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Original Article

Rate of Surgical Site Infection in Elective Surgical Procedures

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ABSTRACT

Background: Surgical site infections remain an important postoperative complication, particularly where surveillance and antimicrobial stewardship are inconsistent. Objective: To determine the occurrence of surgical site infection following selected elective surgical procedures in participating surgical services in Balochistan and describe associated microbiology, hospitalization, and antimicrobial prophylaxis. Methods: This multicentre retrospective observational study analysed adults undergoing elective gastrointestinal, biliary, pancreatic, urogenital, abdominal hernia, or gynaecological procedures. Data were collected using standardized case report forms and analysed using SPSS version 22.0. Results: Among 858 analysed patients, mean age was 38.8±13.1 years and 71.0% were women. SSI occurred in 56 patients (6.5%; 95% CI 5.1%–8.4%). Cultures were positive in 47/56 cases (83.9%), predominantly for Staphylococcus aureus (21/56, 37.5%) and Escherichia coli (17/56, 30.4%). Mean hospital stay was 8.3±10.3 days in patients with SSI versus 3.3±2.9 days without SSI, with a mean difference of 5.00 days (95% CI 2.24–7.76; p<0.001). Nineteen SSI patients (33.9%) required rehospitalization. Antibiotics were continued postoperatively in 94.0% of the overall cohort. Conclusion: SSI affected approximately one in fifteen analysed elective surgical patients and was associated with substantially longer hospitalization. Local surveillance, microbiological monitoring, infection-prevention practices, and antimicrobial stewardship remain important priorities. Keywords: Surgical site infection; elective surgery; antimicrobial prophylaxis; postoperative infection; microbiology; Balochistan.

INTRODUCTION

Surgical site infections (SSIs) remain an important cause of postoperative morbidity and healthcare utilization despite substantial advances in perioperative infection prevention. Contemporary evidence indicates that SSIs continue to affect a clinically meaningful proportion of surgical patients and are associated with prolonged hospitalization, additional treatment requirements, increased healthcare expenditure, and preventable complications. Their occurrence is influenced by interacting patient-, procedure-, wound-, microbial-, and healthcare-related factors, while appropriate perioperative practices—including timely antimicrobial prophylaxis, aseptic technique, skin preparation, maintenance of normothermia, glycaemic control, and structured surveillance—can reduce preventable infection burden (1).

An SSI is an infection involving the surgical incision or deeper operative tissues that develops within the defined postoperative surveillance period. Established surveillance criteria recognize infection through findings such as purulent drainage, microbiological evidence of infection, deliberate opening of an incision in the presence of compatible clinical features, or a diagnosis made by the responsible surgeon

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or physician. SSIs are conventionally categorized as superficial incisional, deep incisional, or organ/space infections according to the anatomical extent of involvement (2). Surgical wounds are also classified according to the expected degree of microbial contamination as clean, clean-contaminated, contaminated, or dirty/infected, with progressively greater contamination generally associated with an increased probability of postoperative infection (2). These classifications are clinically relevant because SSI occurrence is determined not only by microbial exposure but also by operative duration, tissue handling, underlying patient characteristics, surgical complexity, and adherence to preventive practices.

The burden of SSI varies substantially among healthcare systems, surgical specialties, procedures, and surveillance methods. Studies from Pakistan have reported clinically important rates of postoperative wound infection after elective surgery and have identified wound contamination, procedure-related factors, and antimicrobial-use practices as important considerations in local surgical care (3). Earlier Pakistani evidence has nevertheless been derived predominantly from individual institutions or geographically restricted populations, limiting the extent to which such findings can characterize patterns across different surgical services. International assessments have similarly highlighted the relative scarcity of reliable healthcare-associated infection surveillance data from many low- and middle-income settings, where differences in resources, infection-control infrastructure, antimicrobial use, follow-up systems, and microbiological capacity may substantially affect observed SSI rates (4).

