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Surgical Site Infections: Socio-clinical, Microbiological and Antibiogram Profile at a Tertiary-Care Hospital in Eastern India

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Abstract

Background: Surgical site infections (SSI) are estimated to be the most prevalent type of healthcare-associated infections, continuing to pose a significant source of morbidity, economic burden, and mortality. **Aim:** This study aims to estimate the burden of SSI across various surgical specialties, risk factors, distribution of predominant pathogens, and their antibiogram at a tertiary-care hospital in Eastern India. **Methodology:** This was a descriptive, cross-sectional study conducted over a period of 24 months, from January 2023 to February 2025. All SSI cases were included according to guidelines from the Centers for Disease Control and Prevention. Samples were collected, and organisms were identified and tested for antimicrobial susceptibility using the MicroScan WalkAway® plus system (Beckman Coulter, California, USA). SSI rates were calculated by dividing the number of SSIs by the number of operative procedures and multiplying the result by 100. **Results:** Of total 6,628 surgeries, 358 cases were identified as SSI, resulting in a rate of 5.4%, with the majority occurring in the orthopaedics department. Smoking, anaemia, and diabetes mellitus were the most prevalent risk factors. Growth was observed in 87%, with *Staphylococcus aureus* and *Escherichia coli* being the predominant pathogens. Methicillin-resistant *Staphylococcus aureus* (MRSA) accounted for 45%, and Vancomycin-resistant Enterococcus (VRE) was 20%. Among the Enterobacterales, 70% of *Klebsiella spp*., 44% of *Escherichia coli*, and 32% of *Proteus spp.* were identified as multidrug-resistant (MDR). All isolates of *Acinetobacter calcoaceticus-baumannii* complex and 35% of *Pseudomonas aeruginosa* were identified as MDR. **Conclusion:** The high SSI rates in different departments underscore the need for improved infection control practices and the establishment of a robust antimicrobial stewardship program. Surveillance of SSI cases, along with feedback, and regular auditing of prophylaxis protocols and resistance trends, is essential to reduce their prevalence.

Keywords: Surgical site infections; Antimicrobial resistance; Multidrug-resistant; Methicillin-resistant *Staphylococcus aureus*; Vancomycin-resistant *Enterococcus*

1 Introduction

Healthcare-associated infections (HAIs) are acquired by patients during care, originating from either exogenous sources or the endogenous flora of patients. They are the most frequent adverse event that compromises patient safety globally. Research from the World Health Organization's (WHO) 'Clean Care is Safer Care' program indicated that surgical site infections (SSI) are the most monitored and prevalent type of HAI, accounting for 20% of all HAIs. The burden is even greater in low- and middleincome countries (LMICs), affecting up to one-third of patients who have undergone surgical procedures. [1]

SSI are defined as infections that occur at the surgical site within 30- or 90-days post-surgery. They are classified into superficial incisional (within 30 days), deep incisional SSI, and organ/space SSI (within 30 or 90 days). Both superficial and deep incisional SSI are further divided into primary and secondary categories. [2] According to the 2023 HAI data results, the SSI standardized infection ratio (SIR) for all National Health Safety Network (NHSN) operational procedure categories combined increased by almost 2% from the previous year. Although there is no national benchmark data, several multicentric investigations revealed SSI rates ranging from 1.6% to as high as 38% in India. [3] They continue to be a major source of morbidity, mortality, extended hospital stays and significant financial burden. Among patients who develop SSI, these infections are directly associated with 75% of deaths and a 2- to 11-fold increase in mortality risk. [2]

Staphylococcus aureus (*S. aureus*) has historically been the most frequently isolated bacterium from surgical site infections (SSI) wounds. [4] However, recent data indicates that multidrug-resistant (MDR) Gram-negative (GN) bacteria, such as *Pseudomonas aeruginosa* (*P. aeruginosa*) and *Acinetobacter calcoaceticus-baumannii complex* (*A. baumannii*), are increasingly being isolated from SSI. [5]

The risk factors leading to the development of SSI can be patient-related (elderly, presence of co-morbidities, immunosuppression, duration of hospital stay, smoking, obesity/malnutrition, coexistence of infections, etc.), procedure-related (poor surgical technique, improper sterilization of the instruments, prolonged duration of surgery, inadequate antimicrobial prophylaxis, etc.), organism-related (inoculum size, bacterial virulence, biofilm formation), and environmental-related. 6

Quantifying the burden of SSI and ensuring surveillance is essential. Understanding current infection control guidelines and their practice is necessary to identify existing gaps.

