JAMP

Original Research Article

ANALYSIS OF ANTIBIOTIC RESISTANCE PATTERNS IN COMMUNITY-ACQUIRED INFECTIONS: A RETROSPECTIVE STUDY FOCUSING ON CEFTOLOZANE-TAZOBACTAM, AND VANCOMYCIN

K Bala Murali Krishna[1], Prashanth Kumar Patnaik[2], I Sridhar[3], Deepak Kumar[4]

[1]Assistant Professor, Department Of General Medicine, Vishnu Dental College,Vishnupur, Bhimavaram, West Godavari dist, .Andhra Pradesh, India.
[2]Associate Professor, Department Of Pharmacology, RVM Institute of Medical Sciences and Research Centre, Laxmakkapally Village, Siddipet District, Telangana, India.
[3]Professor and Head, Department Of Pharmacology, Government Medical College, Jangaon, Telangana, India.
[4]Associate professor, Department of General Medicine, Lt. Indira Gandhi Medical College, Kanker, Chhattisgarh, India.

Abstract

Background: Antibiotic resistance poses a significant challenge in managing community-acquired infections. Understanding the sensitivity and resistance patterns of key antibiotics is crucial for effective treatment. **Objective:** This retrospective study aimed to analyze the antibiotic sensitivity and resistance patterns of Ceftolozane-Tazobactam and Vancomycin in community-acquired infections. **Material and Methods:** A retrospective analysis was conducted on 100 patients with community-acquired infections. Sensitivity and resistance rates to Ceftolozane-Tazobactam and Vancomycin were assessed. Additionally, infection-specific sensitivity and resistance patterns, demographic factors, and gender distribution of resistance were analyzed. **Results:** Ceftolozane-Tazobactam exhibited a sensitivity rate of 78% and a resistance rate of 22%, while Vancomycin demonstrated sensitivity and resistance rates of 85% and 15%, respectively. Infections primarily sensitive to Ceftolozane-Tazobactam included urinary tract infections (55 cases) and pneumonia (20 cases). Resistance to Ceftolozane-Tazobactam, particularly associated with Extended-Spectrum Beta-Lactamase (ESBL)-producing E. coli, was notable in urinary tract infections. Vancomycin sensitivity was prominent in skin and soft tissue infections (60 cases), with resistance primarily linked to Methicillin-Resistant Staphylococcus Aureus (MRSA). Demographic analysis revealed a higher prevalence of infections among patients aged 41-60 years. Resistance to Ceftolozane-Tazobactam was more prevalent among males (25%) compared to females (17%), while Vancomycin resistance rates were lower, with 10% in males and 5% in females. **Conclusion:** This study highlights the importance of understanding antibiotic sensitivity and resistance patterns in community-acquired infections. The findings provide valuable insights for optimizing treatment strategies and guiding antimicrobial stewardship efforts.

INTRODUCTION

Community-acquired infections present a persistent challenge to healthcare systems worldwide, exerting a significant toll on morbidity, mortality, and healthcare expenditure. Among the numerous hurdles encountered in managing these infections, antibiotic resistance emerges as a critical concern.[1,2] The proliferation of resistant pathogens undermines the efficacy of antibiotic therapies, resulting in treatment failures, prolonged illnesses, and heightened healthcare resource utilization.[3]

In the arsenal against community-acquired infections, Ceftolozane-Tazobactam and Vancomycin stand as pivotal antibiotics.[4] Ceftolozane-Tazobactam, a novel combination of a cephalosporin and a β-lactamase inhibitor, offers promise in combatting multidrug-resistant Gram-negative bacteria.[5] Meanwhile, Vancomycin

686

International Journal of Academic Medicine and Pharmacy (www.academicmed.org)
ISSN (O): 2687-5365; ISSN (P): 2753-6556

remains indispensable for combating Gram-positive pathogens, notably methicillin-resistant Staphylococcus aureus (MRSA).[6]

The necessity of understanding the sensitivity and resistance profiles of these antibiotics in community-acquired infections cannot be overstated. Such comprehension is crucial for guiding empirical therapy and optimizing antimicrobial stewardship strategies.[7] Therefore, this retrospective study seeks to provide comprehensive insights into the sensitivity and resistance patterns of Ceftolozane-Tazobactam and Vancomycin in a cohort of patients with community-acquired infections.

