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Bacteriological Profile and Antibiogram of Postoperative Wound Infections in a Tertiary Care Hospital

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ABSTRACT

Background: Surgical site infections (SSIs) remain a significant cause of postoperative morbidity, mortality, and healthcare expenditure worldwide. The bacteriological profile and antimicrobial susceptibility patterns of SSIs vary geographically and temporally, necessitating continuous surveillance. This study aimed to evaluate the bacteriological profile and antibiogram of organisms causing surgical site infections in a tertiary care hospital in Rajasthan, India.
Methods: This hospital-based observational study was conducted in the Department of General Surgery at RNT Medical College and Hospital, Udaipur, from September 2025 to July 2026. A total of 100 patients with clinically suspected SSIs were enrolled. Wound swabs were collected under aseptic precautions, and standard microbiological techniques were employed for isolation, identification, and antimicrobial susceptibility testing using the Kirby-Bauer disc diffusion method according to CLSI guidelines.
Results: Among 100 clinically suspected SSIs, 81 (81%) were culture-positive. The most common isolates were *Staphylococcus aureus* (32.1%), *Escherichia coli* (24.7%), *Pseudomonas aeruginosa*(14.8%), and *Klebsiella* spp. (12.3%). Gram-negative organisms collectively accounted for 68% of isolates. MRSA prevalence was 30.8% among S. aureus isolates. Superficial incisional SSIs were most common (56%), followed by deep (32%) and organ/space infections (12%). Emergency surgeries accounted for 78% of cases. *S. aureus* showed maximum sensitivity to linezolid (96.15%) and vancomycin (96.15%), while *E. coli* demonstrated 95% sensitivity to polymyxin. Wound dehiscence occurred in 54% of cases, and the mortality rate was 7%.
Conclusion: Gram-negative organisms predominate in SSIs in our setting, with significant antimicrobial resistance patterns. Regular surveillance and updating of local antibiograms are essential for guiding empirical antibiotic therapy and implementing effective antimicrobial stewardship programs.

Keywords*:* *Surgical site infection, Bacteriological profile, Antibiogram, Antimicrobial resistance, MRSA, Staphylococcus aureus, Escherichia coli.*

INTRODUCTION

Surgical site infections (SSIs) are the third most frequently reported nosocomial infections, accounting for 14-16% of all hospital-acquired infections among inpatients.[1] Despite advances in sterilization techniques, asepsis, antimicrobial agents, and surgical practices, SSIs continue to be a major cause of postoperative morbidity, mortality, and prolonged hospital stay, with significant economic implications.[2]

The pathogenesis of SSI is best understood through the relationship: Risk of SSI = (Dose of contamination × Virulence) / Host resistance.[3] A bacterial inoculum exceeding 10^5 colony-forming units per gram of tissue is typically required to establish infection; however, this threshold is dramatically reduced in the presence of foreign material, devitalized tissue, or immunosuppression.[4]

The microbiological landscape of SSIs is dominated by Gram-positive cocci, particularly *Staphylococcus aureus* (including methicillin-resistant strains), coagulase-negative staphylococci, and enterococci in clean procedures. Gram-negative bacilli and anaerobes are more frequently encountered in abdominal and contaminated operations.[5] The emergence of multidrug-resistant (MDR) organisms such as extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae, methicillin-resistant *S. aureus* (MRSA), and carbapenem-resistant Enterobacteriaceae (CRE) has complicated treatment strategies.

The incidence of SSI in developing countries ranges from 2-40%, with Indian rates reported between 4.04-30%.[6,7] The overuse of antibiotics has led to increasing antimicrobial resistance, and in developing countries like India, the problem is compounded by poor infection control, overcrowded hospitals, and inappropriate antimicrobial use.

Understanding the local bacteriological profile and antibiogram is crucial for guiding empirical antibiotic therapy, improving patient outcomes, and reducing antimicrobial resistance. This study was conducted to evaluate the bacteriological profile and antibiogram of organisms causing SSIs in a tertiary care hospital in Rajasthan, India.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based observational study was conducted in the Department of General Surgery at RNT Medical College and Hospital, Udaipur, Rajasthan, a tertiary care teaching hospital. The study was approved by the Institutional Ethics Committee (IEC), and informed written consent was obtained from all participants or their legal guardians.

Study Duration

The study was conducted from September 2025 to July 2026.

Sample Size

The sample size was calculated using the formula $N = Z^2P(1-P)/E^2$, where P was the estimated proportion of pus swabs having *Staphylococcus aureus* in culture (35%) from a previous study,[7] with 5% alpha error, 80% power, and 10% absolute error. The calculated sample size was 90, and considering a 10% dropout rate, 100 patients were enrolled.

