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Original Research Paper

Respiratory Medicine

AN OBSERVATIONAL STUDY ON EVALUATION OF EMPIRICAL ANTIBIOTIC THERAPY WITH FOCUS ON ESCALATION AND DE-ESCALATION STRATEGIES IN MANAGEMENT OF PNEUMONIA

Dr. Vithya Thirumoorthi	Prof and HOD, Department of Pharmacy Practice, Al Ameen College of Pharmacy
Dr. Mohammed Afroz A	Student, Department of Pharmacy Practice, Al Ameen College of Pharmacy
Dr. Salma Afreen	Student, Department of Pharmacy Practice, Al Ameen College of Pharmacy

ABSTRACT Pneumonia is a major cause of hospital admissions, requiring prompt empirical antibiotic therapy to prevent complications. However, inappropriate antibiotic selection contributes to rising antimicrobial resistance. This study aimed to evaluate empirical antibiotic usage and assess escalation and de-escalation practices in pneumonia management based on clinical response and diagnostic findings.A 6-month prospective observational study was conducted at a tertiary care hospital. Data on demographics, diagnosis, laboratory parameters, empirical therapy, and therapeutic modifications were collected and analyzed descriptively. A total of 80 patients were included, with males comprising 58.8%. Most patients were below 18 years of age. Bilateral bronchopneumonia was the most common diagnosis. Respiratory panel testing was positive in 46.25% of cases, with Influenza A virus and Streptococcus pneumoniae being common pathogens. Empirical therapy mainly included ceftriaxone with clarithromycin or cefoperazone–sulbactam. Based on clinical findings, 47.5% underwent de-escalation, 10% required escalation, and 42.5% continued initial therapy.The study highlights the importance of timely diagnostic testing and structured antimicrobial stewardship to optimise pneumonia treatment outcomes.

KEYWORDS : Pneumonia, Empirical Therapy, Escalation, De-Escalation, Respiratory Panel, Antimicrobial Stewardship

INTRODUCTION

Pneumonia continues to be a major global public health challenge and is one of the leading causes of hospitalization and mortality across all age groups. According to the Global Burden of Disease report, lower respiratory tract infections—including pneumonia—remain a top cause of morbidity and mortality worldwide, particularly among children under five, older adults, and individuals with chronic comorbidities.[1] The condition results from infection of the lung parenchyma by a wide range of organisms such as Streptococcus pneumoniae, Haemophilus influenzae, influenza viruses, respiratory syncytial virus (RSV), and atypical pathogens like Mycoplasma pneumoniae.[2,3] Geographic variation, seasonal patterns, and vaccination coverage further influence pathogen distribution and disease burden.[4]

Early initiation of empirical antibiotic therapy is essential to reduce disease progression, complications, and mortality. However, inappropriate or excessive antibiotic use has contributed to rising antimicrobial resistance, posing a significant challenge to clinicians worldwide.[5] Escalation and de-escalation strategies—central to antimicrobial stewardship—play a critical role in optimizing therapeutic outcomes. Escalation involves broadening antibiotic coverage in cases of clinical deterioration or when high-risk pathogens are suspected, whereas de-escalation aims to narrow therapy based on microbiological evidence or clinical improvement, thereby minimizing unnecessary antibiotic exposure.[6] Studies have shown that timely de-escalation reduces hospital stay, costs, and resistance without compromising clinical outcomes.[7]Diagnostic modalities such as chest radiography, inflammatory markers (CRP, procalcitonin), sputum gram staining, blood cultures, and multiplex respiratory panel testing have improved the early identification of pathogens, enabling more informed therapeutic decisions.[8] Despite these advancements, significant variability exists in empirical antibiotic selection and stewardship adherence due to differences in clinician experience, local microbiological patterns, and healthcare resource availability.[9] Evaluating real-world prescribing patterns is crucial in tertiary care settings where cases range from mild community-acquired pneumonia to severe, hypoxic, or viral pneumonias requiring intensive care.[10]

METHODOLOGY

This hospital-based prospective observational study was conducted at a tertiary care hospital over a period of six months. The study included both male and female patients of all age groups with a confirmed clinical and radiological diagnosis of pneumonia. Patients who refused to participate or did not provide informed consent were excluded from the study. Data were obtained from multiple sources, including patient case sheets, direct communication with patients or their attenders, and interactions with treating physicians, residents, and nursing staff. Research students visited the medical wards and intensive care units regularly and followed up with patients until discharge.Eligible patients were recruited after obtaining written informed consent. Relevant data such as demographic characteristics, presenting symptoms, comorbidities, laboratory parameters, radiological findings, and treatment details were collected and documented. Details regarding therapeutic modifications—including escalation or de-escalation of antibiotics—were also recorded based on clinical response, respiratory panel findings, and culture and sensitivity reports. Additional information related to oxygen support, complications, and length of hospital stay was noted wherever applicable.The collected data was expressed using descriptive statistics. Frequencies and percentages were used to summarize categorical variables. Ethical approval for the study was obtained from the Institutional Ethics Committee (IEC) of the hospital prior to commencement of the study.

RESULT

Most pneumonia patients were aged 0–18 years (62.5%), followed by older than 60 years (17.5%), while other adults constituted a smaller proportion of cases.

