IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Antibiotic Sensitivity Patterns in Inpatient Pediatric Department of Tertiary Care Hospital MIMS Mandya: A Record Based Study

[1]Dr. Manu P R, [2]Rakshitha B K, [2]Ravi Kumar K P, [2]Sona R

[1]Assistant Professor, [2]Pharm D
Department of Pharmacy Practice
Bharathi College of Pharmacy, Mandya, Karnataka-571422, India.

Abstract :

BACKGROUND: Antibiotic susceptibility testing (AST) establishes empirical therapy profiles and effective antibiotic dosages for managing pediatric patients 'health against life-threatening infections, amidst rising antimicrobial resistance (AMR) affecting expenses, morbidity, and death. OBJECTIVE: To describe the antibiotic sensitivity and resistance patterns of common bacterial pathogens isolated from pediatric patients in MIMS Mandya. METHODOLOGY: Descriptive Record-based study of 100 pediatric patients using well-designed data collection forms and statistical analysis. RESULTS AND CONCLUSION: Among 100 patients (52% girls, 48% boys, mostly under 1 year old), common comorbidities included anaemia, hyperbilirubinemia, and hypocalcaemia. Staphylococcus showed significant beta-lactam resistance. Vancomycin, Linezolid, and Trimethoprim were most effective. High resistance to penicillin-based treatments emphasizes the need for judicious use, alternative treatments, tailored antibiotic therapy, antibiotic stewardship, and ongoing research.

***Keywords* – Antibiotics, antibiotic resistance, antibiotic culture sensitivity, paediatrics.**

INTRODUCTION

Antibiotics, defined as substances derived from microorganisms or synthesized chemically that inhibit or kill bacteria at low concentrations, are central to treating bacterial infections. Antibiotic Sensitivity testing (AST) specifies effective antibiotic dosage and formulates a profile of empirical therapy for the proper management of an individual patient's health against deadly infections. Antibiotic resistance is defined as the genetic ability of bacteria to encode the resistance genes that counterfeit the inhibitory effect of potential antibiotics for survival. The emergence of antimicrobial resistance (AMR) is a worldwide problem impacting morbidity, mortality, and costs. Antibiotics are widely used drugs in pediatrics due to their beneficial effects in reducing infectious symptoms. Specific pediatric issues, such as reckless antibiotic prescriptions for wrong diagnoses, the limited options, the lack of trials on children, and the evolving nature of this diverse population, are the culprits in this complex perspective. The choice of the best therapeutic option for the treatment of bacterial infections relies on the results of AST, a part of the routine work of all clinical microbiological laboratories. These reports provide insight into local patterns of antimicrobial susceptibility, helping physicians to choose the most effective antibiotic therapy.

In pediatrics, antibiotics are among the most prescribed medications. However, antibiotic resistance—the reduced efficacy of antibiotics against bacterial infections—poses a major threat, particularly as children's developing immune systems make them more vulnerable to infections. Overuse and misuse of antibiotics have accelerated the emergence of resistant strains, complicating treatment, increasing morbidity, and raising healthcare costs.

Numerous studies report inappropriate pediatric antibiotic prescribing practices, often favoring broad-spectrum antibiotics, contributing significantly to resistance. Mechanisms of bacterial resistance include enzymatic degradation (e.g., β-lactamases), target site modification (e.g., alterations in penicillin-binding proteins), efflux pumps, and decreased membrane permeability. Resistant infections, such as those caused by MRSA and ESBL-producing Enterobacteriaceae, demand more toxic and costly treatment options, leading to longer hospital stays and higher mortality.

Effective management strategies include implementing pediatric antibiotic stewardship programs, enhancing infection prevention, promoting vaccination, and public education on antibiotic misuse. Diagnostics such as PCR, culture-sensitivity testing, and next-generation sequencing are vital for early detection of resistant infections.

Paediatric bacterial infections—including bloodstream infections, acute otitis media, streptococcal pharyngitis, pneumonia, urinary tract infections, skin and soft tissue infections, and meningitis—are increasingly affected by resistance trends. Gram-positive

pathogens like *Streptococcus pneumoniae* and *Staphylococcus aureus*, and Gram-negative bacteria like *Escherichia coli* and *Haemophilus influenzae*, remain the primary culprits.
Research into novel therapeutics, such as bacteriophage therapy and new antibiotics, along with robust surveillance and education programs, is essential to combat pediatric antibiotic resistance and safeguard future generations.

MATERIALS AND METHODS

This was a descriptive record-based study conducted in Pediatric Department MIMS Mandya. The study was conducted over a period of six months following ethical approval from the Institutional Ethics Committee of MIMS Teaching Hospital, Mandya. The research period included four months dedicated to data collection and two months for data analysis and manuscript preparation. A total of 100 patients admitted in MIMS were enrolled in the study based on study criteria. The required details from the patient's case sheets were recorded in a well-designed patient profile form. The culture sensitivity report and prescription data of 100 patients were analysed in the current study.

