ORIGINAL ARTICLE

Antimicrobial Resistance among Older Patients Attending Rapti Academy of Health Sciences: A Retrospective Study

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Abstract

Introduction: Antimicrobial resistance (AMR) is an escalating global health concern, particularly in developing countries like Nepal. Older adults are disproportionately affected due to immunosenescence, frequent hospital admissions, and repeated antibiotic exposure. However, limited region-specific data exist on AMR patterns among older adults in Nepal. This study aims to evaluate the microbiological profile and antibiotic resistance patterns, including the prevalence of multidrug-resistant organisms (MDROs), in individuals aged 60 years and above in a tertiary care center in Lumbini Province.

Methods: A retrospective descriptive analysis was conducted on 495 clinical culture samples obtained from patients aged ≥60 years over a one-year period. Data were retrieved from microbiology records and analyzed using SPSS version 16. Descriptive statistics were used to determine organism prevalence, sample sources, and resistance patterns. MDROs were defined as resistance to at least one antimicrobial in three or more drug classes.

Results: The mean age of patients was 71.8 years(SD±8.0), with females comprising 77% of the sample. Urine was the most common specimen (94.3%). Escherichia coli(59.6%) was the predominant isolate, followed by Klebsiella spp.(8.9%) and Acinetobacter spp.(5.9%). MDROs accounted for 62% of isolates. E. coli and Klebsiella exhibited high resistance to penicillins(85–92%) and cephalosporins(70–77%). Acinetobacter demonstrated extensive resistance across multiple antibiotic classes.

Conclusion: This study reveals a high burden of MDROs among older adults, highlighting the urgent need for targeted antimicrobial stewardship, infection control, and development of localized treatment protocols to combat AMR in this vulnerable population.

Keywords: Multidrug-Resistant Organisms(MDROs); Older Adults; Antimicrobial Resistance (AMR)

Introduction

With a projected 1.27 million fatalities in 2019, antimicrobial resistance (AMR) is a major worldwide health concern with disproportionate burden in the low and middle-income countries (LMICs).[1] Around 6,400 deaths in Nepal, the same year were ascribed to AMR.[2] Inappropriate antibiotic use and restricted medication innovation aggravate the risk by hastening the spread of multidrug-resistant organisms (MDROs).[2] Because of their great antibiotic consumption and poor infection control, hospitals, especially in LMICs, are main sources of resistance.[1]

Immunosenescence and chronic comorbidities raise older persons' risk; these also increase antibiotic exposure and infection severity.[3,4] Regular hospital visits and long-term care stays help to significantly increase their likelihood of running across resistant bacteria.[5] As noted in The Lancet Healthy Longevity, AMR disproportionately affects older populations, who are more likely to possess MDROs than younger people.[3]

Though awareness of AMR is growing, data specific to older

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adults in Nepal is rare, especially in areas like Lumbini Province.[6] This study examines one year of microbiological data from older adults (≥60 years) at Rapti Academy of Health Sciences (RAHS), a major referral center of this province.

Methods

Using a retrospective, descriptive chart review approach, this study evaluated antimicrobial resistance (AMR) patterns among older adults (≥60 years) treated in RAHS. The availability of electronic health record system and operating microbiology laboratory, it was possible to access all clinical and laboratory records. The RAHS institutional review committee(IRC-RAHS 2499) authorized this study. Since it included secondary study of de-identified information, devoid of direct patient involvement, informed consent was waived.

All the eligible 495 charts of individuals aged 60 years or above with complete microbiological culture and sensitivity testing were included in this study. Charts having accessible demographic and microbiological data made up inclusion criteria. Records including duplicate entries or missing data were excluded in this study.

Data were manually extracted using a standardized abstraction form. The form gathered antibiotic sensitivity patterns, patient age, gender, sample source, and cultural findings. SPSS-16 was used for data entry and analysis. Patient demographic, organism distribution, and resistance rates were compiled using descriptive statistics. Variables classified as categorical were expressed as frequencies and percentages. Multidrug-resistant organisms (MDROs) was defined as the resistance to at least one drug in three or more antibiotic classes.[7]

Results

The study comprised older adult averaging 71.8 years (SD±8.0). Among them, 381 (77.0%) were females. At 94.3% of all the specimens analyzed, urine was the most often used one; followed by endotracheal aspirates (4.8%), vaginal swabs (0.6%), and blood cultures (0.2%).

The most frequently isolated organism was *Escherichia coli (E. coli)*, accounting for 59.6% (n = 295) of all isolates, reaffirming its predominant role as a cause of urinary tract infections (UTIs) in the older population (Table 1). *Klebsiella* species represented the second most common group, constituting 8.9% (n = 44) of isolates. Following these, *Acinetobacter* spp. accounted for 5.9% (n = 29), reflecting their growing clinical relevance and known multidrug resistance potential. *Enterococcus, Staphylococcus aureus and Staphylococcus saprophyticus* comprised 4.65% (n = 23), 2.63% (n=13), and 2.43% (n = 12) of the isolates, respectively.