Table 01: Distribution of Patients Based on Age.

Sl.no	Age(years)	No. of patients	Percentage
1	less than 18	50	62.50%
2	19-30	7	8.75%

3	31-40	0	0%
4	41-50	5	6.25%
5	51-60	4	5%
6	above 60	14	17.50%
	total	80	100%

The most frequent reasons for admission were combinations of dry cough and fever, while nearly half of the patients (48.75%) presented with varied mixed respiratory symptoms. Respiratory panel testing showed a 46.3% positivity rate, with 8.7% negative results, and not performed in 36%.

Table 2: Clinical and Diagnostic Profile of Pneumonia Patients.

Diagnostic Parameter	Key Findings	No of patients	Percentage out (%)
Reason for Admission	Dry cough, Fever	14	17.5
	Dry cough, Fever, Breathlessness	12	15
	Dry cough, Fever, Vomiting	8	10
	Dry cough, Cold, Fever	7	8.75
	Others (Dry cough, Cold, Fever, Vomiting; Dry cough, Cold, Fever, Breathlessness; Dry cough, Fever, Chills; Cough with yellowish expectoration, Fever, Wheezing; Cough with whitish expectoration, Fever, Wheezing, Breathlessness)	39	48.75
		TOTAL	100
Respiratory Panel Results	Positive	37	46.3
	Negative	7	8.7
	Not Done	36	45
		TOTAL	100

Most patients (51%) received multi-drug empirical regimens. Among specific combinations, ceftriaxone with clarithromycin was most common (13.8%), followed by cefoperazone–sulbactam and ceftriaxone–clarithromycin– oseltamivir (each 8.8%). Cephalosporin-based combinations formed the majority of initial therapy.

Table 03: Empirical Antibiotic Therapy Initiated at Admission.

Therapy Combinations	Empirical Regimen	No. of Patients	Percentage (%)
Dual Therapy	Ceftriaxone + Clarithromycin	11	13.8
Dual Therapy	Cefoperazone + Sulbactam	7	8.8
Dual Therapy	Ceftriaxone + Oseltamivir	5	6.3
Triple Therapy	Ceftriaxone + Clarithromycin + Oseltamivir	7	8.8
Triple Therapy	Cefoperazone + Sulbactam + Oseltamivir	5	6.3
Triple Therapy	Azithromycin + Ceftriaxone + Oseltamivir	4	5.0
Multiple Therapy	Others (Specific Multi-drug combinations) Ex:- {Ceftriaxone, Linezolid, Clarithromycin, and Oseltamivir.} {Piperacillin/Tazobactam, Clarithromycin, Oseltamivir, and Levofloxacin.}	41	51.3
	TOTAL	80	100

De-escalation was most common (47.5%), followed by continuation of empirical therapy (42.5%), while only 10% required escalation.

Table 4: Antibiotic Modification Patterns - Escalation Vs. De-escalation.

Modification Strategy	No of Patients	Percentage (%)
De-escalated therapy	38	47.5
Continued empirical therapy	34	42.5
Escalated therapy	8	10
TOTAL	80	100

Escalation was done for worsening labs or positive panel results, while de-escalation followed clinical or radiological improvement, with most patients shifted from broad-spectrum injectables to targeted oral antibiotics.

Table 5: Therapeutic Transitions: Initial Empirical Vs. Modified Therapy.

Modification Strategy	No of Patients	Percentage (%)
De-escalated therapy	38	47.5
Continued empirical therapy	34	42.5
Escalated therapy	8	10
TOTAL	80	100

DISCUSSION

This six-month prospective observational study included 80 pneumonia patients, with a predominance of males and a higher proportion belonging to the 0–18 years age group. Similar age trends have been reported in earlier studies, highlighting the increased susceptibility of younger individuals to respiratory infections.[2,4] Most patients presented with combinations of dry cough and fever, while nearly half had mixed respiratory symptoms, consistent with typical pneumonia presentations described in literature.[3] Respiratory panel testing showed a positivity rate of 46.3%, commonly detecting Influenza A, RSV, and Streptococcus pneumoniae, which aligns with findings from Metlay et al. emphasizing the role of viral pathogens in pneumonia.[8] Bilateral bronchopneumonia was the most frequent radiological pattern, supporting observations made in previous studies on viral and atypical pneumonias.[3] Ceftriaxone-based and cefoperazone–sulbactam combinations were the most common empirical regimens, with over half of the patients receiving multidrug therapy. This aligns with guideline-based recommendations for community-acquired pneumonia management.[10] Therapeutic modifications showed that de-escalation (47.5%) was more common than escalation (10%), reflecting appropriate antimicrobial stewardship practices and improvement based on diagnostics and clinical response.[7]

CONCLUSION

Over six months, 80 pneumonia patients were evaluated, with respiratory panel testing identifying pathogens such as Influenza A virus and Streptococcus pneumoniae as common causative organisms. Empirical therapy was predominantly cephalosporin-based, often combined with macrolides or antivirals. Treatment modifications were guided by clinical response and laboratory findings, with de-escalation commonly performed in patients showing improvement. This approach highlights the role of pathogen-directed therapy and antimicrobial stewardship in achieving favorable clinical outcomes.

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