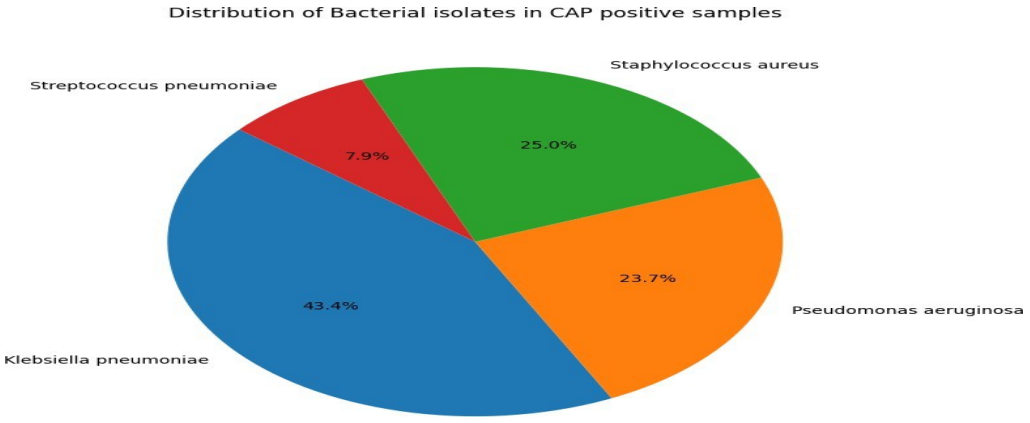
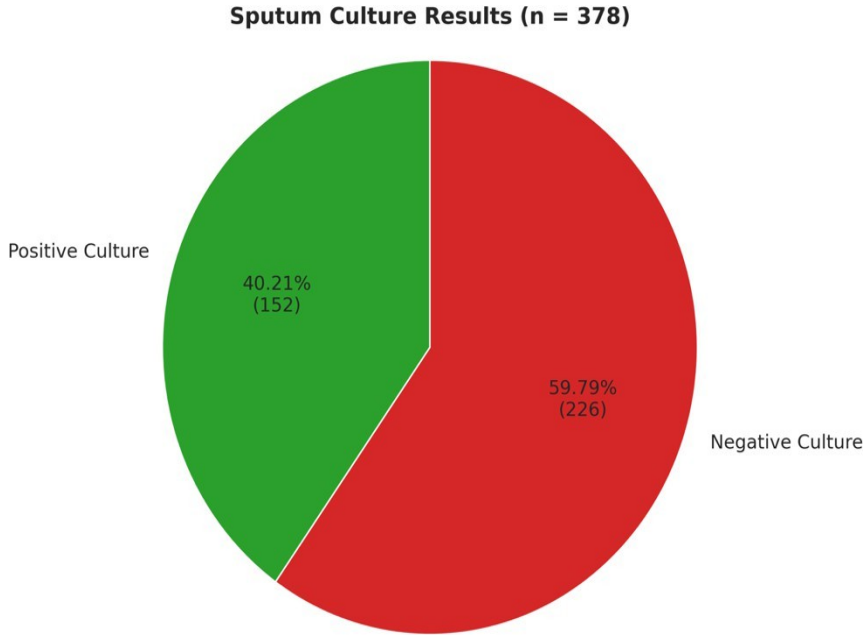


Table 5: Culture results in Sputum (n=378)

Sputum Culture	Number of samples	Percentage %
Positive Culture	152	40.21%
Negative Culture	226	59.79%
Total	**378**	**100%**

Figure 6:



In our study, Gram-negative bacteria were the most frequently isolated pathogens in cases of community acquired pneumonia. Gram-positive bacteria, including *Staphylococcus aureus* and *Streptococcus pneumoniae*, were identified in fewer cases. These findings were consistent with Sarah *et al.,* (2019) ,Shah *et al.,*(2010) and Gupta *et al.,* (2024).