The clinical consequences of SSI extend beyond the surgical wound itself. Infection can delay wound healing, prolong hospitalization, necessitate additional antimicrobial treatment or surgical intervention, increase the likelihood of readmission, and place additional demands on already constrained healthcare resources. Pakistani studies have also documented heterogeneity in the organisms isolated from infected surgical wounds and substantial variation in perioperative antibiotic use, emphasizing the importance of local microbiological surveillance and rational surgical antimicrobial prophylaxis (5,6). This is particularly relevant in settings where postoperative antibiotics may be continued for prolonged periods and where prescribing practices may not consistently reflect procedure-specific prophylactic principles.

Despite the clinical importance of SSI, contemporary multicentre data describing its occurrence after elective surgery in Balochistan remain limited. Region-specific information is needed not only to quantify the observed burden of infection but also to characterize the procedures and wound classes in which infection is most frequently observed, identify the predominant organisms recovered from infected wounds, describe associated hospitalization, and document patterns of perioperative antibiotic prophylaxis. Therefore, the primary objective of this study was to determine the proportion of adult patients developing SSI following selected elective surgical procedures in participating surgical services in Balochistan. Secondary objectives were to describe the distribution of SSI according to surgical procedure and wound classification, characterize the microbiological organisms isolated from infected patients, compare hospital stay between patients with and without SSI, and describe perioperative antimicrobial prophylaxis practices.

MATERIALS AND METHODS

This multicentre retrospective observational study evaluated surgical site infections among adult patients undergoing selected elective surgical procedures in surgical services associated with Bolan Medical College/Sandeman Provincial Hospital, Quetta, and participating public and private tertiary-care surgical practices in Balochistan. Study coordination and data collection were undertaken from 17 October 2024 to 17 April 2025. Because patient information was obtained retrospectively, the study period represented the data-collection and site-participation interval rather than a single uniform operative recruitment period. For each participating investigator, eligible surgical records were identified from operations undertaken during the three-month period preceding the month immediately before site initiation. The most recent 10 consecutive eligible patients were preferentially selected from the interval approximately two to one months before the respective site-initiation date.

Participating investigators were surgeons involved in the care of patients undergoing the eligible procedures. An investigator questionnaire was used to document investigator characteristics and relevant surgical-practice information. Patient-level data were abstracted using a standardized case report form. Eligible participants were adults aged 18 years or older who had undergone elective gastrointestinal, biliary, pancreatic, urogenital, abdominal hernia, or gynaecological surgery, including caesarean section, within the prespecified retrospective sampling interval. Emergency procedures, paediatric surgery, orthopaedic procedures, surgical procedures outside the predefined categories, operations performed for malignancy, cases involving wound dehiscence or faecal, biliary, or urinary fistula, and procedures performed during the month immediately preceding site initiation were excluded. Patients with an SSI were also excluded when the required wound and/or blood culture and susceptibility information was unavailable according to the study eligibility criteria.

The primary outcome was the occurrence of SSI following an eligible elective surgical procedure. SSI ascertainment was based on the clinical and microbiological criteria used in the study, including purulent drainage from the surgical incision or drain, microbiological isolation of an organism from an appropriate wound or blood specimen, deliberate opening of the wound by the surgeon in the presence of compatible clinical findings, or a clinical diagnosis of SSI by the treating surgeon or physician. These criteria were aligned with established surgical-site surveillance principles (2). Where documented, the anatomical involvement of the infection was recorded, including skin, subcutaneous tissue, combined skin and subcutaneous involvement, and deeper surgical-site infection. Surgical wounds were categorized as clean, clean-contaminated, contaminated, or dirty/infected according to the wound-classification framework applied in the study (2).

For each eligible patient, the standardized case report form captured demographic characteristics, type of surgical procedure, wound classification, operative duration, perioperative antimicrobial use, timing and route of prophylactic antibiotic administration, duration of antibiotic therapy, occurrence and timing of SSI, diagnostic features of SSI, microbiological sampling and culture findings, wound-healing information, hospitalization, and rehospitalization where applicable. For patients with suspected or diagnosed SSI, wound specimens were used for microbiological evaluation in the majority of cases, with blood culture information recorded when available. Organisms isolated from the submitted specimens and corresponding culture and susceptibility information were documented as part of the SSI assessment.