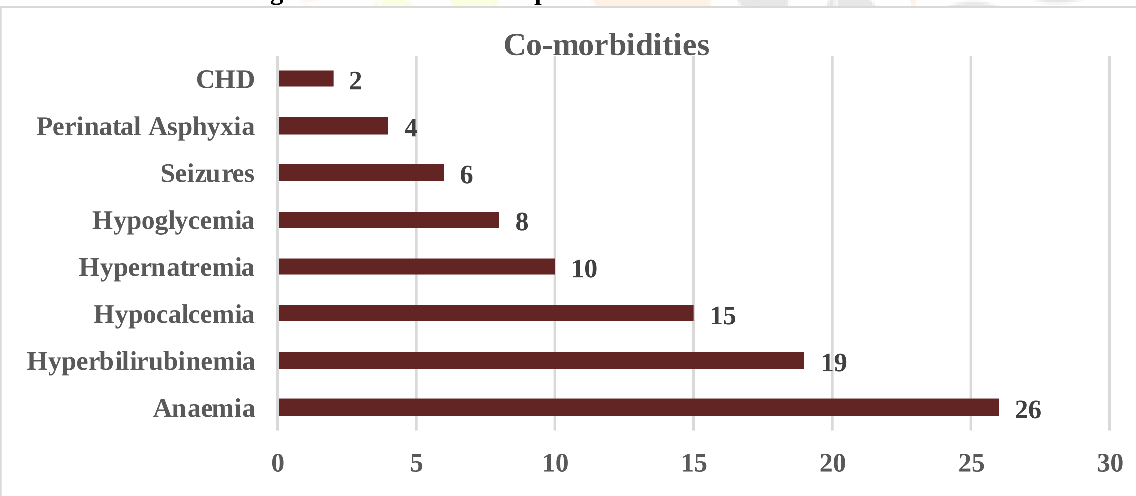
STUDY CRITERIA
a) Inclusion criteria: Records of patient case in IPD of pediatric department where antibiotic culture sensitivity is done.
b) Exclusion criteria: Nil.

METHOD OF DATA COLLECTION (STUDY TOOLS)
A pretested semi structured proforma will be used to collect the following data, socio- demographic details like Name, Age. It also contains details on diagnosis, antibiotic culture sensitivity report, treatment and management.
Analysis: Data collected will be coded and checked for completeness and uniformity, then data will be entered in MS Excel worksheet and descriptive statistics will be used and the results will be presented as tables, graphs or expressed as percentage according to the type of information collected.

RESULTS

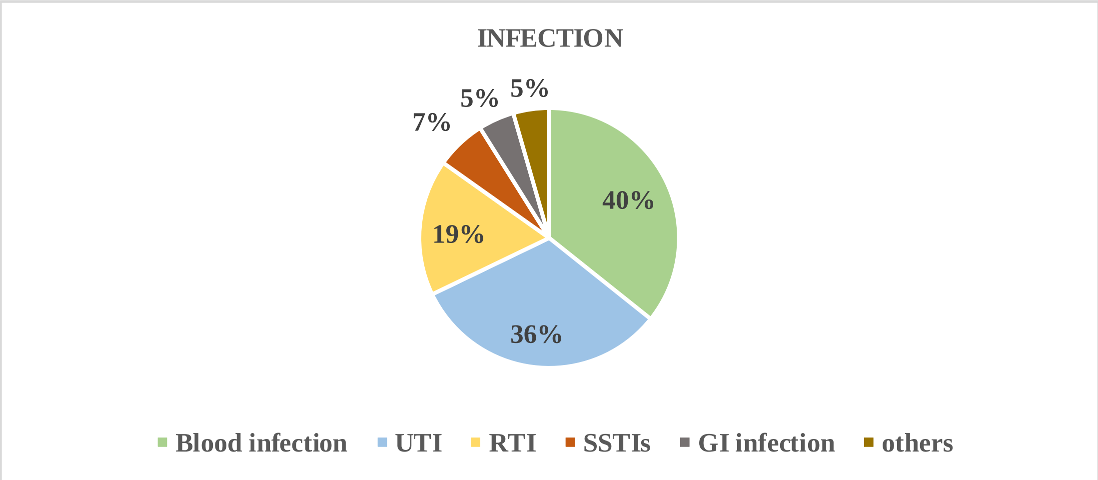
This study, conducted in the In-patient Department of Paediatrics at MIMS, Mandya, involved 100 pediatric patients, providing a detailed overview of their demographics, comorbidities, infection types, and antibiotic sensitivities. The demographic distribution showed a slight predominance of girls (52%) over boys (48%), suggesting a higher prevalence of infections and sensitivity among female patients. The age distribution revealed that infants under 1 year constituted the largest group (56%), emphasizing their vulnerability, while children aged 10 to 13 years were the least represented (10%).

Figure 1: Distribution of patients based on comorbidities



The study also identified several common comorbidities among the patients, with anaemia being the most prevalent (26%), followed by hyperbilirubinemia (19%) and hypocalcaemia (15%). Other noted comorbidities included hypernatremia, hypoglycaemia, seizures, perinatal asphyxia, and coronary heart disease. These findings highlight the complex health challenges faced by the pediatric population in this setting.

Figure 2: Distribution of patients based on types of infection



Infection types were predominantly blood infections (40%), with sepsis being the most common (30%). Urinary tract infections were also significant (36%), followed by respiratory tract infections (19%). Other types of infections included skin, gastrointestinal, and a range of less common infections.

Blood samples were the primary specimens collected (55%), with urine and sputum samples following at 36% and 9%, respectively.