1.1 Objectives

This study aimed to determine the (i) extent of SSI across various surgical specialties, (ii) demographic characteristics, (iii) associated risk factors (iv) distribution of predominant pathogens, and (v) their antimicrobial resistance (AMR) patterns, at a tertiary-care hospital in Eastern India.

2 Methodology

2.1 Study design and setting

This was a descriptive, cross-sectional study conducted in the Department of Microbiology covering a period of 24 months (January 2023 to February 2025), at tertiary-care teaching hospital in Eastern India.

2.1.1 Study samples

All SSI cases according to guidelines by Centers for Disease Control and Prevention (CDC) NHSN criteria were included in this study, irrespective of age and gender. [2] Infections at the surgical site occurring more than 30 days post-operative are excluded from the study, except for breast, implant, and joint surgeries.

2.1.2 Study procedure

1. **Sample Collection, Processing and Analysis:** SSI samples (pus, swab, tissue, implants) were collected from the clinically suspected cases and sent to the Microbiology laboratory for processing. Initial Gram stains from direct specimens were observed, and subsequently, they were cultured on Blood, Chocolate, and MacConkey agar plates, incubated at 37°C for up to 48 hours. The characteristics of the colonies were recorded, and isolated colonies underwent Gram staining, motility testing, and a standard series of biochemical tests. They were ultimately confirmed, identified, and assessed for antimicrobial susceptibility using the MicroScan WalkAway® plus system (Beckman Coulter, California, USA). Antimicrobial susceptibility results were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) 2025, M100 guidelines. MDR for GN infections were interpreted based on Infectious Diseases Society of America (IDSA) 2024 Guidelines. [7]
2. **Data collection:** Demographic data, ward of admission, and other relevant information were obtained from the laboratory register and hospital information system.
3. **Calculation:** SSI rates are calculated by dividing the number of SSIs by the number of operative procedures and multiplying the results by 100. [2]

4. **Statistical analysis:** Data obtained were entered in Microsoft Excel spreadsheet (Office 2021) and analyzed by SPSS (Statistical Package for Social Sciences) software (version16). Categorical variables were expressed in frequency counts and percentage distribution and extrapolated with various charts, tables and diagrams.

2.1.3 Ethical considerations

The study was conducted in conformity with all ethical guidelines. The protocol was reviewed and approved by the Institutional Ethics Committee. Patient confidentiality was maintained throughout the study by de-identifying all collected data.

3 Results

3.1 Prevalence of SSI

A total of 6,628 surgeries were conducted during this period, with 358 confirmed cases of SSI (SSI rate:5.4%). The SSI rate was highest in the orthopaedics department (7.8%), followed by plastic surgery (7.2%) and obstetrics and gynaecology departments (6.4%) Table. 1. The categories of SSI cases across various departments are compiled Table. 2. Superficial, deep, and organ/space SSI accounted for 28% (N=99), 62% (N=223), and 10% (N=36) of the total cases, respectively.

Table 1: Prevalence of SSI across various surgical specialties

Departments	Total Surgeries	No. of SSI cases	SSI rate (%)
Orthopaedics	1298	102	7.8%
Plastic Surgery	388	28	7.2%
OBGY	1354	86	6.4%
General Surgery	1310	77	6%
Neuro Surgery	722	35	4.8%
Urology Surgery	182	8	4.4%
CTVS	254	10	4%
Paediatric Surgery	268	7	2.6%
ENT	188	3	1.6%
Ophthalmology	664	2	0.3%

Table 2: Categories of SSI in various departments

	Orthopaedics (102)	OBGY (86)	General Surgery (77)	Plastic Surgery (28)	Neurosurgery (35)	Urosurgery (8)	Paediatric surgery (7)	CTVS (10)	ENT (3)	Ophthalmology (2)
Superficial SSI [N=99]	36 (35%)	13 (15%)	13 (17%)	19 (68%)	9 (26%)	nil	3 (43%)	3 (30%)	1 (33.3%)	2 (100%)
Deep SSI [N=223]	66 (65%)	64 (74.4%)	54 (70%)	8 (28.5%)	18 (51%)	2 (25%)	4 (57%)	7 (70%)	nil	nil
Organ/ Space SSI [N=36]	nil	9 (10.5%)	10 (13%)	1 (3.8%)	8 (23%)	6 (75%)	nil	nil	2 (66.7%)	nil

