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CLINICO-BACTERIOLOGICAL PROFILE OF COMMUNITY ACQUIRED PNEUMONIA IN RURAL PATIENTS AT TERTIARY CARE CENTRE, SITAPUR, UP

Respiratory Medicine

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ABSTRACT

Background: Community-acquired pneumonia (CAP) is a significant cause of morbidity and mortality worldwide, particularly in rural areas where healthcare access is limited. Understanding the specific bacterial pathogens and their antibiotic resistance patterns in these settings is crucial for effective treatment and public health interventions. **Objectives:** This study aimed to investigate the clinico-bacteriological profile of CAP in rural patients at a tertiary care center in Sitapur, Uttar Pradesh, and to determine the antibiotic sensitivity patterns of the isolated pathogens. **Methods:** A cross-sectional observational study was conducted over 18 months, including 120 patients diagnosed with CAP based on clinical, radiological, and microbiological criteria. Baseline investigations included chest radiographs, complete blood counts, kidney and liver function tests, serum electrolytes, random blood sugar, and viral markers. Sputum samples were collected for Gram staining, culture and sensitivity testing, and CBNAAT for Mycobacterium tuberculosis detection. **Results:** The study revealed that the majority of CAP cases occurred in patients aged 61 years and above (31.7%). Males were more frequently affected (73.3%) compared to females (26.7%). The most common symptoms were fever (71.67%), cough with expectoration (66.6%), and breathlessness (71.67%). Pseudomonas aeruginosa was the most frequently isolated pathogen (25.00%), followed by E coli (21.67%). The antibiotic sensitivity pattern showed that Pseudomonas aeruginosa was sensitive to Piperacillin Tazobactam (92.90%), Tobramycin (82.00%), Imipenem (82.1%)and Aztreonam (80.0%). **Conclusion:** The study highlights the predominance of Klebsiella pneumoniae in CAP cases and the significant antibiotic resistance patterns observed. These findings underscore the need for continuous surveillance of bacterial pathogens and their resistance patterns to guide empirical treatment and improve patient outcomes in rural settings.

KEYWORDS

Community-acquired pneumonia, clinico-bacteriological profile, antibiotic resistance, Klebsiella pneumoniae

INTRODUCTION

Background Of The Study

Pneumonia is a lower respiratory tract infection affecting the pulmonary parenchyma and can be caused by bacteria, fungi, or viruses. It varies in severity, from mild cases treated outside the hospital to severe complications like septic shock, ARDS, and death. Globally, pneumonia significantly contributes to mortality across all age groups, accounting for over two million emergency visits annually. Streptococcus pneumoniae remains the most common cause of community-acquired pneumonia (CAP), while hospital-acquired pneumonias (HAP), including ventilator-associated (VAP) and healthcare-associated pneumonia (HCAP), are often caused by multidrug-resistant organisms like MRSA and Enterobacteriaceae. Predisposing factors such as advanced age, immunosuppression, and comorbidities further elevate the risk (1-3).

Pneumonia triggers a robust immune response involving cytokines like IL-1 and TNF, which, while essential for immunity, can result in sepsis and multiorgan failure if excessive. Streptococcus pneumoniae has developed mechanisms like capsule formation and antibiotic resistance, making treatment increasingly challenging. Vaccination programs have reduced pneumococcal infections but have led to the emergence of replacement serotypes (4-6).

Mortality rates for hospitalized CAP patients range from 5-20% in Europe, increasing to 20-30% in ICU settings, with significant variations in Africa. Factors like enhanced diagnostics and human encroachment into new areas have expanded the spectrum of pneumonia-causing pathogens, including emerging viruses like coronavirus and enterovirus-D68 (7-9).

The World Health Organization's (WHO) 2017 priority list highlights antibiotic-resistant respiratory pathogens, including penicillin-resistant S. pneumoniae and carbapenem-resistant Enterobacteriaceae. This underscores the urgent need for tailored therapies and better post-pneumonia care to combat antibiotic resistance and improve long-term outcomes (10).

Aim And Objectives

Aim

To Know the clinico-Bacteriological profile of patients with community acquired pneumonia and its Antibiotic sensitivity pattern at tertiary care centre, Sitapur UP.

Objectives

Primary Objectives:

To detect the common bacterial organisms causing community acquired pneumonia and their antibiotics sensitivity pattern in a tertiary care center Sitapur, U.P.