Inclusion Criteria

- Age >18 years
- Patients willing to participate
- All patients who underwent surgery in the Department of General Surgery and developed signs and symptoms of SSI postoperatively

Exclusion Criteria

- Patients not willing to participate
- Patients with pre-existing local skin diseases, cellulitis, abscesses, or scabies

Data Collection

All patients admitted and undergoing surgery meeting the inclusion criteria were examined for wound infection on postoperative day 3 and every 3 days thereafter. Wound samples were collected using sterile swabs under aseptic precautions using the Levine technique. Two swabs were obtained from the surgical site without contaminating with skin commensals and transported to the Department of Microbiology immediately.

Microbiological Methods

Gram-stained smears were prepared directly from samples using the first swab to screen for pus cells and organism morphology. Culture was performed from the second swab on blood agar and MacConkey agar. Colony morphology, Gram staining, and conventional standard biochemical tests were used for final identification of bacterial species. Antimicrobial susceptibility testing was performed by the Kirby-Bauer disc diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines.

Statistical Analysis

Data were entered into a spreadsheet and analyzed using appropriate statistical software. Qualitative data were summarized as frequencies and percentages.

RESULTS

Demographic Characteristics

A total of 100 patients with clinically diagnosed SSIs were enrolled in the study. The age distribution showed a peak in the 31-40 years group (27%), followed by 21-30 years (21%), 41-50 years (19%), 51-60 years (18%), >61 years (11%), and

<20 years (4%). Male predominance was observed, with 64% males and 36% females (male-to-female ratio: 1.78:1). The majority of patients (65%) were from rural areas.

Risk Factor Distribution

Among the 100 SSI cases, 54% were smokers, 43% were alcoholics, 42% had hypertension, and 42% had diabetes mellitus (Table 1).

Table 1: Distribution of Risk Factors

Risk Factor	Present (%)	Absent (%)
Hypertension	42	58
Diabetes Mellitus	42	58
Alcoholic	43	57
Smoker	54	46

Type of Surgery and Wound Classification

Emergency surgeries accounted for 78% of cases, while elective surgeries comprised 22%. Clean wounds constituted the largest proportion (43%), followed by contaminated (21%), clean-contaminated (19%), and dirty (17%) wounds.

SSI Classification

Superficial incisional SSIs were most common (56%), followed by deep incisional SSIs (32%) and organ/space infections (12%).

Culture Positivity and Organism Distribution

Out of 100 clinically suspected SSIs, 81 (81%) were culture-positive, while 19 (19%) yielded no growth. Single organism isolation occurred in 90% of cases, and mixed organisms in 10%.

The most common isolate was *Staphylococcus aureus* (32.1%), followed by *Escherichia coli*(24.7%), *Pseudomonas aeruginosa* (14.8%), and *Klebsiella* spp. (12.3%). Other isolates included Acinetobacter (6.2%), Enterobacter (3.7%), Proteus (3.7%), and Citrobacter (2.7%). Gram-negative organisms collectively accounted for 68% of all isolates (Table 2).

Table 2: Distribution of Organisms Isolated

Organism	Number	Percentage
Staphylococcus aureus	26	32.10%
Escherichia coli	20	24.70%
Pseudomonas aeruginosa	12	14.80%
Klebsiella spp.	10	12.33%
Acinetobacter spp.	5	6.16%
Enterobacter spp.	3	3.70%
Proteus spp.	3	3.70%
Citrobacter spp.	2	2.70%
Total	**81**	**100%**

Antimicrobial Susceptibility Patterns

***Staphylococcus aureus* (n=26)**

S. aureus showed maximum sensitivity to linezolid (96.15%) and vancomycin (96.15%), followed by doxycycline (88.46%), ciprofloxacin (80.77%), and cefoxitin (69.2%). MRSA prevalence was 30.8% (8/26 resistant to cefoxitin). Low sensitivity was observed for clindamycin and cotrimoxazole (23.08% each) (Table 3).

Table 3: Antimicrobial Sensitivity of *Staphylococcus aureus*

Antibiotic	Sensitivity (%)
Linezolid	96.15
Vancomycin	92.30
Doxycycline	88.46
Ciprofloxacin	80.77
Cefoxitin (MRSA screen)	69.20
Piperacillin/Tazobactam	69.20
Amikacin	69.20
Erythromycin	46.15
Clindamycin	23.08
Cotrimoxazole	23.08

***Escherichia coli* (n=20)**

E. coli demonstrated maximum sensitivity to polymyxin (95%), followed by meropenem/imipenem (75%) and amikacin (75%). Low sensitivity was observed for cefotaxime (20%) and cotrimoxazole (25%). Ciprofloxacin showed 40% sensitivity (Table 4).

