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EMERGING THREAT OF MULTIDRUG-RESISTANT ORGANISMS IN COMMUNITY-ACQUIRED INFECTIONS: A CLINICAL MICROBIOLOGY PERSPECTIVE

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ABSTRACT The rise of multidrug-resistant organisms (MDROs) in community-acquired infections marks a critical shift in clinical microbiology and public health, particularly in India. Organisms such as extended-spectrum beta-lactamase (ESBL) and carbapenemase-producing Escherichia coli and Klebsiella pneumoniae are increasingly isolated from patients without recent hospital exposure. This study, conducted in North India, found 62% of E. coli isolates exhibiting ESBL production. We review the epidemiology, resistance mechanisms, diagnostic challenges, and therapeutic implications of community-acquired MDROs, emphasizing the clinical microbiology laboratory's role in early detection, antibiotic stewardship, and infection control.

KEYWORDS : Multidrug-resistant organisms, Community-acquired infections, ESBL, Carbapenemase, Antimicrobial resistance, Clinical microbiology, India

INTRODUCTION

Antimicrobial resistance (AMR) ranks among the top 10 global public health threats, with multidrug-resistant organisms (MDROs) posing significant challenges. Historically associated with healthcare settings, MDROs like ESBL- and carbapenemase-producing Enterobacteriaceae are now emerging in community-acquired infections, including urinary tract infections (CA-UTIs), bloodstream infections, and pneumonia, particularly in low- and middle-income countries like India. Globally, community-acquired MDROs have risen by 30% over the past decade, with higher burdens in resource-limited settings. Clinical microbiology laboratories are pivotal in identifying these pathogens, guiding therapy, and informing public health surveillance.

MATERIALS AND METHODS

A retrospective analysis of 300 clinical isolates from community-acquired infections (defined as infections in patients with no hospitalization or antibiotic use in the preceding 3 months, verified via medical records and patient interviews) was conducted from January to December 2024 at a tertiary care center in North India. The sample size was selected to ensure adequate representation of common pathogens, based on prior regional prevalence data. Specimens (urine, blood, sputum) were processed using conventional biochemical methods and MALDI-TOF for identification. Antibiotic susceptibility was assessed via Kirby-Bauer disk diffusion and VITEK 2. ESBL and carbapenemase production were confirmed using phenotypic tests, modified Hodge test, and Carba NP test. Multiplex PCR for resistance genes (e.g., NDM) was performed on 50 isolates due to resource constraints. Data were analyzed using SPSS v24.0, with chi-square tests for resistance rate comparisons. Ethical approval was obtained from the Institutional Ethics Committee, and informed consent was waived for retrospective analysis.

RESULTS

Of 300 isolates, Escherichia coli (n=180), Klebsiella pneumoniae (n=80), Pseudomonas spp. (n=30), and Acinetobacter spp. (n=10) were identified. ESBL production was detected in 62% of E. coli and 55% of K. pneumoniae isolates (p=0.03). Carbapenem resistance was observed in 21% of E. coli and 28% of K. pneumoniae (p=0.12), with most carbapenem-resistant strains NDM-positive (confirmed by PCR on 50 isolates). Patients had a mean age of 32 years (range 20–45), with 58% female and no significant comorbidities.

Table 1: Resistance Profiles of Community-Acquired Isolates

Organism	N	ESBL Production (%)	Carbapenem Resistance (%)
E. coli	180	62%	21%
K. pneumoniae	80	55%	28%
Pseudomonas spp.	30	N/A	20%
Acinetobacter spp.	10	N/A	30%

p-value for ESBL: 0.03; carbapenem resistance: 0.12 (chi-square test).

DISCUSSION

These findings challenge the notion that MDROs are primarily nosocomial. The 62% ESBL rate in E. coli exceeds global averages of 40–50%, reflecting India's high AMR burden driven by over-the-counter antibiotic use, poor sanitation, and unregulated prescriptions. NDM-1 was the predominant carbapenemase detected, consistent with regional studies. Clinical microbiology laboratories are critical for: 1) rapid identification and resistance profiling; 2) surveillance of resistance trends; 3) supporting antibiotic stewardship; and 4) guiding empirical therapy. Molecular diagnostics (e.g., PCR, GeneXpert) are underutilized due to cost, limiting mechanistic insights.

Limitations: This single-center study may not reflect rural settings, and molecular testing was restricted to 50 isolates due to resource constraints. Selection bias from tertiary care referrals is possible. Comparative studies from other regions and expanded molecular profiling are needed to fully elucidate resistance mechanisms.

CONCLUSION

The high prevalence of MDROs in community-acquired infections in India underscores the need for microbiology-led surveillance, public awareness, and regulated antibiotic use. Implementing point-of-care diagnostics in primary care and enforcing prescription policies could curb MDRO spread. Without urgent action, community-acquired MDROs risk escalating into a public health crisis.

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