Table 1: Distribution of patients based on specimen collected

Specimen	Frequency	Percentage
Blood	55	55%
Urine	36	36%
Sputum	9	9%

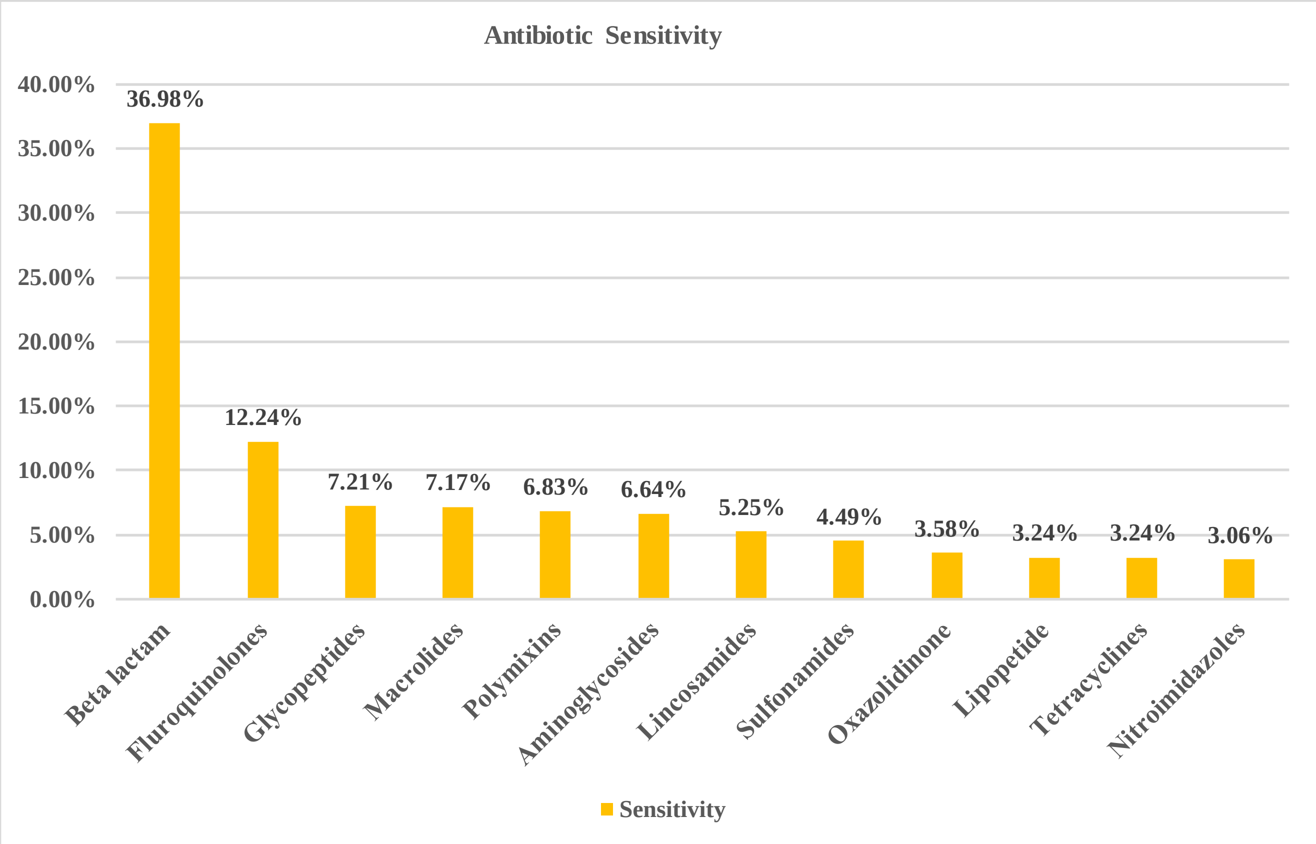
The majority of specimens were collected from blood (55%), followed by urine (36%), and sputum (9%).

Table 2: Distribution of Culture reports based on type of organisms

Type of organisms	Number of positive cases	Percentage
Staphylococcus aureus	37	37%
Escherichia coli	28	28%
Klebsiella	11	11%
Enterococcus	9	9%
Streptococcus	7	7%
Proteus	3	3%
Shigella sonnei	3	3%
Acinetobacter	1	1%
Citrobacter	1	1%