Table 4: Antimicrobial Sensitivity of *Escherichia coli*

Antibiotic	Sensitivity (%)
Polymyxin	95
Meropenem/Imipenem	75
Amikacin	75
Ceftazidime	45
Piperacillin/Tazobactam	45
Ampicillin	45
Ciprofloxacin	40
Cotrimoxazole	25

Antibiotic	Sensitivity (%)
Cefotaxime	20

***Pseudomonas aeruginosa* (n=12)**
P. aeruginosa was most sensitive to gentamicin (83.33%), followed by ciprofloxacin (75%), amikacin (75%), and aztreonam (75%). Low sensitivity was observed for ceftazidime (16.6%) and cotrimoxazole (8.33%) (Table 5).

Table 5: Antimicrobial Sensitivity of *Pseudomonas aeruginosa*

Antibiotic	Sensitivity (%)
Gentamicin	83.33
Ciprofloxacin	75
Amikacin	75
Aztreonam	75
Imipenem	41.67
Cefoperazone-Sulbactam	41.67
Ceftazidime	16.6
Cotrimoxazole	8.33

Management and Outcomes
Most patients (54%) were managed conservatively with antibiotics and dressings alone. Secondary suturing was required in 40%, and debridement in 6% of cases. Wound dehiscence occurred in 54% of SSI cases.
Early discharge (<7 days) was achieved in 54% of patients, while 36% had delayed discharge (>7 days). Leave Against Medical Advice (LAMA) occurred in 3%, and mortality was observed in 7% of cases.

DISCUSSION
Surgical site infections remain a significant challenge in surgical practice, contributing to increased morbidity, mortality, and healthcare costs. This study provides contemporary data on the bacteriological profile and antimicrobial susceptibility patterns of SSIs in a tertiary care hospital in Rajasthan, India.

Demographic and Risk Factors
Our study observed a male predominance (64%), consistent with studies by Narula et al.[7] and Khan et al.[8] This may reflect greater exposure to trauma and emergency surgeries in males. The highest incidence was in the 31-40 years age group, which likely mirrors the demographic profile of the surgical population rather than age-related susceptibility.

The high prevalence of smokers (54%) and diabetics (42%) in our study population is concerning. Khan et al.[8] identified smoking as a statistically significant predictor of SSI, attributed to local tissue vasoconstriction and hypoxia impairing wound healing. Awoke et al.[9] found hyperglycemia to be a strong independent risk factor (AOR: 2.4), emphasizing the need for stringent perioperative glycemic control.

Culture Positivity and Organism Profile
The culture positivity rate of 81% in our study is comparable to studies by Lilani et al. (82.36%)[10] and Shittu et al. (92.15%).[11] The 19% culture negativity may be attributed to prior antibiotic therapy, fastidious organisms, or sampling techniques.

The predominance of *S. aureus* (32.1%) as the most common isolate aligns with studies by Bhattacharya et al. (28.3%)[12] and Singh et al. (31.2%).[13] However, the high proportion of Gram-negative organisms (68%) in our study reflects the significant burden of emergency and contaminated surgeries in our setting. This pattern is consistent with findings from other Indian studies.[14,15]

The MRSA prevalence of 30.8% in our study is comparable to Bhattacharya et al. (42.6%)[12] and Singh et al. (38.5%),[13] indicating that MRSA remains a significant pathogen in SSIs in Indian settings. Vancomycin and linezolid retained excellent activity (92-96%), providing reassuring options for empiric MRSA coverage.

The ESBL-producing *E. coli* prevalence of approximately 80% (based on cefotaxime resistance) and low sensitivity to third-generation cephalosporins (cefotaxime 20%) highlights the challenge of managing Gram-negative SSIs. Carbapenems showed 75% sensitivity, while polymyxin retained 95% sensitivity, underscoring the value of polymyxin as a last-resort option in multidrug-resistant infections.

The resistance pattern of *P. aeruginosa* is concerning, with only gentamicin providing >80% sensitivity. This pattern is similar to that reported by Walelign et al.,[16] where gentamicin showed 100% sensitivity and ciprofloxacin 66.7% sensitivity.

Clinical Implications

The high proportion of superficial SSIs (56%) and wound dehiscence (54%) in our study reflects the tissue-disrupting consequences of these infections. The predominance of emergency surgeries (78%) and clean wounds (43%) developing SSIs suggests that despite proper wound classification, host factors and intraoperative conditions significantly influence infection risk.

The management pattern, with 54% treated conservatively and 40% requiring secondary suturing, indicates that while most SSIs can be managed with appropriate antibiotics and dressings, a significant proportion require additional surgical intervention. The 7% mortality rate highlights the severity of SSIs in a comorbid patient population.