Table 1: Distribution of Bacterial Isolates in Various Samples (N=495)

Variables	Category	Frequency (n)	Percentage (%)
Organisms isolated	E. coli	295	59.60
	Klebsiella species	44	8.89
	Acinetobacter	29	5.90
	Enterococcus	23	4.65
	Staphylococcus aureus	13	2.63
	Staphylococcus saprophyticus	12	2.43
	Enterobacter	11	2.22
	Morganella	9	1.82
	Enterococcus	7	1.41
	Citrobacter	7	1.41
	Morganella	6	1.22
	Proteus species	6	1.22
	Enterobacter	5	1.01
	Pseudomonas	5	1.01
	Others	23	4.64
MDRO status	MDRO	307	62.0
	Non-MDRO	188	38.0

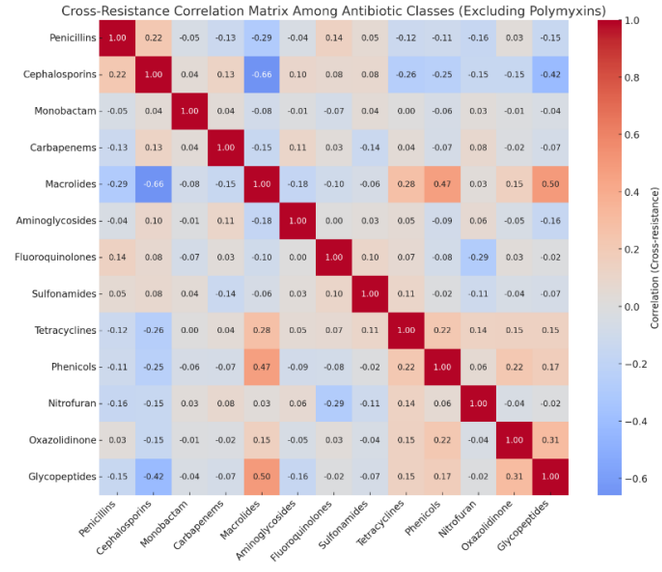

Figure 1: Cross-Resistance Patterns among Antibiotic Classes in Older Adults

The cross-resistance correlation matrix exposes important relationships among antibiotic classes among MDRO isolates. Suggesting common co-resistance in hospital-acquired infections, strong positive correlations were seen between macrolides and glycopeptides (r = 0.50) and between macrolides and phenicols (r = 0.47). Moderate correlations, notably those between tetracyclines and

macrolides (r = 0.28), point to more general multidrug resistance patterns most likely related to similar efflux mechanisms.

Classes like carbapenems, aminoglycosides, and fluoroquinolones showed modest relationships with others, implying more autonomous resistance profiles. Given testing or organism-specific biases, a substantial negative correlation between cephalosporins and macrolides (r = –0.66) could represent The results highlight generally the need of focused stewardship and directed antibiotic usage in order to control co-resistance threats.

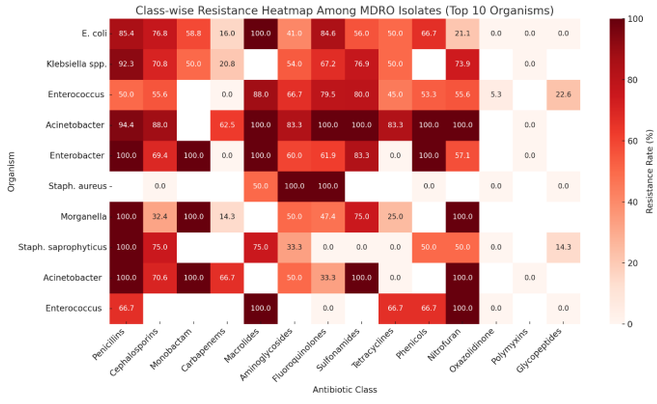

Figure 2: Antibiotic Class Resistance Patterns in Bacterial Isolates

The class-wise resistance heat map for MDRO separates different antimicrobial resistance profiles among the top 10 bacterial pathogens. Reflecting their multidrug-resistant character and restricted treatment choices, Enterobacter, Acinetobacter, and Morganella show notably almost universal resistance (≥100%) to many antibiotic classes, including penicillins, monobactams, macrolides, and phenicols. Likewise, E. coli and Klebsiella spp. also exhibit strong resistance to penicillins (85–92%), cephalosporins (70–77%), and macrolides (100%), thereby implying reduced efficacy of generally used beta-lactam medicines.