Through an exhaustive analysis of antibiotic sensitivity and resistance rates, as well as infection-specific patterns and demographic factors, this study aims to enrich the evidence base supporting informed antibiotic prescribing practices. By delineating the prevalence of resistance, particularly within key infection types and demographic subsets, healthcare providers can tailor treatment regimens to enhance patient outcomes and curb the dissemination of antibiotic resistance.

Ultimately, this study endeavors to serve as a cornerstone for informed clinical decision-making, facilitating the judicious utilization of antibiotics in the management of community-acquired infections. By advancing our understanding of antibiotic resistance dynamics, this research contributes to the collective efforts aimed at combating antibiotic resistance and safeguarding the efficacy of these indispensable therapeutic agents.

Aim and Objectives

The aim of this retrospective study is to analyze the sensitivity and resistance patterns of Ceftolozane-Tazobactam and Vancomycin in community-acquired infections, with the goal of informing antibiotic prescribing practices and optimizing antimicrobial stewardship efforts.

Evaluate the sensitivity and resistance rates of Ceftolozane-Tazobactam and Vancomycin in community-acquired infections.

Investigate infection-specific sensitivity and resistance patterns of Ceftolozane-Tazobactam and Vancomycin, focusing on prevalent pathogens and resistance mechanisms.

Analyze demographic factors associated with susceptibility to Ceftolozane-Tazobactam and Vancomycin, including age and gender.

Examine the distribution of resistance by gender for Ceftolozane-Tazobactam and Vancomycin, providing insights into antibiotic resistance prevalence among different demographic subgroups.

MATERIALS AND METHODS

Study Design: This retrospective study was conducted at RVM Institute of Medical Sciences and Research Centre, located in Siddipet, Telangana, India. The study period spanned from January 2023 to December 2023.

Data Collection: Patient data were extracted from electronic medical records (EMRs) maintained at the institution's healthcare facilities. Inclusion criteria comprised patients diagnosed with community-acquired infections and prescribed Ceftolozane-Tazobactam or Vancomycin as part of their treatment regimen during the study period. Exclusion criteria included patients with hospital-acquired infections or incomplete medical records.

Data Variables: The following variables were collected for each patient: demographic information (age, gender), infection type (e.g., urinary tract infection, pneumonia, skin and soft tissue infection), antibiotic prescribed (Ceftolozane-Tazobactam or Vancomycin), sensitivity/resistance status, and any relevant comorbidities or risk factors.

Data Analysis: Descriptive statistics were employed to analyze the data, including calculation of sensitivity and resistance rates for Ceftolozane-Tazobactam and Vancomycin. Infection-specific sensitivity and resistance patterns were assessed, with particular emphasis on prevalent pathogens and resistance mechanisms. Demographic characteristics of the study population were also analyzed to identify any associations with antibiotic resistance.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee of RVM Institute of Medical Sciences and Research Centre. Patient confidentiality and data protection were strictly maintained throughout the study process, with adherence to relevant ethical guidelines and regulations.

RESULTS

Antibiotic Sensitivity and Resistance Patterns

The retrospective analysis encompassed 100 patients with community-acquired infections, focusing on the sensitivity to Ceftolozane-Tazobactam and Vancomycin. [Table1] The study revealed that Ceftolozane-Tazobactam exhibited a sensitivity rate of 78%, while 22% of cases displayed resistance. In contrast, Vancomycin demonstrated a higher sensitivity rate of 85%, with a resistance rate of 15%.

Ceftolozane-Tazobactam Findings

In the examination of Ceftolozane-Tazobactam (Table 2), the majority of sensitivity cases were associated with urinary tract infections (UTIs), comprising 55 cases, while pneumonia accounted for 20 cases. Notably, urinary tract infections exhibited a higher resistance rate, attributed primarily to Extended-Spectrum Beta-Lactamase (ESBL)-producing E. coli strains, with 15 cases indicating resistance. In other infection types categorized as "Other," there were 3 sensitivity cases and 2 resistance cases.

Vancomycin Findings

Regarding Vancomycin. [Table3] the analysis revealed 60 sensitivity cases related to skin and soft tissue infections (SSTIs) and 10 cases associated with bloodstream infections. Within the SSTI category, 10 cases exhibited resistance, mainly attributed to Methicillin-Resistant Staphylococcus Aureus (MRSA). In other infection types, categorized as "Other," there were 5 sensitivity cases and 1 resistance case.

