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Prevalence, Risk Factors, and Clinical Impact of Multidrug-Resistant Organisms in Diabetic Foot Ulcers

A Prospective Observational Study from ASRAM Hospital in Eluru

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Abstract: ***Background**: Diabetic foot ulcers (DFUs) present a major complication of diabetes in India, with multidrug-resistant organisms (MDROs) escalating therapeutic challenges. **Methods**: An 18-month prospective observational study at ASRAM hospital enrolled 150 diabetic patients with foot lesions. Demographics, clinical data, and microbiology were analyzed using Chi-square, Student's t-test, and multivariate logistic regression. **Results**: MDROs were detected in 68% of infected ulcers and accounted for 56.8% of all isolates. Polymicrobial infections occurred in 60.66% of cases, with gram-negative rods predominating (69.89%). The most frequent isolates were, 1) Escherichia coli (21.9%), 2) Staphylococcus aureus (18.6%), 3) Pseudomonas aeruginosa (18.2%). Recurrent ulcers (OR = 3.32) and higher Wagner's grades (OR = 13.34) independently predicted MDRO infection. MDRO presence prolonged hospital stay (12.36 vs. 7.64 days; p < 0.001) and increased amputation rates (38.4% vs. 18.6%; p < 0.01). Delayed wound healing correlated with peripheral vascular disease, osteomyelitis, nephropathy, interdigital/digital ulcer location, and poor glycemic control. **Conclusion**: A high MDRO burden (68% of ulcers; 56.8% of isolates) exacerbates DFU outcomes in ASRAM. Tailored antibiotic policies and vigilant surveillance are imperative to curb resistance and improve healing.*

Keywords: diabetic foot ulcers, multidrug-resistant organisms, hospital stay and amputation, antibiotic resistance, polymicrobial infections

1.Introduction

Diabetes mellitus is a chronic global health issue, and diabetic foot ulcers (DFUs) contribute substantially to morbidity and healthcare costs.

India, often termed the "diabetic capital of the world," bears a disproportionate share of DFU-related complications and amputations.

The emergence of multidrug-resistant organisms (MDROs) further complicates management, yet Indian data on MDRO prevalence and impact remain scarce.

This study addresses that gap by evaluating MDRO prevalence, risk factors, and clinical outcomes in DFUs at a ASRAM tertiary care center.

2.Materials and Methods

This prospective observational study was conducted from January 2024 to June 2025 at a ASRAM hospital in Eluru, India.

We enrolled 150 diabetic patients presenting with foot lesions after obtaining informed consent. Exclusion criteria included venous ulcers, active abscesses, amputation stump ulcers, and non-diabetic neuropathy.

Clinical assessment captured Wagner's ulcer grade, lesion size, necrosis, and osteomyelitis. Microvascular and macrovascular complications were evaluated by standard criteria.

Pre-antibiotic wound swabs underwent culture and sensitivity testing; MDROs were defined per ECDC guidelines. Patients received empirical antibiotics, adjusted post-culture, plus debridement or amputation as needed. Wound healing was assessed at 10 weeks.

Statistical analyses employed SPSS v20 with Chi-square tests, Student's t-tests, and multivariate logistic regression to identify predictors of MDRO infection and healing delays.

3.Results

- Patient profile: mean age 58.2 years; 74.6% male; 96% had Type II diabetes; 44.66% exhibited HbA1c > 8%.
- Ulcer characteristics: 68% acute (<1 month); 61.33% Wagner's grade III or higher.
- Complications: neuropathy (77.33%), PVD (47.33%), nephropathy (48.66%).

Microbiology and Resistance

Parameter	Value
Total isolates	279
Polymicrobial infections	60.66%
Gram-negative rods	69.89%
MDRO prevalence (ulcers)	68%
MDRO proportion (isolates)	56.8%

Key isolates:
- Escherichia coli: 21.9% (78% ESBL-producing MDROs)
- Staphylococcus aureus: 18.6% (55% MRSA)
- Pseudomonas aeruginosa: 18.2% (74% MDROs)

Independent Predictors of MDRO Infection
1. Recurrent ulcers (OR = 3.32; $p < 0.05$)
2. Higher Wagner's grade (OR = 13.34; $p < 0.001$)

Clinical Impact of MDROs
- Mean hospital stay: 12.36 days vs. 7.64 days (non-MDRO; $p < 0.001$)
- Amputation rates: 38.4% vs. 18.6% (non-MDRO; $p < 0.01$)

Delayed Wound Healing Predictors
- Peripheral vascular disease (OR = 7.872; $p < 0.01$)
- Osteomyelitis (OR = 8.280; $p < 0.01$)
- Nephropathy (OR = 4.369; $p < 0.05$)
- Inter-digital/digital ulcer location (OR = 0.073; $p < 0.05$)
- Poor glycemic control (OR = 6.020; $p < 0.05$)

4.Discussion

Our cohort mirrors Indian DFU demographics: older males with poorly controlled Type II diabetes. Neuropathy and PVD were highly prevalent, underscoring the micro- and macrovascular burden.

Polymicrobial infections (60.66%) and gram-negative dominance (69.89%) contrast with Western patterns but align with regional reports. The elevated MDRO rates (68% of ulcers; 56.8% of isolates) reflect antibiotic overuse and highlight urgent stewardship needs.

E.coli (21.9%), S. aureus (18.6%), and P. aeruginosa (18.2%) led our isolate spectrum. Recurrent ulcers and advanced Wagner grades significantly predicted MDRO presence, suggesting cumulative antibiotic exposure and tissue destruction drive resistance.

MDROs doubled hospital stays and doubled amputation risk, reinforcing their clinical toll. Delayed healing was driven by vascular and metabolic complications rather than MDRO status, indicating that targeted management of comorbidities and glycemic control remains paramount.

5.Conclusion

In this tertiary care setting, MDROs afflicted 68% of infected DFUs and comprised 56.8% of isolates.

Escherichia coli was the most common pathogen (21.9%), predominantly ESBL producers. Recurrent ulcers (OR = 3.32) and higher Wagner grades (OR = 13.34) independently predicted MDRO infection.

MDROs prolonged hospitalization (12.36 vs. 7.64 days) and increased amputation rates (38.4% vs. 18.6%). Wound healing delays were linked to vascular complications, osteomyelitis, nephropathy, interdigital ulcer location, and poor glycemic control.

These findings underscore the need for localized antibiotic guidelines, robust MDRO surveillance, and comprehensive diabetic foot care to optimize outcomes.

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