Secondary Objectives:

To assess the demographic, clinical and radiological profile of pneumonia.

MATERIAL AND METHODS

Study Area

The study will be conducted in the Respiratory Medicine Department, Hind Institute Of Medical Sciences. Village Mau, Post- Ataria, Tehsil– Sidhauli, Dist. – Sitapur UP.

Study Design

Cross sectional observational study.

Study Duration

The study will be conducted over a period of 18 months from this commencement.

Sample Size:

The total sample size for the study comprises patients who visited our department during the course of the study. Similar study was done in UP University of Medical Sciences, Saifai, Etawah, with sample of 125 by Prashant Yadav et.al.

Study Subjects

In the current study, data collected of 136 patients. Out of these, 10 patients were sputum- culture sterile, while another 6 patients tested sputum-positive for TB. Therefore, excluded these 16 patients from the study.

Inclusion Criteria

1. Patientsaboveageof18years.
2. Patients with clinical signs and symptoms suggestive of

Pneumonia.
3. Patients with radiological features suggestive of Pneumonia.
4. Patients who are willing to provide informed consent for the study.

Exclusion Criteria
1. Patientsagelessthan18year.
2. Patients who satisfy the criteria of healthcare (HOSPITAL. acquired and ventilator .associated) associated pneumonia
3. Confirmed case of viral pneumonia (covid 19, H1N1).
4. Confirmed case of fungal pneumonia.
5. Microbiologically confirmed case of mycobacterium tuberculosis.
6. Patients who are unable or not willing to provide informed consent.

Methods

Flow Chart Of Study Protocol

Data were collected from patients attending the OPD and IPD with signs and symptoms of CAP in the Department of Respiratory Medicine who fulfilled the inclusion and exclusion criteria. Patients presenting with signs and symptoms indicative of Community-Acquired Pneumonia were admitted, and a detailed clinical history and comprehensive examination were conducted. Following this, patients were advised to undergo chest X-rays and/or computed tomography (CT) thorax scans, particularly if malignancy was suspected or if the patient was unable to produce sputum. Only those patients who were clinically and radiologically confirmed to have CAP, and who met the inclusion and exclusion criteria, were included in the study to ensure the accuracy and relevance of the data collected.

Upon admission, a series of baseline investigations were performed, including chest radiographs, complete blood count (CBC), kidney and liver function tests, serum electrolytes (sodium, potassium, calcium), random blood sugar, and viral markers for HIV, HBsAg, and HCV. For patients who were unable to expectorate sputum, sputum induction was carried out using cough expectorants with 3% normal saline and N-acetyl cysteine nebulisation.

Sputum samples were collected on the first day of admission before the initiation of antibiotic therapy. These samples were sent to the Department of Microbiology for Gram staining (GS) and culture and sensitivity (CS) testing, along with acid-fast bacilli (AFB) staining and Cartridge Based Nucleic Acid Amplification Test (CBNAAT) for Mycobacterium tuberculosis detection. For patients unable to raise sputum, video-bronchoscopy was performed after obtaining valid written consent, to collect bronchoalveolar lavage (BAL) fluid for GS, CS, AFB, and CBNAAT testing. Thoracentesis was performed to obtain pleural fluid samples in cases of parapneumonic effusion or empyema.

If test results were still negative, participants were considered to have CAP without any bacterial aetiology.

The quality criteria for sputum samples included a neutrophil count of more than 25 cells per field, fewer than 10 epithelial cells per field, and a bacterial load exceeding 10^7 CFU/mL. For bronchial aspirate samples, quality was determined by positive bacteriology, defined as a bacterial count greater than 10^5 CFU/mL.

Special Investigations
- Chest X-ray
- Sputum for cytology, AFB, Gram's stain, culture, and sensitivity, Sputum for CBNAAT
- HRCT Thorax.
- Bronchoscopy: Broncho-alveolar lavage fluid for cytology, AFB, Gram's stain, culture and sensitivity, fungal hyphae and culture, special stain, and CBNAAT.
- USG Thorax guided pleural fluid aspiration in those patients who had Sy- pneumonic effusion.

The CRB-65 score was used in clinical settings to quickly assess the severity of pneumonia and make informed decisions about the level of care required. It aided in identifying patients who might benefit from more intensive treatment and monitoring, ensuring appropriate use of healthcare resources.