The planned sample size was based on an anticipated SSI proportion of 13%. Using a 95% confidence level and an absolute precision of approximately 2%, approximately 1,100 evaluable patients were considered necessary. Allowing approximately 5% additional observations for incomplete retrospective information increased the planned recruitment target to approximately 1,160 patients. The final analytical cohort consisted of 858 patients with evaluable study data. Participant screening and eligibility assessment were performed before inclusion in the analytical dataset.

Antimicrobial prophylaxis was evaluated according to the therapeutic class administered, route of administration, timing of the first prophylactic dose in relation to surgery, use of single or combination therapy, and duration of antibiotic administration. Antibiotic treatment continuing after surgery was recorded separately as postoperative continuation of the perioperative regimen. These variables were evaluated descriptively across the study population and, where relevant, according to surgical procedure, wound classification, and SSI status.

Data were analysed using IBM SPSS Statistics version 22.0, as specified in the original analysis. Categorical variables were summarized as frequencies and percentages, while continuous variables were reported as mean ± standard deviation. The overall proportion of patients developing SSI was calculated using the number of patients with SSI divided by the total number of evaluable surgical patients, with a 95% confidence interval reported for the primary estimate. SSI occurrence was additionally summarized descriptively according to surgical procedure and wound classification. Hospital stay was compared between patients who developed SSI and those who did not using the independent-samples comparison applied in the original analysis. Statistical significance was defined as a two-sided p-value <0.05.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the principles of Good Epidemiological Practice. Patient information was collected through retrospective clinical records and standardized study documentation, with the analysis restricted to variables relevant to the stated study objectives.

RESULTS

A total of 1,549 patient records were screened, of which data were available for 893 patients and 858 fulfilled the requirements for inclusion in the final analysis. The mean age of the analysed population was 38.8 ± 13.1 years, and women constituted 71.0% of participants. Gynaecological procedures, including caesarean section, were the most frequently represented surgical category, accounting for 364 of 858 procedures (42.4%), followed by biliary surgery in 170 (19.8%), abdominal hernia repair in 158 (18.4%), urogenital surgery in 104 (12.1%), gastrointestinal surgery in 59 (6.8%), and pancreatic surgery in 3 (0.3%) patients. Among the reported wound-classification categories, 581 procedures (67.7%) were clean, 233 (27.2%) were clean-contaminated, 37 (4.3%) were contaminated, and 4 (0.5%) were dirty/infected (Table 1).

Table 1. Distribution of Surgical Procedures, Wound Classification, Antibiotic Duration, and Reported SSI Proportion

Clinical characteristic	n	%	Antibiotic duration, mean ± SD (days)	SSI (%)
Wound classification				
Clean	581	67.7	3.2 ± 2.9	4.0
Clean-contaminated	233	27.2	2.9 ± 2.2	8.2
Contaminated	37	4.3	4.8 ± 3.2	29.7
Dirty/infected	4	0.5	6.5 ± 5.5	50.0
Surgical procedure				
Gynaecological, including caesarean section	364	42.4	3.3 ± 2.9	2.5
Biliary	170	19.8	3.0 ± 2.7	9.4
Abdominal hernia	158	18.4	2.6 ± 2.4	8.2
Urogenital	104	12.1	4.3 ± 3.2	9.6
Gastrointestinal	59	6.8	3.8 ± 2.6	13.6
Pancreatic	3	0.3	7.0 ± 2.6	100.0

Abbreviations: SD, standard deviation; SSI, surgical site infection. Wound-classification categories account for 855 of the 858 analysed patients. SSI percentages are presented as reported for each category; pancreatic surgery estimates should be interpreted in the context of the very small denominator (n=3).