Demographic Analysis

The study explored demographic factors concerning infection susceptibility. [Table 4] Patients aged 41-60 years represented the largest cohort, constituting 60% of the total cases. Within this age group, the most affected infections were observed, with 36 cases displaying sensitivity and 7 cases showing resistance. Conversely, the 0-20 and 81+ age groups showed lower prevalence, with minimal or no reported cases.

Distribution of Resistance by Gender

Analysis of resistance distribution by gender indicated a higher resistance rate among male patients for Ceftolozane-Tazobactam, with 25% resistance compared to 17% in female patients. However, for Vancomycin, resistance rates were lower overall, with 10% among male patients and 5% among female patients. [Table 5]

Table 1: Antibiotic Sensitivity and Resistance Patterns

Antibiotic	Sensitivity (%)	Resistance (%)
Ceftolozane-Tazobactam	78	22
Vancomycin	85	15

Table 2: Ceftolozane-Tazobactam Findings

Infection Type	Sensitivity Cases	Resistance Cases
Urinary Tract	55	15
Pneumonia	20	5
Other	3	2

Table 3: Vancomycin Findings

Infection Type	Sensitivity Cases	Resistance Cases
Skin and Soft Tissue	60	10
Bloodstream	10	3
Other	5	1

Table 4: Demographic Analysis

Age Group	Most Affected Infections	Percentage of Cohort (%)
0-20	5	10
21-40	12	20
41-60	36	60
61-80	7	10
81+	0	0

Table 5: Distribution of Resistance by Gender

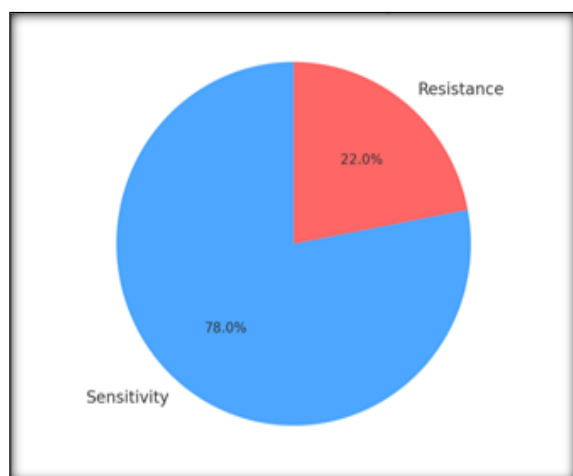| Antibiotic	Male (%)	Female (%)
Ceftolozane-Tazobactam	25	17
Vancomycin	10	5

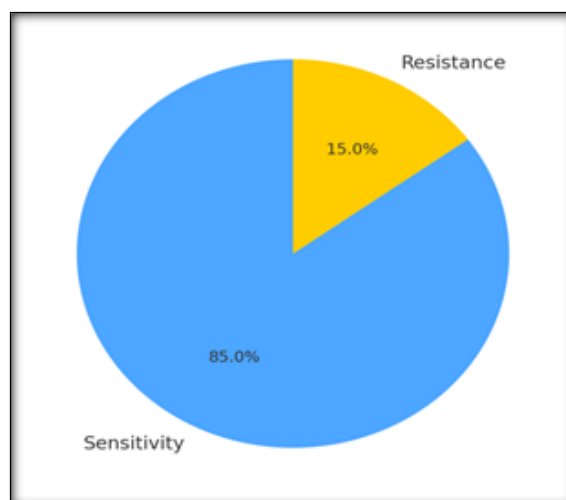**Figure 1: Ceftolozone -Tazobactam Sensitivity and Resistance**

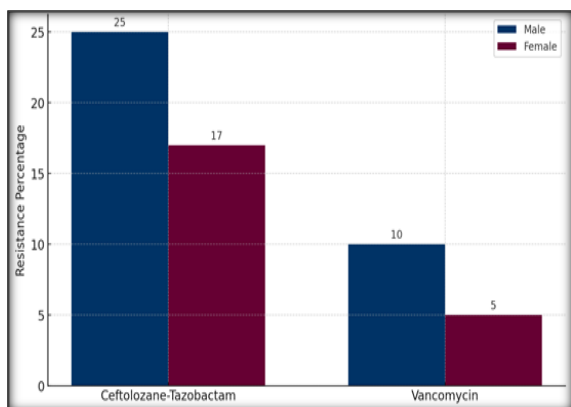**Figure 2: Vancomycin Sensitivity and Resistance**

Figure 3: Distribution of Resistance by Gender

DISCUSSION

Antibiotic resistance remains a significant global health challenge, particularly in the context of community-acquired infections. This retrospective study aimed to elucidate the sensitivity and resistance patterns of Ceftolozane-Tazobactam and Vancomycin, two key antibiotics commonly used in the management of such infections. The findings shed light on several important aspects related to antibiotic resistance and have implications for clinical practice and antimicrobial stewardship efforts.