3.2 Demographic Profile with associated risk factors

About 60% were males (n=214), with a sex ratio of 1.5:1. The highest incidence of SSI was noted in the 31-40 years age group (n=86, 24%) Fig. 1. Smoking (48%) was the most prevalent risk factor Fig. 2.

3.2.1 Bacteriological Profile

Microbiological confirmation was observed in 87% (n=312) of the SSI cases, of which 67% (n=240) exhibited monomicrobial growth and 20% (n=72) showed polymicrobial growth. A total of 324 pathogens were isolated during the study period where GN and Gram-positive (GP) bacteria constituted 65.4% (n=212) and 34.6% (n=112) of the isolates, respectively. Among GP, *S. aureus* comprised of the majority (n=78, 70%). *Escherichia coli (E. coli*) (n=59,28%) was the predominant pathogen among GN, followed by *Klebsiella spp.* (n=49, 23%), *P. aeruginosa* (n=46, 21.6%), *A. baumannii* (n=33, 15.6%), *Proteus spp.* (n=15, 7%) and others (n=10, 5%) Table. 3.

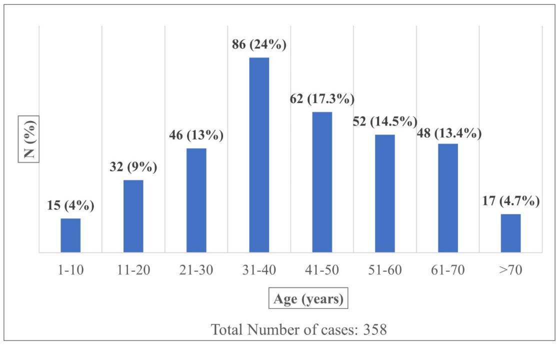

Figure 1: Age Distribution among study participants

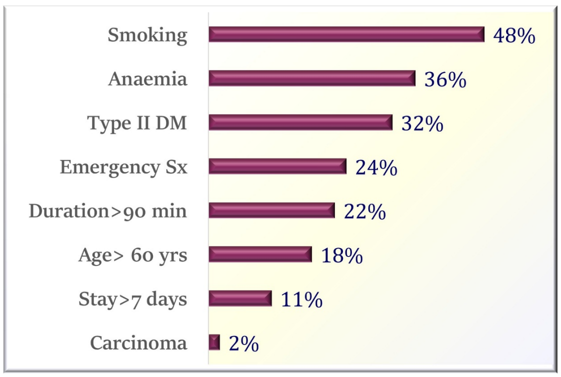

Figure 2: Presence of risk factors

Table 3: Distribution of the isolates

Microorganism	Species isolated	n (%)
Gram-positive (N= 112, 34.6%)	*Staphylococcus aureus*	78 (70%)
	Coagulase-negative staphylococci	18 (16%)
	Enterococcus spp.	16 (14%)
Gram-negative (N=212, 65.4%)	*Escherichia coli*	59 (28%)
	Klebsiella spp.	49 (23%)
	Pseudomonas aeruginosa	46 (21.6%)
	Acinetobacter baumannii complex	33 (15.6%)
	Proteus spp.	15 (7%)
	Burkholderia cepacia complex	4 (2%)
	Enterobacter cloacae	3 (1.5%)
	Morganella morganii	1 (0.5%)
	Serratia marcescens	1 (0.5%)
	Providencia spp.	1 (0.5%)