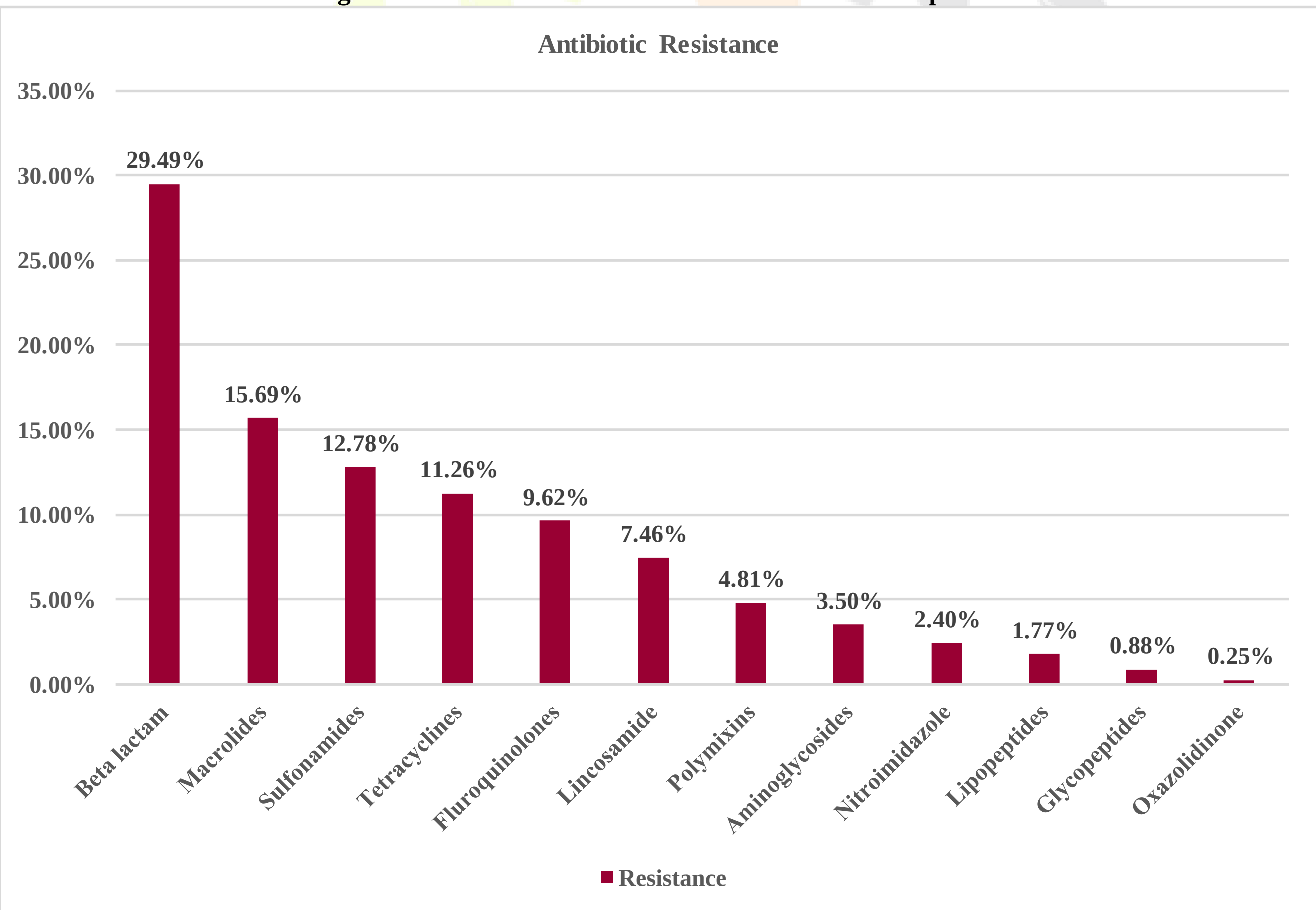
Majority of cultures showing Staphylococcus (37%), followed by E. coli (28%), Klebsiella (11%), Enterococcus (9%), Streptococcus (7%), Proteus (3%), Shigella sonnei (3%), Acinetobacter (1%), and Citrobacter (1%).

Figure 3: Distribution of Antibiotic culture sensitivity profile



According to the study conducted among 100 pediatric patients, it was estimated that beta-lactam antibiotics (36.98%) were the mosteffective against bacterial cultures, followed by fluoroquinolones (12.24%), with nitroimidazoles (3.06%) being the least effective.

Figure 4: Distribution of Antibiotic culture resistance profile



According to the study conducted among 100 pediatric patients, it was estimated that beta-lactam antibiotics (29.49%) were the most resistant to bacterial cultures, followed by macrolides (15.69%), while oxazolidinones (0.25%) were the least resistant.

Distribution of antibiotics for Staphylococcus aureus based on their sensitivity and resistant pattern