Sepsis is defined as a life-threatening condition resulting from organ dysfunction caused by a dysregulated immune response to infection. Septic shock refers to a severe form of sepsis marked by significant circulatory, cellular, and metabolic disturbances, carrying a higher risk of death compared to sepsis alone.(11). The quick Sequential Organ Failure Assessment (qSOFA) score, comprising a Glasgow Coma Scale score below 15, a respiratory rate of 22 breaths per minute or higher, and a systolic blood pressure of 100 mm Hg or lower, was utilized to predict mortality and extended ICU stays in patients with suspected sepsis. A qSOFA score of two or more was classified as qSOFA-positive. (12).

Sepsis is a medical emergency that can manifest through a range of symptoms, such as fever or low body temperature accompanied by shivering, confusion or altered mental state, rapid or labored breathing, increased heart rate, weak pulse or low blood pressure, reduced urine output, bluish or mottled skin, cold extremities, and severe body pain or discomfort. (13-15).

The importance of obtaining a comprehensive screen for infectious agents prior to initiating antimicrobial therapy was emphasized. Routine microbiologic cultures, including blood cultures, were obtained before starting antimicrobial therapy in patients with suspected sepsis and septic shock, provided it did not cause a substantial delay in initiating antimicrobials, ideally within 45 minutes (16-17).

COVID-19 pneumonia was suspected in patients presenting with acute respiratory illness (fever and at least one respiratory symptom, such as cough or shortness of breath) combined with a history of travel to or residence in an area with community transmission of COVID-19 within the 14 days prior to symptom onset. It was also considered in patients with acute respiratory illness who had contact with a confirmed or probable COVID-19 case within 14 days before symptom onset. Additionally, it was suspected in patients with severe acute respiratory illness (fever and at least one respiratory symptom requiring hospitalization) when no alternative diagnosis could fully explain the clinical presentation.(18).

Important clinical features of swine influenza included fever, upper respiratory symptoms such as cough, runny nose, and sore throat, as well as headache, body ache, fatigue, diarrhea, and vomiting (19).

Data Analysis

Each variable and characteristics may be represented in mean ± sd. various diagram for depiction of variable in pictorial forms, like pie chart ,histogram, bar chart ,scatter diagram etc.as per analysis of study. Some statistical test like Chi- square test, unpaired t-test may be used. P value < 0.05 is significant. to analyse the collected and stored in SPSS software version 26.

RESULTS AND OBSERVATION

The age distribution of the study population (table 1) showed that most community-acquired pneumonia (CAP) cases occurred in patients aged 61 years and above (31.7%), followed by those aged 51 to 60 years (25%). Younger adults aged 18 to 30 years accounted for 20%, while 31 to 40 years and 41 to 50 years groups comprised 13.3% and 10%, respectively. This indicates a higher prevalence of CAP among the elderly, with a decline in younger age groups.

The gender distribution revealed a predominance of males (73.3%) compared to females (26.7%), suggesting a higher incidence of CAP among males in the studied rural setting.

Table 1: Demographic Distribution Of The Study Population

Demographic Variable	Category	Frequency (n=120)	Percentage (%)
Age Group	18 to 30 years	24	20.0
	31 to 40 years	16	13.3
	41 to 50 years	12	10.0
	51 to 60 years	30	25.0
	61 years and above	38	31.7
Gender	Male	88	73.3
	Female	32	26.7
Total		120	100.0

The socioeconomic distribution of patients, based on the B.G. Prasad Scale, showed that the majority of community-acquired pneumonia (CAP) cases were from the lower class (50.83%), followed by the lower middle class (25%) and the middle class (16.67%). Only 0.83%

of patients were from the upper middle class, and no cases were reported in the upper class. This highlights the higher prevalence of CAP among individuals from lower socioeconomic groups.