Table 2. Microbiological Findings Among Patients With Surgical Site Infection

Microbiological finding	n	% of SSI cases (N=56)	% of culture-positive cases (N=47)
Culture-positive specimen	47	83.9	—
Staphylococcus aureus	21	37.5	44.7
Escherichia coli	17	30.4	36.2
Enterobacter spp.	3	5.4	6.4
Enterococcus spp.	2	3.6	4.3
Morganella/Moraxella species as recorded	2	3.6	4.3
Klebsiella spp.	1	1.8	2.1
Streptococcus spp.	1	1.8	2.1
Total organisms isolated	47	83.9	100.0

Abbreviations: SSI, surgical site infection. Percentages based on N=56 describe all SSI cases, whereas percentages based on N=47 describe only culture-positive cases.

Antibiotic classes were not mutually exclusive because combination prophylaxis was used in some patients; therefore, column frequencies and percentages may exceed the number or percentage of individual patients. Cephalosporins collectively accounted for 41 recorded exposures among the 56 patients with SSI (73.2%), including 34 third-generation cephalosporin exposures (60.7%).

Half of all SSIs were identified during the postoperative hospitalization period (28/56, 50.0%), while the remaining 28 cases (50.0%) were identified after discharge. Purulent discharge from the incision was the diagnostic feature in 28 patients (50.0%). A surgeon's clinical diagnosis accounted for 16.1% of cases, deliberate opening of the wound for 8.9%, purulent drainage from a surgical drain for 5.4%, and isolation of an organism from wound or blood culture as the recorded diagnostic criterion in 1.8%. More than one diagnostic criterion was documented in 17.9% of SSI cases. Skin involvement was reported in 28% of patients, subcutaneous involvement in 26%, combined skin and subcutaneous involvement in 40%, and deep SSI in 7%.

Table 3. Prophylactic Antibiotic Classes Recorded Among Patients Who Developed SSI

Antibiotic class	n	% of SSI cases (N=56)	Mean dose ± SD (mg)	Mean duration ± SD (days)
First-generation cephalosporin	2	3.6	750.0 ± 353.5	3.0 ± 2.8
Second-generation cephalosporin	5	8.9	1300.0 ± 541.9	4.2 ± 2.5
Third-generation cephalosporin	34	60.7	1080.8 ± 293.3	5.2 ± 5.1
Metronidazole	9	16.1	1133.3 ± 556.7	9.7 ± 8.5
Amoxicillin/clavulanate	5	8.9	1080.0 ± 109.5	5.2 ± 3.8
Quinolone	2	3.6	350.0 ± 212.1	22.0 ± 0.0
Penicillin	1	1.8	2000.0 ± 0.0	3.0 ± 0.0
Aminoglycoside	2	3.6	1500.0 ± 707.1	16.5 ± 13.4
Ampicillin	0	0.0	0.0 ± 0.0	0.0 ± 0.0

Abbreviations: SD, standard deviation; SSI, surgical site infection.

Table 4. Surgical Site Infection Occurrence, Clinical Course, and Hospital Utilization

Outcome	Result
Analysed patients	858
Patients developing SSI	56 (6.5%)
95% CI for overall SSI proportion	5.1%–8.4%
SSI identified during postoperative hospitalization	28/56 (50.0%)
SSI identified after discharge	28/56 (50.0%)
Culture-positive SSI	47/56 (83.9%)
Time from surgery to SSI development	6.8 ± 6.3 days
Wound-healing duration among SSI patients	13.2 ± 5.7 days
Rehospitalization among SSI patients	19/56 (33.9%)
Duration of rehospitalization	8.0 ± 4.8 days
Hospital stay, SSI group	8.3 ± 10.3 days
Hospital stay, non-SSI group	3.3 ± 2.9 days
Mean difference in hospital stay	5.00 days
95% CI for mean difference	2.24–7.76 days
Welch t statistic	3.62
Degrees of freedom	55.6
p-value	<0.001

Abbreviations: CI, confidence interval; SD, standard deviation; SSI, surgical site infection. Continuous variables are presented as mean ± SD. The hospital-stay comparison was reanalysed using Welch's independent-samples t-test because of the substantial difference in variability between groups.