Antimicrobial Stewardship Implications

The resistance patterns observed in our study underscore the urgent need for:

1. Regular updating of local antibiograms
2. Establishment and adherence to antibiotic policies
3. Implementation of antimicrobial stewardship programs
4. Judicious use of broad-spectrum antibiotics, especially carbapenems and polymyxins
5. Preoperative MRSA screening and decolonization in high-risk patients

Limitations

This study has several limitations. It is a single-center study with a relatively small sample size, which may limit generalizability. The absence of a control group precludes assessment of risk factors. Anaerobic organisms were not routinely isolated due to the absence of anaerobic culture facilities. Additionally, molecular methods for resistance gene detection were not employed.

CONCLUSION

Surgical site infections in our tertiary care hospital are predominantly caused by Gram-negative organisms, with significant antimicrobial resistance patterns. *Staphylococcus aureus* remains the most common single pathogen, with an MRSA prevalence of 30.8%. Vancomycin and linezolid retain excellent activity against MRSA, while carbapenems and polymyxin are the most effective options for Gram-negative infections.

These findings emphasize the importance of:

1. Continuous surveillance of SSI bacteriological profiles and antibiograms
2. Establishment of hospital-specific antibiotic policies
3. Implementation of evidence-based SSI prevention bundles
4. Strengthening antimicrobial stewardship programs
5. Regular monitoring and updating of treatment guidelines

The study provides valuable data to guide empirical antibiotic therapy in our setting and highlights the need for ongoing research to monitor emerging resistance patterns. Future multicenter studies with larger sample sizes and molecular characterization of resistance mechanisms would further strengthen our understanding of SSI epidemiology in India.

SUPPLEMENTARY MATERIAL

Conflict of Interest: None declared.
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Ethical Approval: The study was approved by the Institutional Ethics Committee of RNT Medical College, Udaipur.

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REFERENCES

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Infect Control Hosp Epidemiol. 1999;20(4):247-78.
2. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. Infect Control Hosp Epidemiol. 1999;20(11):725-30.
3. Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, et al. Surgical Infections: Principles of Surgery. In: 8th ed. Schwartz: Tata Mc Graw Hill; 2005. p. 143-75.
4. Krizek TJ, Robson MC. Evolution of quantitative bacteriology in wound management. Am J Surg. 1975;130(5):579-84.
5. Nichols RL. Preventing surgical site infections: a surgeon's perspective. Emerg Infect Dis. 2001;7(2):220-4.
6. Allegranzi B, Bagheri Nejad S, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. Lancet. 2011;377(9761):228-41.
7. Narula H, Chikara G, Gupta P. A prospective study on bacteriological profile and antibiogram of postoperative wound infections in a tertiary care hospital in Western Rajasthan. J Family Med Prim Care. 2020;9:1927-34.
8. Khan AS, Sarwat T, Mohan S, Dutta R. Surgical site infection: bacteriological and clinicopathological profile and antibiogram in a tertiary care hospital. J Med Sci Health. 2020;6(3):51-57.
9. Awoke N, Desta K, Asefa A, et al. Surgical site infections and antimicrobial resistance pattern in a referral hospital, Ethiopia: A prospective cross-sectional study. Infect Dis (Lond). 2019;51(9):673-681.
10. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian J Med Microbiol. 2005;23(4):249-52.
11. Shittu AO, Kolawole DO, Oyedepo EAR. A study of wound infections in two health institutions in Ile-Ife, Nigeria. Afr J Biomed Res. 2002;5(3):97-102.
12. Bhattacharya S, Pal K, Sengupta A, et al. Bacteriological profile and antimicrobial susceptibility pattern of surgical site infections in a tertiary care hospital of Eastern India. J Clin Diagn Res. 2016;10(8):DC01-DC05.
13. Singh R, Sharma P, Gupta N, et al. Clinical and microbiological profile of surgical site infections in a North Indian tertiary care hospital. Int J Med Sci. 2018;15(8):784-790.
14. Kumar A, Jose M, Nair P, et al. Bacteriological profile of surgical site infections following gastrointestinal surgeries in a South Indian hospital. J Glob Infect Dis. 2017;9(3):95-100.
15. Dhote S, Teltumbde U, Khatri S, Saoji A. Bacteriological profile and antibiogram of surgical site infections in a tertiary care hospital. Int J Med Microbiol Trop Dis. 2017;3(2):92-6.
16. Walelign M, Mulu W, Abera B. Bacterial profile and antimicrobial susceptibility pattern of surgical site infections at Gondar University Hospital. Antimicrob Resist Infect Control. 2017;6:56.