Table 6: Gram staining findings:

Gram Stain (Predominant Organism)	No: of samples	Percentage %
Gram positive cocci	50	32.89%
Gram negative bacilli	102	67.10%

Figure 7:

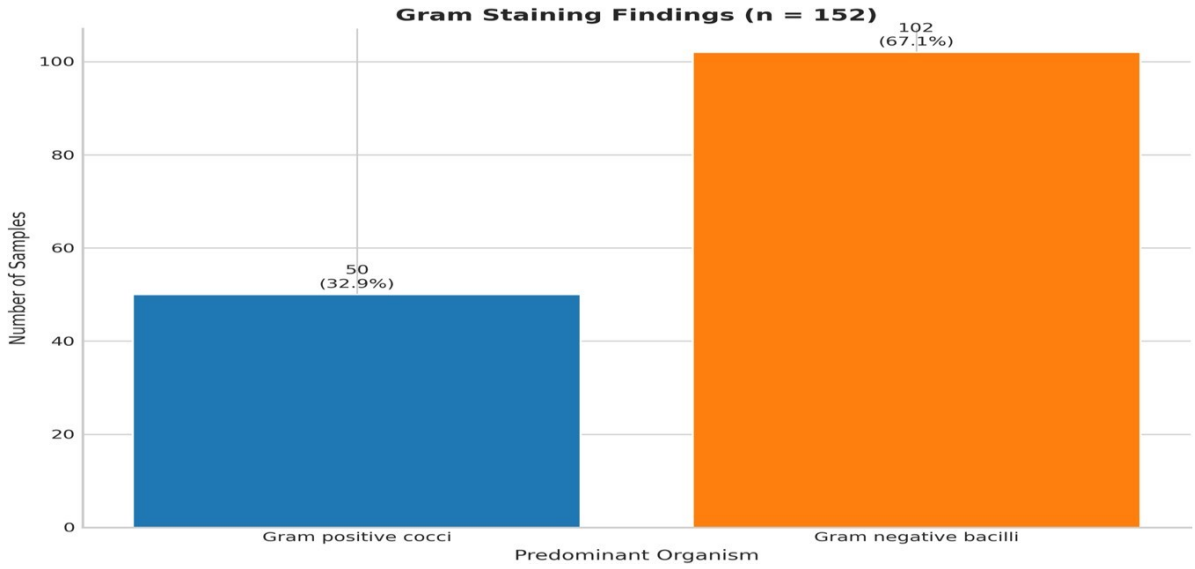


Table 7: Antimicrobial sensitivity pattern of Gram negative isolates:

Antibiotics	Organisms (Percentage of Sensitivity)	
	***Klebsiella pneumoniae*(n=66)**	***Pseudomonas aeruginosa*(n=36)**
Amoxicillin-clavulanate	(n=16), 24.24%	(n=0)
Amikacin	(n=52), 78.78%	(n=30), 83.33%
Ceftriaxone	(n=50), 75.75%	(n=0)
Levofloxacin	(n=46), 69.69%	(n=26), 72.22%
Piperacillin-tazobactam	(n=60), 90.90%	(n=34), 94.44%
Meropenem	(n=66), 100%	(n=36), 100%
Cefoperazone-sulbactam	(n=56), 84.84%	(n=32), 88.88%
Cotrimoxazole	(n=52), 78.78%	(n=0)
Ceftazidime		(n=12), 33.33%