Table2: Clinical Profile And Duration Of Illness Of Patients With Community-acquired Pneumonia *multiple Response

Parameter	Frequency (n=120)*	Percentage (%)
Clinical Features		
Fever	86	71.67
Dry Cough	31	25.8
Cough with Expectoration	80	66.6
Breathlessness	86	71.67
Chest Pain	47	39.2
Haemoptysis	20	16.7
Duration of Illness (DOI)		
Acute	37	30.83
Subacute	53	44.17
Chronic	30	25.00
Total	**120**	**100.0**

The table 2 shows clinical profile of the study highlights the most common symptoms observed in patients with community-acquired pneumonia (CAP). Fever and breathlessness were the predominant symptoms, reported by 71.67% of the patients. Cough with expectoration was also widespread, affecting 66.6% of the cases, while dry cough was seen in 25.8% of the patients. Chest pain was present in 39.2% of the cases, and haemoptysis, the least common symptom, was reported by 16.7% of the patients.

Regarding the duration of illness (DOI), the study found that the majority of patients presented with subacute symptoms, accounting for 44.17% of the cases. Acute presentations were observed in 30.83% of the patients, and chronic cases made up 25%. This suggests that many patients experienced symptoms for a prolonged period before seeking medical care, with subacute and chronic forms of CAP being more prevalent than acute presentations. This pattern may indicate delayed healthcare-seeking behaviour or insufficient recognition of symptoms at earlier stages.

Table 3: Describing the study groups as per medical history and comorbidity

Medical Condition and Comorbidity	Frequency (n=120)*	Percentage (%)
No Past History	78	65.0%
HCV (Hepatitis C Virus)	5	4.2%
EPTB (Extrapulmonary Tuberculosis)	3	2.5%
HBSAG (Hepatitis B Surface Antigen)	3	2.5%
Hypertension (HTN)	2	1.7%
Hypothyroidism	1	0.8%
Previously Treated Pulmonary TB	26	21.7%
On ATT for Active Pulmonary TB	3	2.5%
Asthma	4	3.3%
Chronic Obstructive Pulmonary Disease (COPD)	11	9.2%
Diabetes Mellitus (DM)	7	5.8%
Obstructive Airway Disease (OAD)	6	5.0%

This table 3 shows the medical conditions and comorbidities of 120 study participants, with frequencies expressed as percentages. A majority (65.0%) of participants had no past medical history. Other conditions were less common, with Hepatitis C Virus (HCV) affecting 4.2% of participants, and conditions such as hypertension (1.7%), hypothyroidism (0.8%), and hepatitis B surface antigen (HBSAG) positivity (2.5%) appearing in small proportions. A notable 21.7% of participants had a history of previously treated pulmonary tuberculosis, while 9.2% had chronic obstructive pulmonary disease (COPD). Diabetes mellitus (5.8%) and obstructive airway disease (5.0%) were also observed in a moderate proportion of participants.

Table 4: Describing The Study Groups As Per Smoking Status

Smoking Status	Frequency (n=120)	Percentage (%)
Yes (Smokers)	58	48.33%
No (Non-Smokers)	62	51.67%
Total	120	100.00%

The study population's smoking status, as shown in Table 4, indicates a nearly even distribution between smokers and non-smokers among patients with community-acquired pneumonia (CAP). Specifically, 51.67% of the participants were non-smokers, while 48.33% were smokers. This suggests a slightly higher prevalence of non-smokers in the study group. However, the proportion of smokers is still considerable, highlighting smoking as a potential risk factor or contributing characteristic in patients with CAP.

Table 5 : Describing the study groups as per CRB 65

CRB-65 Score	Frequency (n=120)	Percentage (%)
0	2	1.67%
1	61	50.83%
2	51	42.50%
3 and 4	6	5.00%
Total	120	100.00%

The distribution of the study population according to the CRB-65 scoring system, as shown in Table 5, revealed that the majority of patients with community-acquired pneumonia (CAP) had a CRB-65 score of 1, accounting for 50.83% of the cases. A large proportion (42.50%) had a score of 2, indicating moderate severity of pneumonia. Patients with a score of 3 and 4 represented 5.00%, suggesting a smaller group with higher severity and risk. Only 1.67% of the patients had a CRB-65 score of 0, indicating lower severity. This distribution suggests that most patients had a moderate to severe form of CAP, with a significant portion at higher risk for complications.

Table 6: Describing the study groups as per Chest X-ray

Chest X-ray Involvement	**Frequency (n=120)**	**Percentage (%)**
Bilateral	37	30.83%
Unilateral	72	60.00%
Nil	11	9.17%
Total	120	100.00%

The analysis of chest X-ray findings among the study population, as shown in Table 6, revealed that the majority of patients with community-acquired pneumonia (CAP) had unilateral involvement, accounting for 60.00% of the cases. Bilateral involvement was observed in 30.83% of the patients. Additionally, 9.17% of the patients showed no radiographic evidence of pneumonia.