The study revealed notable differences in sensitivity and resistance rates between Ceftolozane-Tazobactam and Vancomycin. Ceftolozane-Tazobactam exhibited a sensitivity rate of 78%, with a resistance rate of 22%, whereas Vancomycin demonstrated higher sensitivity8 at 85%, with a resistance rate of 15%. These findings underscore the importance of considering local antibiotic resistance patterns when selecting empirical therapy for community-acquired infections.[9]

Infection-specific analysis revealed distinct patterns of sensitivity and resistance. For Ceftolozane-Tazobactam, urinary tract infections (UTIs) constituted a significant proportion of sensitivity cases, while resistance was notably higher in this infection type, primarily due to Extended-Spectrum Beta-Lactamase (ESBL)-producing E. coli strains. Similarly, Vancomycin sensitivity was prominent in skin and soft tissue infections (SSTIs), with resistance primarily associated with Methicillin-Resistant Staphylococcus Aureus.[10,11] (MRSA).

The demographic analysis identified the 41-60 age group as the most affected cohort, constituting 60% of the total cases. This finding highlights the need for tailored interventions targeting specific demographic groups at higher risk of infection and antibiotic resistance.[12,13]

Furthermore, the distribution of resistance by gender revealed a higher resistance rate among male patients for Ceftolozane-Tazobactam, highlighting potential gender-related differences in infection susceptibility and antibiotic response.[14]

While this study provides valuable insights, several limitations must be acknowledged. The retrospective nature of the study may have introduced selection bias and limited the availability of complete clinical data. Additionally, the study was conducted at a single institution, which may limit the generalizability of the findings to other settings.

CONCLUSION

This study contributes to our understanding of antibiotic resistance patterns in community-acquired infections and highlights the importance of judicious antibiotic prescribing practices and antimicrobial stewardship initiatives. Future research should focus on multicenter studies and longitudinal surveillance to monitor trends in antibiotic resistance and guide effective interventions to combat this growing threat to public health.

REFERENCES

1. Agyeman WY, Bisht A, Gopinath A, Cheema AH, Chaludiya K, Khalid M, Nwosu M, Konka S, Khan S. A Systematic Review of Antibiotic Resistance Trends and Treatment Options for Hospital-Acquired Multidrug-Resistant Infections. Cureus. 2022 Oct 5; 14(10):e29956. doi: 10.7759/cureus.29956. PMID: 36381838; PMCID: PMC9635809.

2. Haidar G, Philips NJ, Shields RK, Snyder D, Cheng S, Potoski BA, Doi Y, Hao B, Press EG, Cooper VS, Clancy CJ, Nguyen MH. Ceftolozane-Tazobactam for the Treatment of Multidrug-Resistant Pseudomonas aeruginosa Infections: Clinical Effectiveness and Evolution of Resistance. Clin Infect Dis. 2017 Jul 1; 65(1):110-120. doi: 10.1093/cid/cix182. PMID: 29017262; PMCID: PMC5848332.

3. Matlock A, Garcia JA, Moussavi K, Long B, Liang SY. Advances in novel antibiotics to treat multidrug-resistant gram-negative bacterial infections. Intern Emerg Med. 2021 Nov; 16(8):2231-2241. doi: 10.1007/s11739-021-02749-1. Epub 2021 May 6. PMID: 33956311; PMCID: PMC8100742.

4. Palacios-Baena ZR, Valiente de Santis L, Maldonado N, Rosso-Fernández CM, Borreguero I, Herrero-Rodríguez C, et al. Quasiexperimental intervention study protocol to optimise the use of new antibiotics in Spain: the NEW_SAFE project. BMJ Open. 2020 Jul 31; 10(7):e035460. doi: 10.1136/bmjopen-2019-035460. PMID: 32737088; PMCID: PMC7398103.