Microbiological specimens were obtained from the wound in all but one patient, for whom the specimen was obtained from blood. Organisms were isolated in 47 of 56 SSI cases, giving a culture positivity of 83.9%. Staphylococcus aureus was the predominant isolate, accounting for 21 of 56 SSI cases (37.5%) and 44.7% of culture-positive cases. Escherichia coli was the second most frequent isolate, occurring in 17 patients (30.4% of all SSI cases; 36.2% of culture-positive cases), followed by Enterobacter species in three patients (5.4% and 6.4%, respectively). The remaining organisms occurred infrequently (Table 2).

SSI developed a mean of 6.8 ± 6.3 days after surgery, and the mean reported time to wound healing among affected patients was 13.2 ± 5.7 days. Nineteen of the 56 patients with SSI (33.9%) required rehospitalization, with a mean rehospitalization duration of 8.0 ± 4.8 days. Patients who developed SSI had a mean hospital stay of 8.3 ± 10.3 days compared with 3.3 ± 2.9 days among the 802 patients without SSI. Reanalysis allowing for unequal group variances demonstrated a mean difference of 5.00 days (95%

CI 2.24–7.76), with Welch's t=3.62, df=55.6, and p<0.001, indicating substantially greater hospital utilization among patients who developed SSI (Table 4).

Cephalosporins were the most frequently recorded prophylactic antibiotic class among the 56 patients who developed SSI, with 41 cephalosporin exposures corresponding to 73.2% of the SSI subgroup. Third-generation cephalosporins accounted for 34 exposures (60.7%), followed by metronidazole in nine (16.1%), second-generation cephalosporins in five (8.9%), and amoxicillin/clavulanate in five (8.9%). Because combination prophylaxis was used, antibiotic-class categories were not mutually exclusive and should not be interpreted as representing 56 separate antibiotic prescriptions (Table 3).

Across the broader surgical cohort, combination antibiotic therapy was used in 23.8% of patients and was most frequently documented in gynaecological procedures including caesarean section (12.8%) and gastrointestinal procedures (3.7%). Intravenous administration was used in 95.7% of cases. The first prophylactic antibiotic dose was administered a mean of 68 ± 270 minutes before surgery; 83% of patients received prophylaxis within one hour before surgery and 8% received the antibiotic at the time of incision. The overall mean duration of antibiotic administration was 3.3 ± 2.8 days, increasing to 4.3 ± 3.2 days for urogenital procedures and 6.5 ± 5.5 days for dirty/infected wounds.

Postoperative continuation of antibiotics was recorded in 802 of 858 patients (94.0%), with treatment continuing for a mean of 4 ± 3 days. Among patients who developed SSI, 51 of 56 (91.1%) continued the same antibiotic that had been used for prophylaxis. Postoperative continuation was reported most frequently in association with gynaecological procedures including caesarean section (38.2%), followed by biliary procedures (19.5%) and abdominal surgical procedures (18.2%).

DISCUSSION

The present multicentre retrospective observational study found that 56 of 858 adults undergoing selected elective surgical procedures developed a surgical site infection, corresponding to an overall observed SSI proportion of 6.5% (95% CI 5.1%–8.4%). SSI occurrence varied across wound classifications and surgical categories, with higher reported proportions among contaminated and dirty/infected wounds. Staphylococcus aureus and Escherichia coli were the predominant cultured organisms. SSI was also associated with substantially greater healthcare utilization: affected patients remained in hospital for an average of 5.0 days longer than patients without SSI, and approximately one-third of patients with SSI required rehospitalization. Antibiotic use was extensive throughout the cohort, including frequent postoperative continuation, while third-generation cephalosporins predominated among the prophylactic antibiotic exposures recorded in patients who subsequently developed SSI.