With 100% resistance recorded across multiple broad-spectrum classes including macrolides, aminoglycosides, fluoroquinolones, phenicols, and nitrofuran, Acinetobacter shows especially alarming resistance patterns and should be a major focus pathogen. By contrast, carbapenem resistance varied; it was negligible in Enterobacter and Enterococcus but rather significant in Acinetobacter (62.5%) and Klebsiella spp. (20.8%).

While preserving sensitivity to carbapenems and oxazolidinones, Enterococcus displayed strong resistance to macrolides (88%) and glycopeptides (22.6%). Though uncommon, Staphylococcus aureus isolates were universally resistant to fluoroquinolones, aminoglycosides, and macrolides but sensitive to other groups. Furthermore, raised throughout various classes were resistance patterns in *Staph. saprophyticus* and *Morganella*, implying general resistance across both Gram-positive and negative organisms.

Discussion

Our study aimed to evaluate the microbiological profile, the patterns of antimicrobial resistance and the prevalence of MDROs, among older adults. By focusing on this vulnerable group, the study sought to generate region-specific evidence to guide empirical therapy, antimicrobial stewardship, and infection control in Lumbini Province, Nepal.

The present findings show that Gram-negative bacteria, particularly *Escherichia coli* (59.6%) and *Klebsiella* spp. (8.9%), were the predominant isolates, with MDROs accounting for 62% of all cases. The finding emphasizes the great burden of AMR among older adults in a tertiary care hospital in Nepal. Similar patterns have been reported in Nepali hospitals, where *E. coli* is the main uropathogen affecting older persons.[8] High resistance to widely used oral medications such as amoxicillin-clavulanate and trimethoprim-sulfamethoxazole confirmed the declining value of these antibiotics for empirical therapy.

Worldwide estimate indicated that more than 60% of *Klebsiella pneumoniae* isolates were resistant to cephalosporins.[1] A prior study from Nepal found that 42.5% of *E. coli* isolates from older persons were multidrug-resistant.[8] In our study, carbapenem resistance, though less common, was clinically significant, especially in relation to *Acinetobacter* and *Klebsiella* species. This emphasizes how urgently reserve antibiotics' effectiveness needs to be preserved.

Comparisons outside highlight even more the seriousness of the issue in LMICs such as Nepal. Less than 5% of *E. coli* urine isolates from older persons in the United States are multidrug-resistant, a far cry from the >60% MDRO frequency our study found.[9] Likewise, *Staphylococcus aureus* in our study displayed a significant degree of methicillin resistance, in line with other studies from Kathmandu, where 26% of *S. aureus* isolates were MRSA.[10]

The consequences for empirical therapy are obvious; depending too much on conventional first-line drugs like fluoroquinolones or cephalosporins could prove insufficient. Given the great frequency of extended-spectrum β-lactamase (ESBL)-producing pathogens, empiric use of carbapenems or β-lactam/β-lactamase inhibitor combos should be taken under consideration in severe infections, especially in older persons with recent healthcare exposure. In suspected MRSA patients, vancomycin or linezolid can be required for Gram-positive coverage. These decisions have to be weighed against the need of antimicrobial stewardship.

Also quite important is infection control. Many times, older persons find themselves in clinical settings where MDRO transmission is rampant. Rigorous commitment to infection prevention and control strategies including contact precautions, hand hygiene and environmental cleaning is essential.[11] Previous research conducted in Nepal have underlined flaws in hospital infection control policies and their influence on increasing AMR.[6] Furthermore, helping to lower infection risk in this vulnerable group are preventative measures which include vaccination and early removal of intrusive devices. This study draws attention to AMR among Nepal's older population in a tertiary care real-world environment. For empirical therapy and stewardship, its emphasis on a high-risk age range, year-long data coverage, and organism-specific resistance profiling has pragmatic worth. Using conventional MDRO definitions lends strength to this study.

But the retroactive strategy restricts control of clinical variables including past antibiotic use and comorbidities. There was no assessment of clinical outcomes; the single-center environment might lower generalization. Further restricting understanding of resistance mechanisms are incomplete data and insufficient molecular testing. Notwithstanding these constraints, the work fills in a crucial surveillance void and helps better infection control in older adults.

Conclusion

This study exposes a significant load of MDROs among tertiary hospital older patients in Nepal. The results draw attention to important difficulties for empirical treatment since many first-line drugs demonstrate poor effectiveness. To stop more resistance from spreading, we really need antimicrobial stewardship and infection control. Priority should be given to locally customized antibiotic recommendations, improved monitoring, and preventative programs like vaccination. These steps are absolutely essential for preserving the health of Nepal's aging population in view of rising AMR. The findings of this study generally support the critical requirement of regionally tailored antibiotic recommendations, strong infection control practices, and ongoing surveillance for managing AMR among older people in Nepal.

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