Figure 5: Distribution of sensitive antibiotic for Staphylococcus aureus

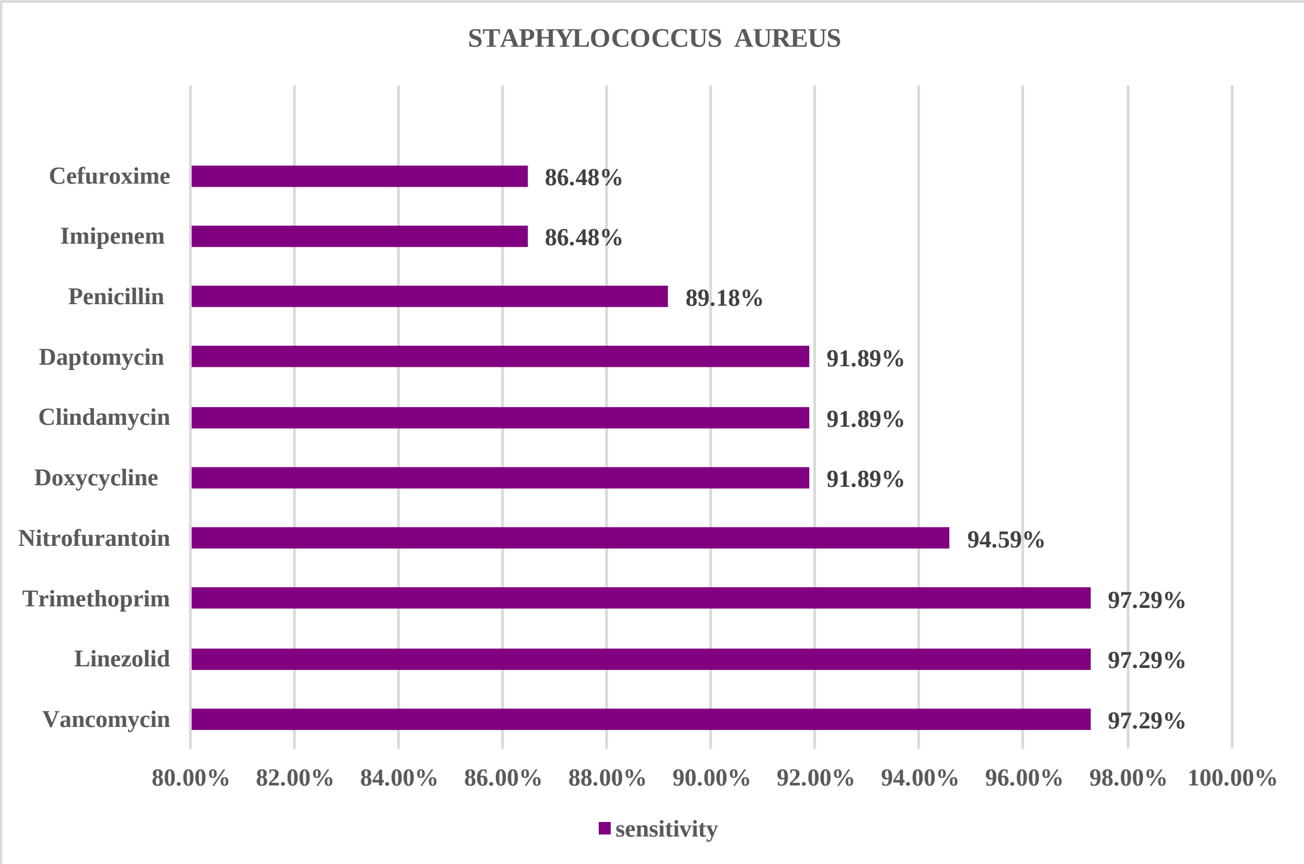
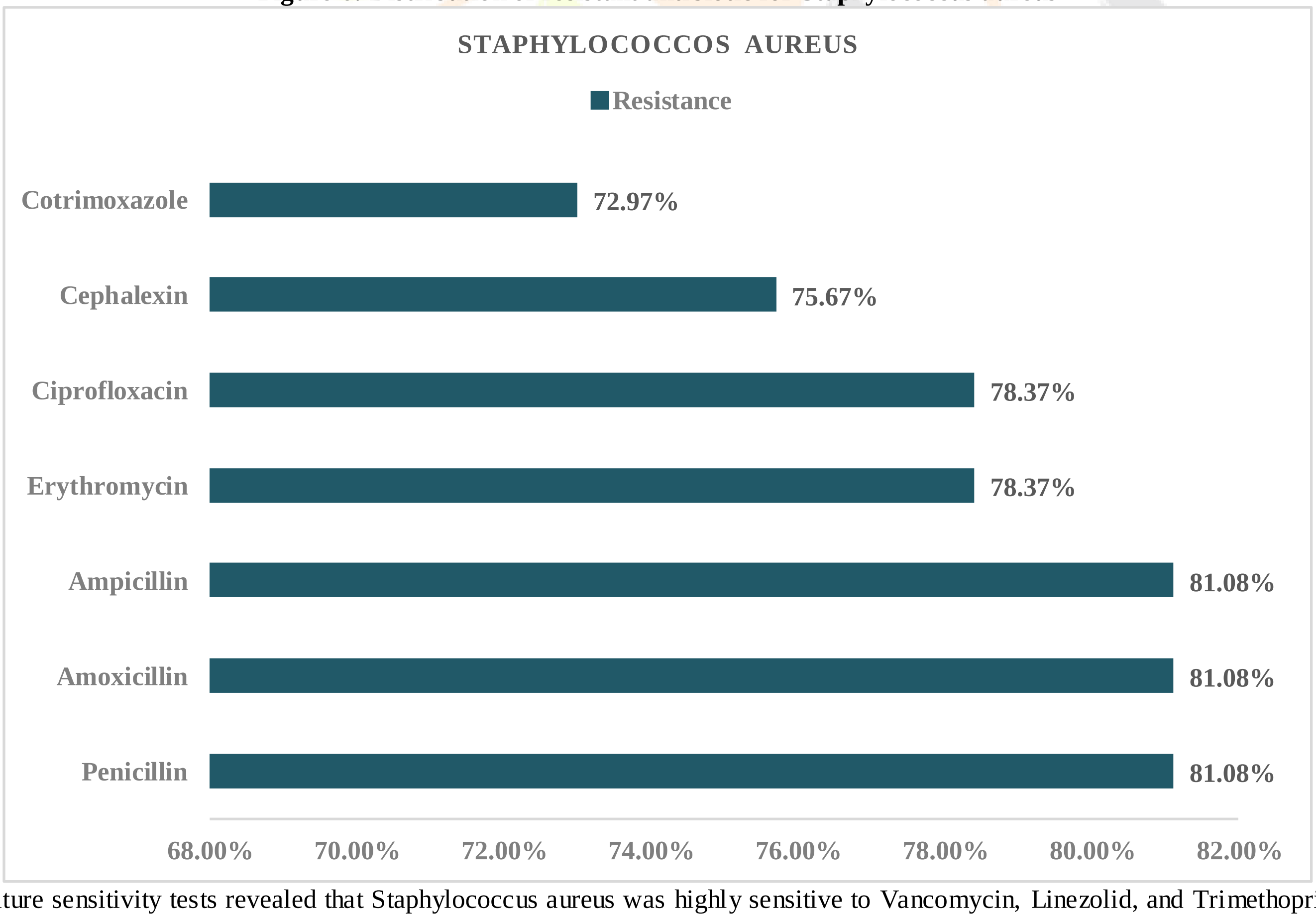


Figure 6: Distribution of resistant antibiotic for Staphylococcus aureus



Culture sensitivity tests revealed that Staphylococcus aureus was highly sensitive to Vancomycin, Linezolid, and Trimethoprim, yet exhibited high resistance to Penicillin, Amoxicillin, and Ampicillin.