5. Coppola N, Maraolo AE, Onorato L, Scotto R, Calò F, Atripaldi L, et al. Epidemiology, Mechanisms of Resistance and Treatment Algorithm for Infections Due to Carbapenem-Resistant Gram-Negative Bacteria: An Expert Panel Opinion. Antibiotics (Basel). 2022 Sep 17; 11(9):1263. doi: 10.3390/antibiotics11091263. PMID: 36140042; PMCID: PMC9495208.

6. Gajic I, Kabic J, Kekic D, Jovicevic M, Milenkovic M, Mitic Culafic D, et al. Antimicrobial Susceptibility Testing: A Comprehensive Review of Currently Used Methods. Antibiotics (Basel). 2022 Mar 23; 11(4):427. doi: 10.3390/antibiotics11040427. PMID: 35453179; PMCID: PMC9024665.

7. Bassetti M, Vena A, Giacobbe DR, Falcone M, Tiseo G, Giannella M, et al; CEFTABUSE Study Group. Ceftolozane/Tazobactam for Treatment of Severe ESBL-Producing Enterobacterales Infections: A Multicenter Nationwide Clinical Experience (CEFTABUSE II Study). Open Forum Infect Dis. 2020 Apr 21; 7(5):ofaa139. doi:

689

International Journal of Academic Medicine and Pharmacy (www.academicmed.org)
ISSN (O): 2687-5365; ISSN (P): 2753-6556

10.1093/ofid/ofaa139. PMID: 32462046; PMCID: PMC7237821.

8. Chaïbi K, Jaureguy F, Do Rego H, Ruiz P, Mory C, El Helali N, Mrabet S, Mizrahi A, Zahar JR, Pilmis B. What to Do with the New Antibiotics? Antibiotics (Basel). 2023 Mar 27; 12(4):654. doi: 10.3390/antibiotics12040654. PMID: 37107016; PMCID: PMC10135159.

9. Bostanghadiri N, Sholeh M, Navidifar T, Dadgar-Zankbar L, Elahi Z, van Belkum A, et al. Global mapping of antibiotic resistance rates among clinical isolates of Stenotrophomonas maltophilia: a systematic review and meta-analysis. Ann Clin Microbiol Antimicrob. 2024 Mar 19; 23(1):26. doi: 10.1186/s12941-024-00685-4. PMID: 38504262; PMCID: PMC10953290.

10. Rödenbeck M, Ayobami O, Eckmanns T, Pletz MW, Bleidorn J, Markwart R. Clinical epidemiology and case fatality due to antimicrobial resistance in Germany: a systematic review and meta-analysis, 1 January 2010 to 31 December 2021. Euro Surveill. 2023 May; 28(20):2200672. doi: 10.2807/1560-7917.ES.2023.28.20.2200672. PMID: 37199987; PMCID: PMC10197495.

11. Sivasankar S, Goldman JL, Hoffman MA. Variation in antibiotic resistance patterns for children and adults treated at 166 non-affiliated US facilities using EHR data. JAC Antimicrob Resist. 2023 Jan 2;5(1):dlac128. doi: 10.1093/jacamr/dlac128. PMID: 36601546; PMCID: PMC9806600.

12. Poggi C, Dani C. New Antimicrobials for the Treatment of Neonatal Sepsis Caused by Multi-Drug-Resistant Bacteria: A Systematic Review. Antibiotics. 2023; 12(6):956. https://doi.org/10.3390/antibiotics12060956

13. Banar M, Sattari-Maraji A, Bayatinejad G, Ebrahimi E, Jabalameli L, Beigverdi R, et al. Global prevalence and antibiotic resistance in clinical isolates of Stenotrophomonas maltophilia: a systematic review and meta-analysis. Front Med (Lausanne). 2023 May 5; 10:1163439. doi: 10.3389/fmed.2023.1163439. PMID: 37215718; PMCID: PMC10196134.

14. Thabit AK, Alabbasi AY, Alnezary FS, Almasoudi IA. An Overview of Antimicrobial Resistance in Saudi Arabia (2013–2023) and the Need for National Surveillance. Microorganisms. 2023; 11(8):2086.

690

International Journal of Academic Medicine and Pharmacy (www.academicmed.org)
ISSN (O): 2687-5365; ISSN (P): 2753-6556