In the study of chest X-ray zone involvement among patients, the data revealed distinct frequencies and percentages for different zones. The right upper zone was affected in 28 cases (23.93%), while the left upper zone had 16 cases (13.68%). The middle zones showed involvement in 15 cases (12.82%) for the right side and 10 cases (8.55%) for the left side. The lower zones exhibited the highest frequencies, with 46 cases (39.32%) for the right lower zone and 42 cases (35.90%) for the left lower zone. In cases involving the entire lung, the right whole lung was affected in 3 cases (2.56%), whereas the left whole lung showed no involvement. This distribution highlights the variability in the pattern of lung involvement across different patients.

The blood investigation results for the study population revealed several notable findings. The mean total leukocyte count (TLC) was significantly elevated at 12,998.23 cells/µL, indicating an increased white blood cell count typically associated with infection and inflammation. Differential leukocyte counts (DLC) showed mean percentages for polymorphs (P) at 81.17%, lymphocytes (L) at 12.37%, monocytes (M) at 4.27%, and eosinophils (E) at 2.39%, suggesting substantial deviations from normal ranges, which are common in infection and inflammatory responses.

Renal function tests (RFT) showed mean urea and creatinine levels at 40.34 mg/dL and 0.9508 mg/dL, respectively, indicating possible renal impairment. Liver function tests (LFT) revealed a mean total bilirubin (T. BILI) of 0.6801 mg/dL, direct bilirubin (D. BILI) of 0.3968 mg/dL, SGOT of 43.72 U/L, SGPT of 46.28 U/L, and ALP of 118.22 U/L. These results indicate potential liver involvement or stress. These findings collectively highlight marked inflammatory responses, possible renal impairment, and liver function alterations in patients with community-acquired pneumonia.

The sample of the study population indicate that sputum samples were the primary source for bacteriological analysis, accounting for 90.0% of the cases. Bronchoalveolar lavage (BAL) was performed in 4.2% of the patients, pleural fluid samples were collected in 3.3%, and endotracheal (ET) aspirates were used in 1.7% of the cases. These

findings underscore the reliance on sputum samples for diagnosing community- acquired pneumonia (CAP) in this rural patient population, with less frequent use of other methods such as BAL, pleural fluid analysis, and ET aspirates.

Table 7: Describing The Study Groups As Per Organism

Organism	Frequency (n=120)	Percentage
Pseudomonas spp.	30	25.00%
Escherichia coli	26	21.67%
Klebsiella spp.	21	17.50%
Staphylococcus aureus	20	16.67%
Enterococcus spp.	17	14.17%
Citrobacter spp.	3	2.50%
Streptococcus pneumoniae	3	2.47%
Total	120	100.00%

The distribution of organisms in (table 7) identified in the study population, showed that Pseudomonas species were the most frequently isolated, accounting for 25.00% of the cases. This was followed by Escherichia coli (21.67%) and Klebsiella species (17.50%). Staphylococcus aureus was identified in 16.67% of the patients, while Enterococcus species were found in 14.17%. Less commonly isolated organisms included Citrobacter species (2.50%) and Streptococcus pneumoniae (2.47%).

Table 8: Antibiotic Susceptibility Of Various Bacterial Species.