- **Distribution of pathogens among various surgical specialties (Table. 4):** S. aureus was the predominant pathogen isolated in orthopaedics, paediatric surgery and obstetrics and gynaecology department. Enterobacterales were predominant pathogens in general surgery, neurosurgery, urosurgery and ENT. *P. aeruginosa* was the most commonly isolated organism in plastic surgery patients (32%). In CTVS department, four cases of Burkholderia cepacia complex were isolated, primarily from pacemaker pocket site.
- **AMR patterns of the isolates:** GP isolates demonstrated a high level of resistance to penicillin (81%) and ampicillin (66%). Enterococcus spp., in particular, also showed a greater resistance to erythromycin (86%), clindamycin (80%), and high-level aminoglycosides (66.5%). The most effective antimicrobials for *S. aureus*, exhibiting low levels of resistance, were vancomycin (0%), teicoplanin (6.4%) and linezolid (11.3%). Daptomycin was the least resistant antimicrobial for Enterococcus spp. (6%). Methicillin resistance S. aureus (MRSA) was detected to be 45% (n=35), based on their resistance to cefoxitin. Vancomycin resistance was observed in 20% (n=4) of Enterococcus spp. (VRE).

Among the Enterobacterales, approximately 70% of *Klebsiella spp*., 44% of *E. coli* isolates, and 32% of *Proteus spp*. were identified as MDR. For *E. coli* and *Klebsiella spp*., the highest resistance was observed to third-generation cephalosporins, monobactam and fluoroquinolones. *E. coli* and *Klebsiella spp*. showed the least resistance to tigecycline (12.5%), and colistin (21.3%), respectively. *Proteus spp*. exhibited a high resistance to third-generation cephalosporins (57%), aminoglycosides (57%), and co-trimoxazole (57%), with the least resistance to carbapenems (21.4%).

Carbapenem-resistant Enterobacterales (CRE) comprised of 46.4%. Among non-fermenters, all isolates of *A. baumannii* were MDRO, demonstrating a high level of resistance to third and fourth-generation cephalosporins (100%), fluoroquinolones (90.6%), and aminoglycosides (81.3%).

P. aeruginosa showed maximum resistance to fluoroquinolones (77.3%), cephalosporins (71.7%), and monobactam (66%). Both *A. baumannii* and *P. aeruginosa* were least resistant to colistin. About 35% of P. aeruginosa were classified as MDR or Difficult-to-treat (DTR). [7] *Burkholderia cepacia complex* isolates were resistant to 50% of levofloxacin and 25% of co-trimoxazole. The detailed antibiotic resistance patterns of the isolated GP and GN organisms have been compiled (Table. 5 and Table. 6).

Table 4: Distribution of Organisms in various departments

Department	*S. aureus*	*Enterococcus spp.*	*E. coli*	*Klebsiella spp.*	*P. aeruginosa*	*A. baumannii complex*	*Proteus spp.*	Others
Orthopaedics (N=118)	33 (28%)	9 (7.6%)	13 (11%)	19 (16%)	16 (14%)	12 (10%)	6 (5%)	10 (8.4%)
General surgery (N=73)	15 (20.5%)	5 (7%)	18 (24.6%)	8 (11%)	10 (13.7%)	7 (9.6%)	4 (5.6%)	6 (8%)
Plastic surgery (N=25)	4 (16%)	Nil	3 (12%)	5 (20%)	8 (32%)	2 (8%)	1 (4%)	2 (8%)
Neurosurgery (N=17)	3 (17.6%)	1 (5.7%)	5 (29.4%)	2 (12%)	3 (17.6%)	2 (12%)	1 (5.7%)	Nil
Urosurgery (N=9)	1 (11%)	Nil	2 (22.2%)	3 (33.3%)	2 (22.2%)	Nil	Nil	1 (11%)
Paediatric surgery (N=7)	3 (43%)	Nil	2 (28.5%)	2 (28.5%)	Nil	Nil	Nil	Nil
OBGY (N=62)	18 (29%)	1 (1.6%)	15 (24%)	7 (11%)	3 (5%)	9 (14.5%)	3 (5%)	6 (9.6%)
CTVS (N=10)	1 (10%)	Nil	Nil	2 (20%)	2 (20%)	1 (10%)	Nil	4 (40%) : [*B. cepacia*]
ENT (N=2)	Nil	Nil	1 (50%)	1 (50%)	Nil	Nil	Nil	Nil

