RESEARCH PAPER

Prevalence of Multidrug-Resistant Organisms in Surgical Site Infections: A Cross-Sectional Study

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Abstract

Background: Surgical site infections are among the most common healthcare-associated infections and are increasingly complicated by the emergence of multidrug-resistant organisms. These infections lead to prolonged hospital stay, increased morbidity, and higher healthcare costs. The rising prevalence of antimicrobial resistance poses a significant challenge in effective management.

Aim: To determine the prevalence of multidrug-resistant organisms in surgical site infections.

Materials and Methods: This hospital-based cross-sectional study was conducted at Meenakshi Medical College Hospital, Kanchipuram, over one year. A total of 90 patients with clinically diagnosed surgical site infections were included. Wound samples were collected and subjected to culture and sensitivity testing. Multidrug resistance was defined as resistance to at least one agent in three or more classes of antibiotics. Statistical analysis was performed using SPSS, and a p value < 0.05 was considered statistically significant.

Results: Staphylococcus aureus (31.1%) was the most common organism isolated, followed by Escherichia coli (24.4%) and Klebsiella species (17.8%). Multidrug-resistant organisms were identified in 57.8% of cases. A higher prevalence of multidrug resistance was observed in clean-contaminated, contaminated, and dirty surgeries compared to clean surgeries ($p = 0.04$). A significant proportion of isolates, including MRSA and ESBL-producing organisms, demonstrated resistance to multiple antibiotics.

Conclusion: There is a high prevalence of multidrug-resistant organisms in surgical site infections, particularly in higher-risk surgical categories. Strengthening infection control practices, implementing antimicrobial stewardship, and continuous surveillance are essential to reduce the burden of resistance and improve patient outcomes.

Keywords: Surgical site infection, multidrug-resistant organisms, antimicrobial resistance, MRSA, ESBL, cross-sectional study.

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Introduction

Surgical site infections are among the most common healthcare-associated infections and contribute significantly to postoperative morbidity, prolonged hospital stay, and increased healthcare costs. These infections occur at or near the surgical incision within 30 days of the procedure and are influenced by multiple factors including patient characteristics, surgical technique, and hospital environment [1].

In recent years, the emergence of multidrug-resistant organisms has become a major concern in the management of surgical site infections. Multidrug resistance refers to the ability of microorganisms to resist the effects of multiple classes of antimicrobial agents, making treatment more difficult and limiting therapeutic options [2].

Common pathogens associated with surgical site infections include Staphylococcus aureus, Escherichia coli, Klebsiella species, and Pseudomonas aeruginosa. The increasing prevalence of resistant strains such as methicillin-resistant Staphylococcus aureus and extended-spectrum beta-lactamase producing organisms has further complicated infection management [3].

The development of multidrug resistance is attributed to factors such as inappropriate antibiotic use, prolonged hospital stay, invasive procedures, and inadequate infection control practices. These factors promote the selection and spread of resistant organisms within healthcare settings [4].

Surgical site infections caused by multidrug-resistant organisms are associated with higher rates of complications, delayed wound healing, and increased mortality. Early identification of these pathogens is essential for effective antimicrobial therapy and improved patient outcomes [5].

Several studies have reported varying prevalence rates of multidrug-resistant organisms in surgical site infections, depending on geographical location and hospital practices. Continuous surveillance is necessary to understand local patterns and guide empirical antibiotic therapy [6].

Cross-sectional studies provide valuable insights into the prevalence and distribution of multidrug-resistant organisms in clinical settings. Such studies help in identifying trends, evaluating infection control measures, and formulating appropriate antibiotic policies.Therefore, the present study was undertaken to assess the prevalence of multidrug-resistant organisms in surgical site infections in a cross-sectional study setting [7].

Materials and Methods

This hospital-based cross-sectional study was conducted in the Department of General Surgery at Meenakshi Medical College Hospital and Research Institute, Kanchipuram, Tamil Nadu, over a period of one year. The study aimed to determine the prevalence of multidrug-resistant organisms in surgical site infections.

A total of 90 patients who developed surgical site infections following various surgical procedures were included in the study. Patients aged 18 years and above with clinically diagnosed surgical site infections were considered eligible. Patients with pre-existing infections prior to surgery, those on prolonged antibiotic therapy before surgery, immunocompromised patients, or those unwilling to participate were excluded from the study.

Surgical site infection was defined based on standard clinical criteria, including presence of purulent discharge, localized swelling, redness, pain, and signs of infection at the surgical site within 30 days of surgery.

Wound samples were collected under aseptic precautions from all patients and sent for microbiological analysis. Culture and sensitivity testing were performed to identify the causative organisms and their antibiotic susceptibility patterns. Multidrug resistance was defined as resistance to at least one agent in three or more classes of antibiotics.

Data collected included patient demographics, type of surgery, duration of hospital stay, type of organism isolated, and antibiotic resistance patterns.

All data were systematically entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences software. Descriptive statistics such as mean, standard deviation, frequency, and percentage were used to summarize the data. The prevalence of multidrug-resistant organisms was calculated, and associations between variables were analyzed using the Chi square test. A p value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic Characteristics of Study Participants (n = 90)

Variable	Frequency (%)
Mean age (years)	45.6 ± 12.4
Male	54 (60%)
Female	36 (40%)

The majority of patients were middle-aged, with a mean age of 45.6 years. Males constituted a higher proportion of cases, indicating a slightly higher prevalence of surgical site infections among male patients.