Antibiotic	Pseudomonas spp. (S/R)	E. coli spp. (S/R)	Klebsiella spp. (S/R)	Staphylo-coccus aureus (S/R)	Entero-coccus spp. (S/R)	Citro-bacter spp. (S/R)	Strepto-coccus pneumoniae (S/R)
Piperacillin	26/2	14/1	15/4	-	-	-	0/2
Tazobactam	-	21/2	10/7	-	-	-	0/2
Ceftazidime	23/7	-	-	-	-	-	-
Cefepime	25/4	42/0	33/5	-	-	-	-
Amikacin	24/3	15/1	14/5	-	-	-	-
Tobramycin	14/5	14/9	15/4	-	-	-	-
Gentamycin	-	-	15/6	12/2	15/1	-	-
Ciprofloxacin	16/1	11/4	7/33	11/6	3/8	-	-
Levofloxacin	16/1	31/4	3/33	11/6	-	-	-
Aztreonam	24/8	9/15	7/27	-	-	0/2	0/2
Imipenem	15/4	32/0	11/3	-	-	-	-
Meropenem	16/3	22/2	12/0	-	-	-	-
Colistin	13/4	-	-	-	-	-	-
Polymyxin B	15/3	-	-	-	-	-	-
Piperacillin	-	-	-	8/8	8/8	-	-
Ampicillin	-	3/11	2/11	-	-	-	-
Ampicillin-Sulbactam	-	6/11	6/11	-	-	-	-
Amoxicillin-Clavulanic Acid	-	6/11	6/11	-	-	-	-
Cefotaxime	-	6/17	1/17	-	-	0/2	-
Ceftriaxone	-	1/21	6/12	-	-	-	-

Summary

The study findings can be summarized as follows:

Age Distribution

The majority of patients with community-acquired pneumonia (CAP) were aged 61 years and above, comprising 31.7% of the study population. This was followed by the 51-60 years age group at 25%, indicating a higher prevalence of CAP among the elderly.

Gender Distribution

Male patients predominated the study, accounting for 73.3% of the cases, while females made up 26.7%. This significant gender disparity suggests a higher incidence of CAP among males in the rural population studied.

Clinical Profile

The most common symptoms among CAP patients were fever and breathlessness, each reported by 71.67% of the cases. Cough with expectoration was prevalent in 66.6% of the patients, while 25.8% experienced a dry cough. Chest pain and haemoptysis were reported by 39.2% and 16.7% of patients, respectively.

Duration of Illness (DOI)

Subacute presentations were the most common, accounting for 44.17% of cases, followed by acute (30.83%) and chronic (25%) presentations. This indicates that many patients experienced symptoms for a prolonged period before seeking medical care.

Comorbidities

A significant majority of patients (74.17%) had no underlying comorbidities. Among those with comorbid conditions, COPD was the most prevalent at 9.17%, followed by diabetes mellitus (5.83%), and other airway diseases (5.00%).

Smoking Status

The study population was nearly evenly split between smokers and non- smokers, with 51.67% being non-smokers and 48.33% smokers, suggesting smoking as a notable risk factor for CAP.

CRB-65 scores

The majority of patients had a CRB-65 score of 1 (50.83%) or 2 (42.50%), indicating moderate severity of pneumonia. A smaller percentage had scores of 3 (5.00%) or 0 (1.67%).

Blood Investigations

Patients showed elevated total leukocyte counts (mean 12,998.23 cells/μL), with significant deviations in differential leukocyte counts, renal function, and liver function tests. These results highlighted substantial inflammatory responses and possible organ involvement.

Chest X-ray Findings

Unilateral involvement was more common (60.00%) compared to bilateral involvement (30.83%). A small percentage (9.17%) had no radiographic evidence of pneumonia.

Bacteriological Findings

Sputum was the primary sample used for bacteriological analysis (90.0%). Other methods included BAL (4.2%), pleural fluid (3.3%), and ET aspirates (1.7%).

Organisms Identified

Pseudomonas species were the most frequently isolated organisms (25.00%), followed by Escherichia coli (21.67%), Klebsiella species (17.50%), and Staphylococcus aureus (16.67%).

Pseudomonas Spp.

The analysis revealed that Pseudomonas spp. exhibited high sensitivity to piperacillin-tazobactam (92.9%), cefepime (86.2%), and amikacin (88.9%), making these antibiotics highly effective for treating infections caused by this pathogen. Imipenem also showed significant effectiveness with an 82.1% sensitivity rate. However, resistance was noted with levofloxacin (58.3%) and ciprofloxacin (23.1%), indicating the need for cautious use of these antibiotics in managing Pseudomonas infections.

Escherichia Coli

Escherichia coli exhibited high resistance to many commonly used antibiotics, highlighting significant challenges in treatment. Piperacillin, ampicillin, cefotaxime, ceftriaxone, and cefoxitin demonstrated very high resistance rates, ranging from 78.26% to 95.65%. Conversely, certain antibiotics showed promising effectiveness, with chloramphenicol having the highest sensitivity rate of 82.35%, and imipenem and amikacin both showing high sensitivity rates of 76.92% and 76.00%, respectively. Piperacillin-tazobactam and ampicillin- sulbactam showed moderate effectiveness with sensitivity rates of 57.69% and 42.11%, respectively.