Distribution of antibiotics for escherichia coli based on their sensitivity and resistant pattern

Figure 7: Distribution of sensitive antibiotic for Escherichia coli

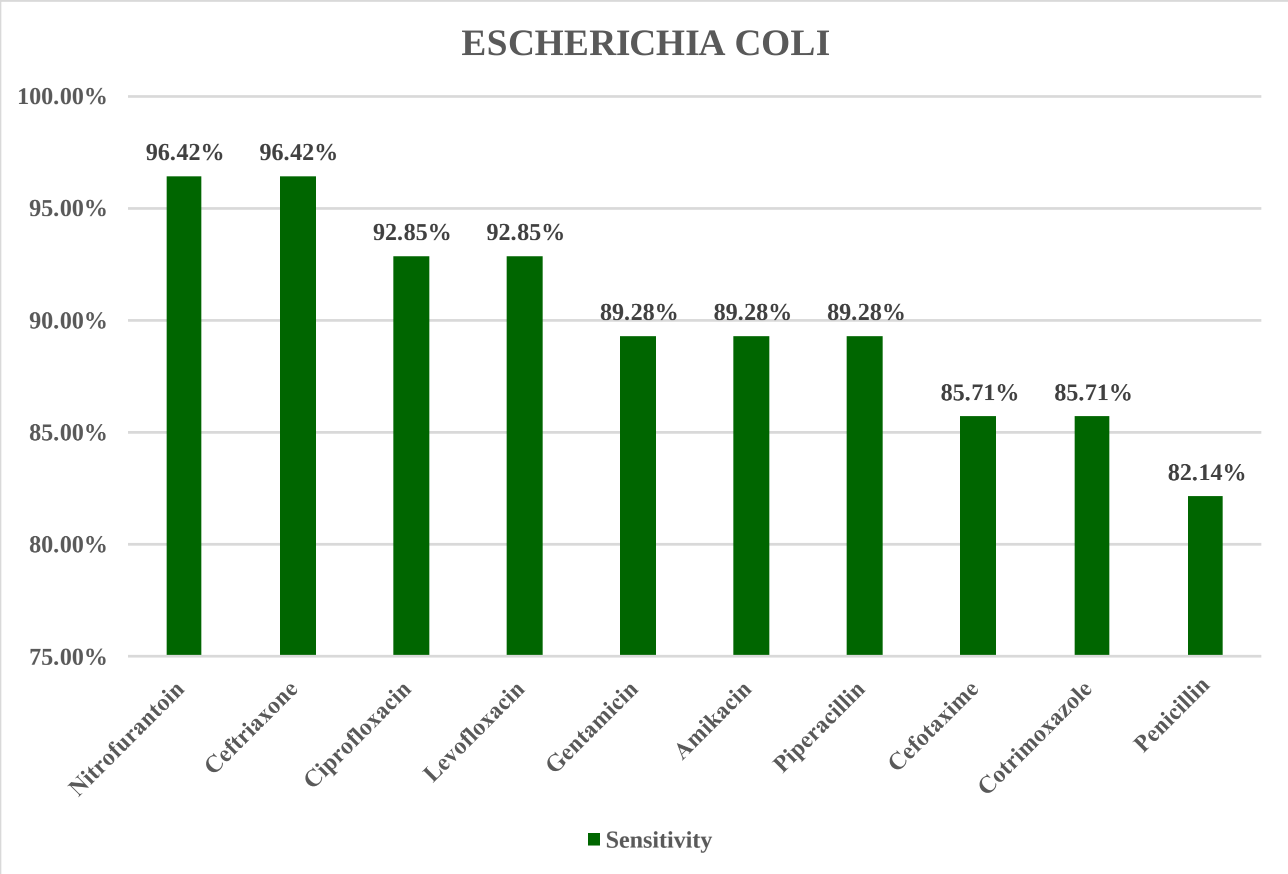
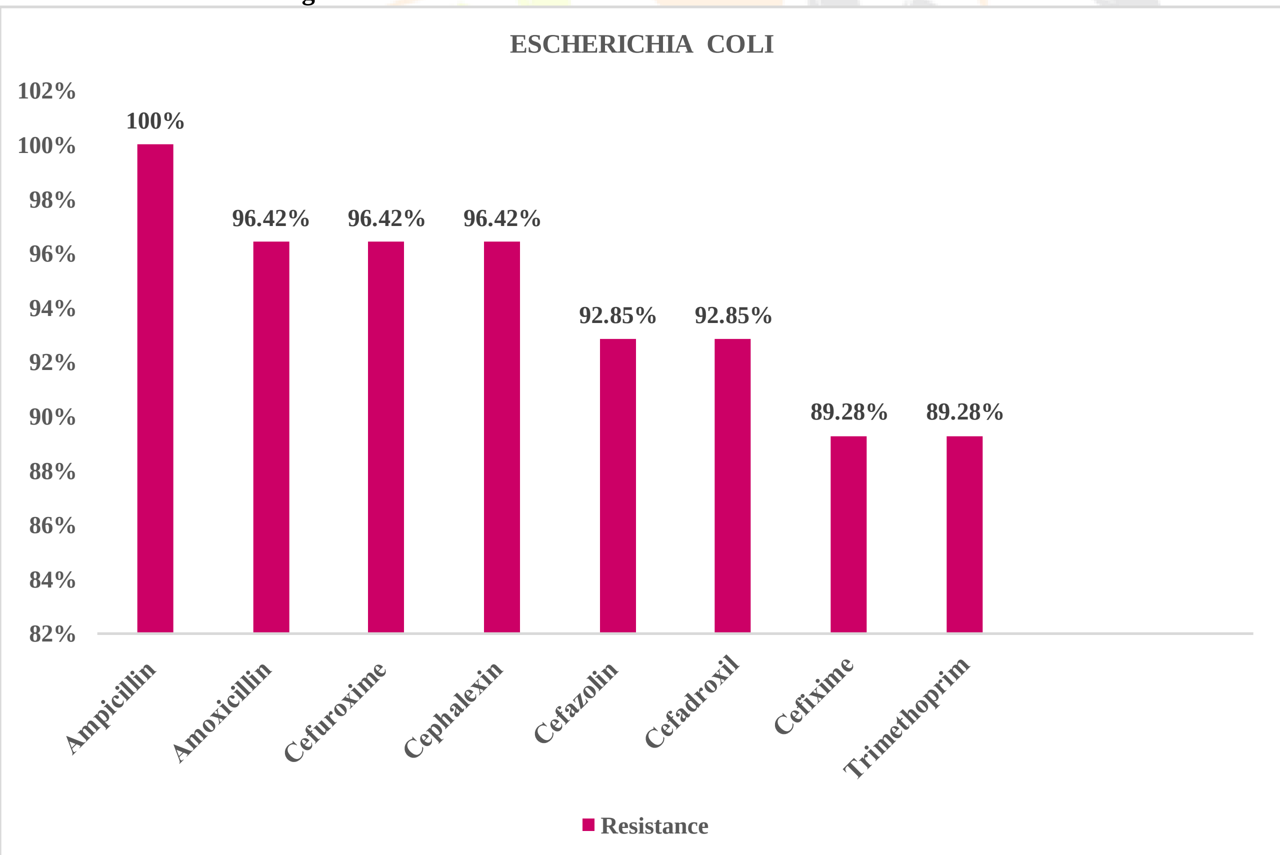