The overall SSI proportion of 6.5% is broadly comparable with earlier Pakistani institutional reports, although considerable variation has been observed between hospitals, patient populations, wound categories, and surgical procedures (3,5–8). Such variation is expected because SSI occurrence is influenced by the underlying surgical case mix, degree of wound contamination, operative conditions, patient characteristics, surveillance intensity, duration of postoperative follow-up, and local infection-prevention practices (1,2). The present estimate should therefore be interpreted as representative of the analysed elective surgical population from the participating services rather than as a national prevalence estimate for Pakistan. A recent systematic review of postoperative SSI reports also demonstrated substantial heterogeneity among surgical populations and institutions, reinforcing the importance of local surveillance when interpreting SSI rates and benchmarking surgical quality (8).

The pattern observed across wound classifications was clinically coherent, with the lowest reported SSI proportion among clean procedures and progressively higher proportions among clean-contaminated, contaminated, and dirty/infected wounds. Wound contamination is an established determinant of SSI because increasing microbial burden at the operative site increases the probability that host and procedural defences will be overwhelmed (1,2). Earlier Pakistani studies have similarly reported greater infection frequency among contaminated and dirty wounds (3,7). Nevertheless, the wound-classification findings in the present study are descriptive and should not be interpreted as adjusted estimates of independent risk, because potential confounders such as comorbid disease, nutritional status, obesity, smoking, glycaemic control, operative complexity, and other patient-level factors were not included in the reported comparative analysis. The very high reported proportion among pancreatic procedures is also based on only three patients and therefore represents an unstable small-sample observation rather than evidence that pancreatic surgery independently carries the highest risk in this population.

The microbiological profile was dominated by Staphylococcus aureus, which accounted for 21 of the 56 SSI cases and 44.7% of the 47 culture-positive infections, followed by Escherichia coli, which accounted for 17 cases and 36.2% of culture-positive infections. This predominance of S. aureus is consistent with previous surgical surveillance studies in which staphylococci have remained important causes of incisional infection (6,9). Gram-negative organisms, particularly E. coli, have also been commonly reported in abdominal, gastrointestinal, and contaminated surgical wounds because the microbiological profile is influenced by both endogenous skin flora and organisms associated with the operative anatomical site (6,11). The finding is therefore biologically plausible given the mixture of gynaecological, biliary, gastrointestinal, urogenital, and abdominal procedures represented in the cohort. Previous Pakistani surveillance has additionally documented antimicrobial resistance among S. aureus isolates, including methicillin resistance, while resistance among gram-negative SSI pathogens remains an important therapeutic concern (10,11). These observations support microbiological surveillance and susceptibility-guided treatment rather than empiric escalation to broader-spectrum antimicrobials solely on the basis of SSI occurrence.

SSI was associated with a substantial increase in hospital utilization. Patients with SSI had a mean hospital stay of 8.3 ± 10.3 days compared with 3.3 ± 2.9 days among patients without SSI, corresponding to a mean difference of 5.00 days (95% CI 2.24–7.76; $p<0.001$). Approximately one-third of affected patients were also rehospitalized. Longer hospitalization among patients developing SSI has been consistently demonstrated in previous studies and constitutes an important component of the clinical and economic burden associated with postoperative infection (1,5,12–14). Prolonged hospitalization may reflect the need for wound care, microbiological investigations, antimicrobial treatment, repeated procedures, monitoring, or management of other postoperative complications. Because the present study was observational, however, the additional hospital stay should be regarded as associated with SSI rather than entirely attributable to infection.

Operative duration and wound characteristics may also contribute to differences in observed SSI frequency. More than half of procedures in the present cohort lasted between one and four hours, while 44.1% lasted one hour or less. Longer operative exposure has previously been associated with increased SSI occurrence through mechanisms that may include greater tissue manipulation, longer environmental exposure of the operative field, declining antimicrobial concentrations during prolonged procedures, and greater procedural complexity (2,3,15,16). Operative duration was not modelled as an independent predictor in the present analysis, and consequently the current findings cannot determine whether duration independently explained infection occurrence. Future analyses using patient-level data could evaluate procedure type, wound class, operative duration, patient characteristics, and prophylactic antibiotic practices simultaneously to distinguish unadjusted patterns from independent associations.