Antibiotic susceptibility testing showed that *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* exhibited the highest susceptibility to meropenem, with 100% sensitivity in both organisms. High sensitivity was also observed with piperacillin–tazobactam and cefoperazone-sulbactam, 90.90% and 84.84% respectively for *Klebsiella pneumoniae,* and 94.44% and 88.88% respectively for *Pseudomonas aeruginosa*.Moderate sensitivity was seen with amikacin and levofloxacin against both organisms- *Klebsiella pneumoniae*: 78.78% and 69.69%; *Pseudomonas aeruginosa*: 83.33% and 72.22%. *Klebsiella pneumoniae* also showed 75.75% sensitivity to ceftriaxone and 78.78% to cotrimoxazole, whereas *Pseudomonas aeruginosa* showed no sensitivity to these antibiotics. Amoxicillin-clavulanate had the lowest sensitivity in *Klebsiella pneumoniae*: 24.24% and showed no sensitivity in *Pseudomonas aeruginosa.*

Table 8: Antimicrobial sensitivity pattern of Gram positive isolates:

Antibiotics	Organisms (Percentage of Sensitivity)	
	***Staphylococcus aureus*(n=38)**	***Streptococcus pneumoniae* (n=12)**
Penicillin	(n=22), 57.89%	(n=8), 66.66%
Azithromycin	(n=32), 84.21%	(n=6), 50%
Cotrimoxazole	(n=34), 89.47%	(n=10), 83.33%
Gentamicin	(n=32), 84.21 %	(n=10), 83.33%
Amoxicillin-clavulanate	(n=20), 52.63%	(n=10), 83.33%
Clindamycin	(n=30), 78.94%	(n=10), 83.33%
Levofloxacin	(n=20), 52.63%	(n=10), 83.33%
Erythromycin	(n=16), 42.10%	(n=6), 50%
Doxycycline	(n=34), 89.47%	(n=6), 50%
Ceftriaxone	(n=28), 73.68%	(n=8), 66.66%

Among Gram-positive organisms, antibiotic sensitivity testing showed that *Staphylococcus aureus* (n=38) had the highest susceptibility to cotrimoxazole and doxycycline (both 89.47%), followed closely by azithromycin and gentamicin (84.21% each). Sensitivity to clindamycin was 78.94%, and ceftriaxone showed 73.68% effectiveness. Lower sensitivity rates were observed for penicillin (57.89%), amoxicillin-clavulanate (52.63%), levofloxacin (52.63%) and erythromycin (42.10%).

In *Streptococcus pneumoniae* isolates (n=12), the highest sensitivity was observed with cotrimoxazole, gentamicin, amoxicillin-clavulanate, clindamycin, and levofloxacin, each showing 83.33% sensitivity. Moderate sensitivity was seen with penicillin and ceftriaxone (66.66%), while azithromycin, erythromycin, and doxycycline showed lower sensitivity rates around 50%.

Conclusion:-

The present study demonstrates that community-acquired pneumonia (CAP) remains a significant cause of respiratory morbidity, with a culture positivity rate of 40.2%. A clear male predominance and higher incidence among the elderly population, particularly in the 56–65-year age group, were observed, indicating increased susceptibility in these groups. Clinically, fever, dyspnea, and cough were the predominant presenting features, consistent with the typical clinical spectrum of CAP. Hypertension and diabetes mellitus are the most common comorbidities in CAP patients in our study. Microbiological analysis revealed a predominance of Gram-negative organisms, with *Klebsiella pneumoniae* being the most frequently isolated pathogen, followed by *Staphylococcus aureus, Pseudomonas aeruginosa,* and *Streptococcus pneumoniae*. This shift toward Gram-negative predominance reflects evolving etiological trends in CAP cases.

Antimicrobial susceptibility patterns demonstrated the highest efficacy of carbapenems against Gram-negative isolates, followed by beta-lactam/beta-lactamase inhibitor (BL-BLI) combinations and third-generation cephalosporins. Among Gram-positive isolates, higher sensitivity was observed with cotrimoxazole, doxycycline, and gentamicin. The findings emphasize the importance of early microbiological diagnosis and culture-guided antimicrobial therapy for effective management of CAP. The increasing antimicrobial resistance observed in this study underscores the need for continuous local surveillance and strengthened antimicrobial stewardship programs to guide empirical therapy and improve clinical outcomes.

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