Figure 8: Distribution of resistant antibiotic for Escherichia coli



Escherichia coli showed high sensitivity to Nitrofurantoin, Ceftriaxone, and Ciprofloxacin but was resistant to Ampicillin and other antibiotics.

Distribution of antibiotics for klebsiella species based on their sensitivity and resistant pattern

Figure 9: Distribution of sensitive antibiotic for Klebsiella species

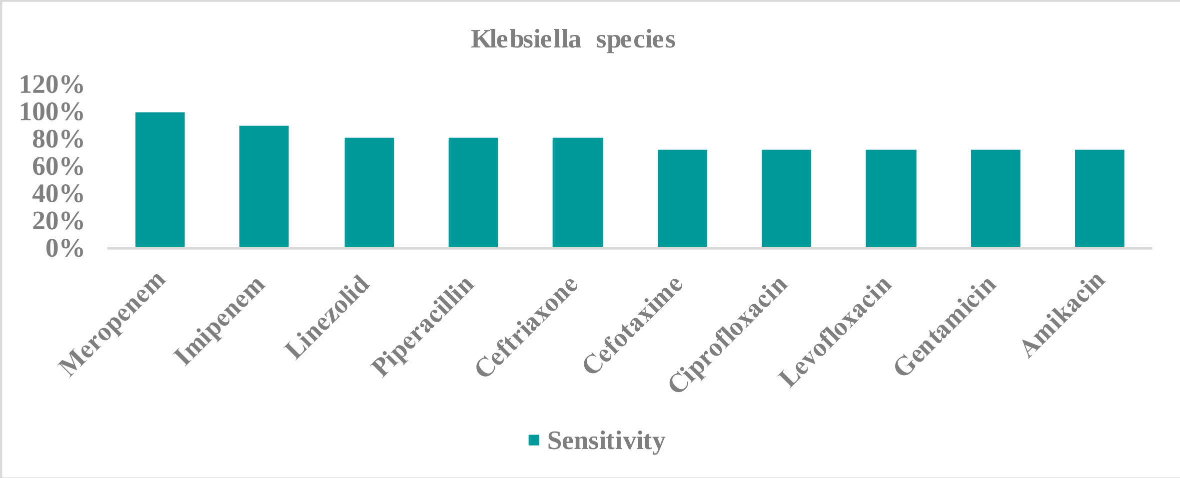
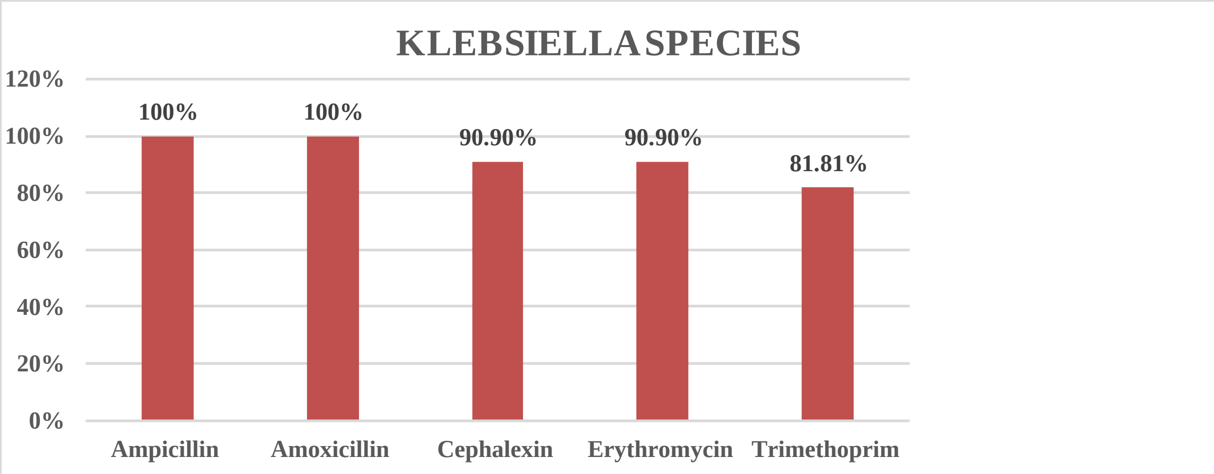