The antimicrobial findings are particularly relevant to surgical stewardship. Although 83% of patients reportedly received prophylactic antibiotics within one hour before surgery, antibiotics were continued postoperatively in 802 of 858 patients (94.0%) for an average of approximately four days. Pakistani audit data have previously demonstrated substantial departures from recommended surgical antimicrobial prophylaxis in relation to antibiotic selection, administration timing, and postoperative duration (17). Similarly, evidence from elective laparoscopic cholecystectomy in Pakistan found no meaningful reduction in SSI when a prolonged postoperative antibiotic regimen was compared with a single perioperative dose, illustrating that greater antibiotic exposure does not necessarily provide greater infection prevention (18). International and regional evidence supports appropriate selection, dose, timing, and procedure-specific duration of surgical prophylaxis rather than routine prolonged postoperative administration (1,19,20). In the present study, cephalosporins accounted for 73.2% of antibiotic-class exposures among patients who developed SSI, with third-generation cephalosporins accounting for 60.7%. These figures describe prescribing within the SSI subgroup and must not be interpreted as evidence that cephalosporins either caused or prevented infection because comparative exposure information for patients with and without SSI was not analysed. The appropriate implication is therefore the need for antimicrobial stewardship and procedure-specific prophylaxis assessment rather than preferential use of broader-spectrum agents.

Several characteristics strengthen the study. It included a relatively large cohort of 858 elective surgical patients, incorporated several surgical specialties, described both clinical and microbiological features of SSI, documented post-discharge infections, and evaluated hospitalization and antimicrobial-use patterns alongside the primary SSI estimate. The availability of culture results in 83.9% of SSI cases also strengthens characterization of the infecting organisms. At the same time, the retrospective observational design introduces limitations inherent to medical-record completeness and variable ascertainment. Post-discharge infections accounted for half of all identified SSI cases, making surveillance procedures particularly important because infections not returning to participating services could have been missed. The planned sample size was not achieved, and the participating-centre structure requires careful interpretation when assessing representativeness. Several important patient-level SSI determinants were not included in the reported analysis, preventing adjusted estimation of independent risk factors. Furthermore, the reported wound-classification categories do not account for three of the 858 analysed patients, and the procedure-specific SSI percentages require reconciliation with the overall total of 56 SSI cases before they are used for detailed comparative inference. These limitations do not invalidate the overall 56/858 SSI estimate but restrict the strength of subgroup and causal interpretations.

Overall, the findings demonstrate a clinically important burden of SSI among adults undergoing elective surgery in the participating Balochistan surgical services, accompanied by microbiologically confirmed infection, longer hospitalization, rehospitalization, and extensive perioperative antibiotic exposure. Continued surveillance should emphasize consistent postoperative case ascertainment, microbiological monitoring, accurate wound and procedure classification, and evaluation of compliance with evidence-based antimicrobial prophylaxis. Future multicentre prospective surveillance using standardized postoperative follow-up and patient-level multivariable analysis would allow more precise identification of modifiable factors associated with SSI and better distinguish differences attributable to case mix from those related to perioperative practice.

CONCLUSION

Surgical site infection occurred in 56 of 858 patients undergoing selected elective surgical procedures, corresponding to an observed SSI proportion of 6.5%, with Staphylococcus aureus and Escherichia coli representing the predominant cultured organisms. SSI was associated with substantially longer hospitalization and frequent rehospitalization, indicating an important clinical and resource burden within the participating surgical services in Balochistan. The extensive perioperative and postoperative use of antibiotics further highlights the relevance of standardized surgical prophylaxis and antimicrobial stewardship. These findings support continued local SSI surveillance, microbiological monitoring, and adherence to evidence-based infection-prevention practices while avoiding generalization of the observed rate to the entire Pakistani surgical population.

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