Klebsiella Spp.

Klebsiella spp. showed high sensitivity to amikacin (78.9%), gentamycin (83.3%), and tobramycin (73.7%), suggesting these antibiotics as primary treatment options. Piperacillin-tazobactam and cefepime demonstrated moderate sensitivity rates of 78.9% and 68.4%, respectively. Notably, ampicillin was completely ineffective with a 100.0% resistance rate, and ceftazidime also showed considerable resistance (41.2%). These findings suggest that carbapenems and certain cephalosporins may still play a role in treatment regimens despite the presence of resistance.

Staphylococcus Aureus

Staphylococcus aureus isolates were highly sensitive to netilmicin

(100.0%), chloramphenicol (100.0%), and amikacin (90.9%), indicating their strong efficacy. Gentamycin (88.9%) and linezolid (88.2%) also performed well, showing substantial effectiveness. Conversely, ciprofloxacin (68.7%) and azithromycin (63.6%) exhibited high resistance rates, suggesting limited utility in treating S. aureus infections. The data advocate for the use of highly effective antibiotics like netilmicin, chloramphenicol, amikacin, tobramycin, and linezolid.

Enterococcus Spp.

Enterococcus spp. demonstrated high sensitivity to gentamycin (high strength) (93.8%) and streptomycin (high strength) (81.8%), making them effective options for treatment. Linezolid and vancomycin showed moderate sensitivity with rates of 80.0% and 61.5%, respectively. Significant resistance was observed with ciprofloxacin (72.7%) and doxycycline (44.4%), necessitating careful selection of antibiotics. Effective management relies on utilizing highly effective antibiotics like linezolid, gentamycin (high strength), streptomycin (high strength), and chloramphenicol.

Citrobacter Spp.

Citrobacter spp. were highly sensitive to amikacin, tobramycin, gentamycin, tetracycline, and co-trimoxazole, all showing complete sensitivity (100.0%). However, these isolates were completely resistant to several antibiotics, including penicillin, ampicillin, ceftazidime, cefepime, cefotaxime, cefoxitin, ceftriaxone, amoxicillin-clavulanic acid, piperacillin-tazobactam, and ampicillin-sulbactam, with 100.0% resistance rates. This emphasizes the need for precise antibiotic selection to effectively manage Citrobacter infections.

Streptococcus Pneumoniae

Streptococcus pneumoniae displayed complete resistance (100.0%) to penicillin, ampicillin, ceftazidime, cefepime, cefotaxime, cefoxitin, ceftriaxone, amoxicillin-clavulanic acid, piperacillin-tazobactam, and ampicillin-sulbactam, indicating these antibiotics are ineffective for treating infections caused by this pathogen. In contrast, amikacin, tobramycin, gentamycin, tetracycline, and co- trimoxazole demonstrated complete sensitivity (100.0%), suggesting these as the most effective treatment options for Streptococcus pneumoniae in this setting. his study examines the clinico-bacteriological profile of community-acquired pneumonia (CAP) among rural patients at the Hind Institute of Medical Sciences, Sitapur, Uttar Pradesh, highlighting key findings on demographics, pathogens, and resistance patterns. Elderly males were most affected, with common symptoms such as fever, productive cough, and breathlessness. Delayed healthcare-seeking behaviours were prevalent, contributing to subacute and chronic presentations. The predominant pathogens included Pseudomonas spp., Escherichia coli, and Klebsiella spp..

Antibiotic resistance was notably high for piperacillin, ampicillin, and cephalosporins, while amikacin, gentamycin, and linezolid demonstrated higher sensitivity rates. Over 60% of isolates were identified as multi-drug resistant organisms (MDROs), complicating treatment. These findings align with global concerns about MDROs in respiratory infections, as reported by Franquet (2018) [20] and Priyadarshi et al. (2022) [21]. Both studies stress the need for new therapeutic strategies and rigorous infection control practices.

The study underscores the importance of continuous resistance monitoring, tailored treatment protocols, and the potential of newer agents like ceftazidime-avibactam and meropenem-vaborbactam in managing resistant infections. Such evidence-based approaches are critical to improving CAP outcomes in rural settings.

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