Figure 10: Distribution of resistant antibiotic for Klebsiella species



Klebsiella species were notably sensitive to Meropenem and Imipenem but resistant to Ampicillin and Amoxicillin.

Regarding antibiotic effectiveness, beta-lactam antibiotics emerged as the most effective (36.98%), followed by fluoroquinolones (12.24%). Nitroimidazoles were the least effective (3.06%). Conversely, beta-lactam antibiotics were also the most resistant (29.49%), with macrolides following. Antibiotic prescriptions predominantly featured beta-lactams (39.13%), with Aminoglycosides and Fluoroquinolones also frequently prescribed. This detailed analysis underscores the importance of precise antibiotic usage and monitoring of resistance patterns in pediatric infections.

CONCLUSION

- A study on pediatric infections revealed that infants, especially those under one year old, are at higher risk and require vigilant monitoring. Common comorbidities included anemia, hyperbilirubinemia, and hypocalcemia, which can complicate infection treatment. Blood infections, particularly sepsis, were prevalent, emphasizing the need for effective management protocols. Urinary tract and respiratory tract infections were also significant, highlighting the need for targeted prevention strategies.

- Antibiotic sensitivity testing showed Staphylococcus aureus, Escherichia coli, and Klebsiella species had high resistance to penicillin-based treatments. However, they were sensitive to alternative antibiotics such as Vancomycin, Linezolid, Nitrofurantoin, Ceftriaxone, and Meropenem. Beta-lactams were the most frequently prescribed antibiotics but also showed high resistance rates, underscoring the need for judicious use and ongoing surveillance of antibiotic resistance patterns.

- The study emphasizes the importance of tailored antibiotic therapy based on culture sensitivity results and monitoring antibiotic resistance to ensure effective treatment outcomes. Future efforts should focus on improving antibiotic stewardship, enhancing patient and caregiver education, and continuing research to address resistance. A collaborative approach involving healthcare providers, researchers, and policymakers is crucial for advancing infection management and combating antibiotic resistance.

ACKNOWLEDGMENT
This work is dedicated to our Parents and Teachers.
The assistance from MIMS is gratefully acknowledged.

CONFLICT OF INTEREST

Nil

REFERENCE

1. Khan ZA, Siddiqui MF, Park S. Current and Emerging Methods of Antibiotic Susceptibility Testing. Diagnostics [Internet]. 2019 May 3;9(2):49. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6627445/

2. Wal Pranay, Wal Ankita, Srivastava Rishabh, Rastogi Prateek, Rai Awani K. Antibiotic Therapy in Pediatric Patients. Research J. Pharm. and Tech. 3(1): Jan.-Mar. 2010; Page 118-120. Available on: https://rjptonline.org/AbstractView.aspx?PID=2010-3-1-17

3. Romandini, A.; Pani, A.; Schenardi, P.A.; Pattarino, G.A.C.; DeGiacomo,C.; Scaglione, F. Antibiotic Resistance in Pediatric Infections: Global Emerging Threats, Predicting the Near Future. Antibiotics 2021, 10, 393. https://doi.org/10.3390/ antibiotics10040393

4. Ibraheem Altamimi, Abeer Almazyed , Sami Alshammary, Abdulaziz Altamimi, et al. Bacterial Pathogens and Antimicrobial Susceptibility Patterns of Urinary Tract Infections in Children during COVID-19 2019–2020: A Large Tertiary Care Center in SaudiArabia.MultidisciplinaryDigitalPublishingInstitute.2023;10(6):971.https://doi.org/10.3390/children10060971

5. Essamedin M. Negm a, Eman S. Elgharabawy b, Shahenda G. Badran b, ALZahraa M. et al. Analysis of cumulative antibiogram reports in intensive care units at an Raichur University Hospital. Journal of Infection and Public , volume 16 , August 2023 page no 2020-2029https://doi.org/10.1016/j.jiph.2023.05.032

6. Maarbjerg, Sabine F. MD; Kiefer, Lotte V. MD; Albertsen, Bloodstream Infections in Children With Cancer: Pathogen Distribution and Antimicrobial Susceptibility Patterns Over a 10-Year Period .Journal of Pediatric Hematology/Oncology 44(1):p e160-e167, January 2022. DOI: 10.1097/MPH.0000000000002258

7. Snehal Vala 1, Urvesh Shah, Syed Amir Ahmad, Dennis Scolnik, et al. Resistance Patterns of Typhoid Fever in Children: A Longitudinal Community-Based Study. National library of medicine. 2016 Sep-Oct;23(5):e1151-4.Doi: 10.1097/MJT.0000000000000094.