Table 5: Antimicrobial Resistance Pattern of Gram-positive isolates

Antimicrobials	*S. aureus* [N=78]	*Coagulase-negative staphylococci* [N=18]	*Enterococcus spp.* [N=16]
Penicillin	61 (82%)	15 (88%)	11 (73%)
Ampicillin	48 (65%)	11 (65%)	10 (67%)
Ciprofloxacin	54 (76%)	10 (59%)	5 (33%)
Co-trimoxazole	16 (22%)	5 (29%)	-
Erythromycin	31 (42%)	8 (47%)	13 (86%)
Clindamycin	37 (38%)	5 (29%)	12 (80%)
Gentamicin	10 (13%)	12 (15.4%)	-
Vancomycin	0 (0%)	0 (0%)	3 (20%)
Linezolid	7 (9%)	2 (12%)	2 (13%)
Teicoplanin	5 (6.4%)	0 (0%)	2 (12.5%)
Daptomycin	-	-	1 (6%)
High-level Gentamicin	-	-	9 (60%)
High-level Streptomycin	-	-	11 (73%)

4 Discussion

Despite considerable advancements in infection control, surgical, and sterilization techniques within healthcare settings, SSIs remain a significant burden. The rise of high AMR among pathogens has further complicated management and treatment. [8]

Overall, the SSI rate in our study was 5.4%, aligning with studies by Hirani S et al. (5.6%), Karan et al. (5.5%) and Mohan et al. (5.5%). [8, 9, 10] However, studies by Negi V et al. and Verma U et al. reported a high infection rate of 17.5% and 37.1%, respectively. [11, 12] The neglect of infection control practices, improper hand hygiene practices, and overcrowded hospitals are significant contributing factors to the high infection rates in India. [11]

Male preponderance was observed in our study, corresponding with several other studies. [11, 13, 14] A higher proportion of SSI was observed in the age group of 31-40 years (24%), followed by 41-50 years (17.3%). The increase in the incidence of SSI with age, as also evident in other studies, may be attributed to low immunity, delayed wound healing, diminished physiological defence, and the presence of co-morbidities. [15] Conversely, a study by Mohan et al. noted a greater number of SSI cases in individuals below 25 years. [10]

Smoking was the primary risk factor identified in our study (48%). It leads to the constriction of peripheral blood vessels, resulting in tissue hypovolaemia and hypoxia, which interferes with wound healing. [6] Anaemia (36%) and diabetes mellitus (32%) were the main associated co-morbidities in our study, concurring with the findings from Kasukurthy LR et al. and Choudhury K et al. [15, 16] Approximately 24% of patients who underwent emergency procedures developed SSIs. This may be due to a very limited time frame lacking adequate patient preparation, surgical readiness, or the presence of contaminated wounds, as seen in cases of road traffic accidents.

Maximum SSI was recorded in the orthopaedics department (7.8%), in tandem with a study Khan AS et al (3.4%). [17] This was followed by plastic surgery (7.2%), and obstetrics and gynaecology department (6.4%). Studies by Banik et al. (8.22%) and Choudhury et al. (4.8%) reported highest infection rate in plastic surgery whereas Pham JC et al. reported the maximum in general surgery. [13, 15, 18] Given the potential for implant or graft rejection, a higher percentage of SSIs in orthopaedics and plastic surgery departments is concerning. Deep SSI accounted for the majority of the SSI (62%), corresponding with a few other studies.[10, 13] However, Kumar A et al. reported that the incidence of superficial SSIs was the highest. [19]

In our study, culture-positivity rate was 87%, corresponding with Choudhury et al (84.55%) and Dhote et al (92%). [15, 20] Of this, 67% exhibited monomicrobial growth and 20% were polymicrobial, showing similarity with many other studies. [13, 16, 21] A few studies reported lower culture positivity rates (Khan AS et al: 52%, and Kokate et al.: 49.5%). [17, 22] Polymicrobial infections present challenges due to their requirement for higher classes of antimicrobials and extended treatment durations.