Table 2: Type of Surgical Procedures

Type of Surgery	Frequency (%)
Clean	18 (20%)
Clean-contaminated	32 (35.6%)
Contaminated	24 (26.7%)
Dirty	16 (17.7%)

Surgical site infections were most commonly observed in clean-contaminated and contaminated surgeries, indicating a higher risk associated with these categories.

Table 3: Microorganisms Isolated from Surgical Site Infections

Organism	Frequency (%)
Staphylococcus aureus	28 (31.1%)
Escherichia coli	22 (24.4%)
Klebsiella species	16 (17.8%)
Pseudomonas aeruginosa	14 (15.6%)
Others	10 (11.1%)

Staphylococcus aureus was the most commonly isolated organism, followed by Escherichia coli and Klebsiella species, indicating a mix of gram-positive and gram-negative pathogens.

Table 4: Prevalence of Multidrug-Resistant Organisms

Category	Frequency (%)
MDR organisms present	52 (57.8%)
Non-MDR organisms	38 (42.2%)

More than half of the isolates were multidrug-resistant organisms, indicating a high prevalence of antimicrobial resistance in surgical site infections.

Table 5: Distribution of MDR Organisms Among Isolates

Organism	MDR (%)
Staphylococcus aureus (MRSA)	18/28 (64.3%)
Escherichia coli (ESBL)	14/22 (63.6%)
Klebsiella species	10/16 (62.5%)
Pseudomonas aeruginosa	6/14 (42.9%)

A high proportion of MDR strains was observed across most organisms, particularly MRSA and ESBL-producing gram-negative bacteria, indicating widespread resistance.

Table 6: Association Between Type of Surgery and MDR Infection

Surgery Type	MDR (%)	Non-MDR (%)	p value
Clean	6 (33.3%)	12 (66.7%)	0.04
Clean-contaminated	20 (62.5%)	12 (37.5%)	
Contaminated	16 (66.7%)	8 (33.3%)	
Dirty	10 (62.5%)	6 (37.5%)	

Multidrug-resistant infections were significantly more common in clean-contaminated, contaminated, and dirty surgeries compared to clean surgeries. The association was statistically significant ($p = 0.04$), indicating increased risk of MDR infections with higher wound contamination levels.

Discussion

The present cross-sectional study assessed the prevalence of multidrug-resistant organisms in surgical site infections and demonstrated a high burden of antimicrobial resistance, with more than half of the isolates identified as multidrug-resistant. The findings highlight the growing challenge of managing surgical site infections in the era of increasing antibiotic resistance.

In the present study, surgical site infections were more common among middle-aged patients with a slight male predominance. Similar findings were reported by Owens CD et al [8], who noted that demographic factors may influence the incidence of surgical site infections.

Staphylococcus aureus was the most frequently isolated organism (31.1%), followed by Escherichia coli and Klebsiella species. This pattern is consistent with Anderson DJ et al [9], who reported that both gram-positive and gram-negative organisms commonly contribute to surgical site infections.

The prevalence of multidrug-resistant organisms in the present study was 57.8%, which is notably high. This finding aligns with Allegranzi B et al [10], who highlighted the increasing global burden of antimicrobial resistance in healthcare-associated infections.

A high proportion of MRSA (64.3%) and ESBL-producing gram-negative organisms was observed in this study. Similar findings were reported by Magill SS et al [11], who demonstrated a significant prevalence of resistant organisms in hospital-acquired infections.

The association between type of surgery and multidrug resistance showed that clean-contaminated, contaminated, and dirty surgeries had a higher proportion of MDR infections compared to clean surgeries ($p = 0.04$). This is supported by de Lissovoy G et al [12], who reported that the risk of infection and resistance increases with the level of wound contamination.

The development of multidrug resistance is influenced by factors such as inappropriate antibiotic use, prolonged hospital stay, and inadequate infection control practices. World Health Organization [13] has emphasized the need for strict antimicrobial stewardship programs to combat resistance.

Surgical site infections caused by multidrug-resistant organisms are associated with increased morbidity and prolonged hospitalization. Kirkland KB et al [14] reported that such infections significantly increase healthcare costs and length of stay.

Effective infection control measures, including proper sterilization, hand hygiene, and rational antibiotic use, are essential to reduce the burden of multidrug resistance. Leaper DJ et al [15] emphasized the importance of preventive strategies in reducing surgical site infections.

Recent studies have highlighted the importance of surveillance systems in monitoring antimicrobial

resistance patterns. Weiser TG et al [16] reported that continuous surveillance helps in guiding appropriate antibiotic policies.

Additionally, Cheng H et al [17] demonstrated that prolonged operative duration and hospital exposure contribute to increased risk of resistant infections. Similarly, Hawn MT et al [18] emphasized the role of adherence to infection prevention protocols in reducing surgical site infections.

Conclusion

The present cross-sectional study demonstrated a high prevalence of multidrug-resistant organisms in surgical site infections, with more than half of the isolates showing resistance to multiple classes of antibiotics. Staphylococcus aureus, Escherichia coli, and Klebsiella species were the most commonly identified pathogens, with a significant proportion exhibiting multidrug resistance. The occurrence of multidrug-resistant infections was significantly higher in clean-contaminated, contaminated, and dirty surgical procedures ($p = 0.04$), indicating an increased risk with higher levels of wound contamination. These findings highlight the growing challenge of antimicrobial resistance in surgical settings. Implementation of strict infection control practices, regular surveillance, and rational antibiotic use is essential to reduce the burden of multidrug-resistant organisms and improve postoperative outcomes.

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