Table 6: Antimicrobial Resistance Pattern of Gram-negative isolates

Antimicrobials	*E. coli* [N=59]	*Klebsiella spp.* [N=49]	*Proteus spp.* [N=15]	*P. aeruginosa* [N=46]	*A. baumannii complex* [N=33]
Ceftazidime	49 (88%)	37 (79%)	7 (50%)	32 (73%)	32 (100%)
Ceftriaxone	49 (88%)	35 (74.5%)	9 (64%)	*IR	32 (100%)
Cefepime	39 (70%)	32 (68%)	7 (50%)	31 (70.4%)	32 (100%)
Amoxicillin/ Clavulanate	31 (55.3%)	30 (64%)	4 (28.5%)	*IR	*IR
Piperacillin/ Tazobactam	18 (32%)	27 (56%)	4 (28.5%)	22 (50%)	19 (59.3%)
Ampicillin/ Sulbactam	32 (57%)	25 (53%)	4 (28.5%)	*IR	17 (53%)
Aztreonam	56 (87.5%)	35 (71.4%)	5 (36%)	29 (66%)	*IR
Meropenem	19 (34%)	33 (70%)	3 (21.4%)	25 (57%)	22 (69%)
Imipenem	19 (34%	33 (70%)	3 (21.4%)	25 (57%)	23 (72%)
Ertapenem	19 (34%)	31 (66%)	3 (21.4%)	*IR	*IR
Gentamicin	18 (32%)	33 (70%)	9 (64%)	25 (57%)	26 (81.3%)
Amikacin	18 (32%)	33 (70%)	7 (50%)	25 (57%)	26 (81.3%)
Ciprofloxacin	47 (84%)	35 (74.4%)	6 (43%)	34 (77.3%)	29 (90.6%)
Co-trimoxazole	31 (55.3%)	34 (72.3%)	8 (57%)	*IR	23 (72%)
Tigecycline	7 (12.5%)	14 (30%)	*IR	*IR	5 (15.6%)
Colistin	13 (23%)	10 (21.3%)	*IR	3 (7%)	4 (12.5%)

*IR: Intrinsic resistance

GN organisms (65.4%) were isolated more frequently than GP organisms (34.6%) in this study. Consistent with majority of studies, our research also showed *S. aureus* to be the most prevalent isolate (70%) among GP organisms and E. coli (28%) among GN organisms. [10, 11, 14, 15, 17] Contrary to previous reports, recent investigations had observed the emergence of non-fermenters like *P. aeruginosa* and *A. baumannii* as emerging pathogens of SSI. [23]

The antimicrobial profile of majority of the organisms showed a high prevalence of resistance. GP organisms exhibited maximum resistance to penicillin (81%), corroborating with a study Banik A et al. (95%).[11] A sizable fraction of the *S. aureus* isolates exhibited methicillin resistance (MRSA) (45%), which is higher when compared to studies by Negi V et al. (15.7%) and Choudhury K. et al (39.29%) but lower than Patnaik et al (52.3%). [11, 15, 24] Increased MRSA isolation from SSI samples suggests that infection

Table 7: Comparison of SSI rate along with resistance among pathogens

Author	Place of study	Year of publication	SSI rate	% GP	% GN	Most common isolate	Resistance
Mohan K et al. [10]	Tamil Nadu	2023	5.6%	30.17%	69.83%	GP: *S. aureus* GN: *E. coli*	-
Negi V et al. [11]	Uttarakhand	2015	17.8%	50.4%	49.6%	GP: *S. aureus* GN: *E. coli*	MRSA:15.7% MDR GNB: 50-100%
Verma U et al. [12]	Rajasthan	2021	37.1%	66.6%	29.5%	GP: *CoNS* GN: *E. coli*	MRSA: 84.6%
Banik Aet al. [13]	Kolkata	2024	6.3%	24.7%	58%	GP: *S. aureus* GN: *K. pneumoniae*	*MRSA: 43.9%* *VRE:4%* *CRE: 34.78%* *CRAB: 70.52%* *DTR-P:16.35%*
Chada CKR et al. [14]	Andhra Pradesh	2017	3.83%	38%	62%	GP: *S. aureus* GN: *E. coli*	MRSA:35.7% VRE:0% CRE:4.2%
Choudhury K et al. [15]	West Bengal	2023	2.83%	*38.53%*	*58.72%*	GP: *S. aureus* GN: *E. coli*	MRSA:39.29% ESBL:67.97%
Kasukurthy LR et al. [16]	Karnataka	2020	10.3%	*34%*	*66%*	GP: *S. aureus* GN: *K. pneumoniae*	MRSA:15% ESBL:44%
Khan AS et al. [17]	Uttar Pradesh	2020	3.43%	40.9%	57.2%	GP: *S. aureus* GN: *E. coli*	*MRSA: 40%* *VRE: 0%* *MDR:80.3%*
Pradeep MSS et al. [21]	Andhra Pradesh	2019	2.30%	33.7%	66.3%	GP: *S. aureus* GN: *E. coli*	MRSA:31.03%, VRE:0%, MDR: 26.7%, ESBL: 43.9%
Kokate S B et al. [22]	Maharashtra	2017	1.64%	39.72%	60.28%	GP: *S. aureus* GN: *E. coli*	MRSA: 31.03% ESBL:33%
Patnaik N et al. [24]	Odisha	2019	8.5%	51.8%	48.2%	GP: *S. aureus* GN: *E. coli*	MRSA:52.38% CRE: 37.6%
Present Study	West Bengal	-	5.4%	65.4%	34.6%	GP: *S. aureus* GN: *E. coli*	MRSA: 45% VRE: 25% CRE:46.4% DTR-P: 35%

***GP: Gram-positive, GN: Gram-negative, MRSA: Methicillin-resistant *Staphylococcus aureus*, VRE: Vancomycin-resistant *Enterococcus*, MDR: Multidrug-resistant, CRE: Carbapenem-resistant *Enterobacterales*, DTR-P: Difficult-to-treat *P. aeruginosa*, ESBL: Extended-spectrum Beta-Lactamase, CRAB: Carbapenem-resistant *Acinetobacter baumannii.*

control procedures need to be improved. Vancomycin, linezolid, teicoplanin were found to be most effective antimicrobials for S. aureus and daptomycin was the most effective for Enterococcus spp, consistent with the findings by Verma U et al. and Choudhury et al. [12, 15]

GN organisms were predominantly resistant to cephalosporins and fluoroquinolones, aligning with the findings of Banik A et al. [11] The carbapenem resistance among Enterobacterales detected in our study was 46.4%, which is higher than a study by Banik A et al. (34.78%). [11] This may be attributed to the imprudent use of meropenem as the first line of empirical treatment. Lower rates of resistance were noted for carbapenems and β-lactam/β-lactamase inhibitor (BL/BLI) combination in a study conducted by Negi V et al. [11]

A comparison of SSI rate among various studies across India, along with important resistance among isolates is compiled in Table. 7. Before every procedure, all cases had received prophylactic antimicrobials in our study. The most widely used drug was a third-generation cephalosporin. The findings of the antimicrobial susceptibility test, however, indicated that the isolated bacterial strains exhibited a high degree of resistance to this agent. The frequent empirical administration of this antimicrobial both for therapeutic and preventative purposes in our hospital may have contributed to the high level of resistance.

A study by Aghdassi et al. found a significant increase in SSI caused by GNB during warmer months, suggesting a link between temperature and SSI risk. This has important implications for SSI prevention strategies, which should consider the influence of temperature and climate factors. Therefore, underlying changes in microbiome composition brought on by climatic conditions should be included in future investigations. [25]

5 Conclusion

Surgical site infections (SSI) remain a significant clinical challenge despite rapid advancements in technology and knowledge. The elevated SSI rates across various departments underscore the critical need for enhanced stringent infection control protocols and robust antimicrobial stewardship within our hospital. A paradigm shift in bacteriological profiles, from GP to MDR GN organisms, poses a serious threat to patient outcomes and significantly impedes surgical progress.[26] Therefore, understanding the local microbial epidemiology is crucial for guiding appropriate empirical treatment. Regular surveillance of SSI cases, including their risk factors and timely feedback, is essential for reducing prevalence. To effectively combat the rising incidence and complexity of SSI, a proactive strategy is paramount, encompassing rigorous auditing of surgical antimicrobial prophylaxis protocols and consistent, periodic resistance trend analysis. Evidence strongly supports these practices in optimizing antimicrobial use.[27, 28] This enables timely adjustments to empirical treatment strategies and minimizes selective pressure for resistance, thereby improving patient outcomes and contributing to broader antimicrobial stewardship efforts.

6 Disclosure

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Declaration of patient consent: The authors attest to having acquired all required patient permission documents. The patients had grant permission for the journal to publish his or her clinical data. They are aware that due efforts will be made to conceal their identity.

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