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Original Research Article

Surgical Site Infections

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Abstract

Background: Surgical Site Infections (SSIs) cause most of the illnesses linked to healthcare. Also, it's a big reason why people get sick after surgery, have to stay in the hospital longer, and need more expensive medical care. Even though surgery and ways to avoid getting infections have gotten better, SSIs are still an issue of concern, especially in poor countries.

Materials and Methods: At a territory care hospital, this retrospective observational study was done over the course of one year, from January 2025 to December 2025. Medical records of 100 patients were reviewed who had clean or clean-contaminated operations was made. Data were retrieved regarding demographic characteristics, comorbidities, type and duration of surgery, antibiotic prophylaxis as well as post-operative outcomes. SSI were diagnosed and graded according to the criteria established by Centers for Disease Control and Prevention (CDC). Statistical analysis was done by SPSS and a $p<0.05$ was regarded as significant.

Results: Overall, 18% had SSI with superficial incisional (11%), deep incisional (5%) and organ/space (2%). Important risk factors were diabetes mellitus ($p = 0.01$), obesity ($p = 0.03$), extended surgery duration greater than two to four hours, emergency operation and improper antibiotic prophylaxis order. Staphylococcus aureus was the most common pathogen identified. SSI patients were also maintained with significantly longer hospital stay and reoperation rate.

Conclusion: SSIs continue to be a significant postoperative morbidity for which there are identifiable and modifiable risk factors. Better surveillance and prevention of infections are measures in place to stop infections. This can be done by making antibiotic prophylaxis more effective or by monitoring patients after surgery. Both of these things help to lower SSIs and make patients feel better.

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Introduction

SSI is one of the most regular healthcare related diseases [1]. It is still a major cause of illness and death after surgery around the world. As per the U.S. CDC SSI is an infection that develops at or near a surgical incision site within 30 days of surgery (or one year, if an implant is left in place). SSIs are divided into three occurrences: superficial incisional SSI, in which the infection occurs within the skin and subcutaneous tissue layers; deep incisional SSI, affecting deeper soft tissues including fascia or muscle; and organ or space SSI, occurring in an anatomical site opened during surgery [2]. The World Health Organization (WHO) has adopted the same classification guidelines, underscoring the need to standardize surveillance and diagnosis of SSIs across health-care delivery settings. Worldwide SSIs are a significant portion of the hospital acquired infections [3]. The incidence of SSI differs substantially by geographical location, type of surgery, and healthcare system [4]. SSI incidence is 2%-5% of all surgical procedures in developed countries, where improved infection control and surveillance practices widely are implemented [5,6]. However, the incidence can be significantly higher from 10-20% or even more in developing and low-income countries. Lack of resources, overcrowded hospitals, inadequate sterilization processes and poor adherence to infection prevention standards are a few of the reasons contributing to the disparity [7,8]. SSI is the most commonly recorded healthcare-associated infection in low- and middle-income countries and an effective preventive strategy is desperately required [9]. SSIs have big effects on health, increasing morbidity and keeping them in the hospital longer. SSIs are linked to patients' wounds not healing properly and pain. These patients may need more surgery, like debridement the wound or reoperation. SSIs can sometimes cause sepsis, organ failure, and death. After SSI, complications can make hospital stays longer by 7 to 10 days on average and cost a lot because of longer drug treatments, more diagnostic tests, and use of intensive care [10]. SSI has a big effect on patients' quality of life and may be linked to long-term problems. It also has a financial effect on healthcare systems.

There are many risk factors for the incidence of SSIs. Patient factors such as elderly age, diabetes mellitus, obesity, malnutrition and smoking as well as immunosuppression all of which impair wound healing and immune defense [11,12]. Procedure-associated factors such as prolonged operative time, emergency procedures, ineffective preoperative skin preparation, inappropriate antibiotic prophylaxis and failure to adhere to aseptic technique are also important. Operating theatre type, surgical team adherence to infection control practices and postoperative wound management are also important hospital factors associated with SSI rates. Although advancements in surgery and infection control have been made, SSIs still represent one of the most challenge complications, particularly in developing countries. Local data in many hospitals for the incidence, risk factors and microbial profile of SSIs. Community-specific epidemiology of SSIs is critical to implement risk-adapted preventive measures and to optimise patient outcomes.

Objectives

1. To determine the frequency of SSIs in patients operated on during study period.
2. To determine the patient and operative risk factors of SSIs.
3. To evaluate clinical outcomes, such as length of hospital stay, secondary therapy requirements and postoperative complications for patients with an SSI.

Materials and Methods

Study Design: This study retrospectively assesses the incidence of SSIs, classifies related risk factors, and observes their clinical outcomes. Clinical and demographic data were obtained by reviewing patients' medical records. The use of a retrospective study design enabled us to evaluate the available data in a defined time period and investigate SSI trends without influencing patient management.

Study Setting and Duration: The research was conducted at a university-based tertiary care surgical facility, where surgery is performed in all subspecialties. It is a referral hospital and the patient population is large and heterogeneous. Data were compiled over a one-year study period, January 2025 to December 2025, to secure an appropriate sample size and include varying surgical modalities.

Study Population: The study sample included those who underwent operations during the study time frame. It was included all patients submitted to clean and clean-contaminated surgeries, since they are more frequently related to SSIs, which allows standardization comparisons. People who already had SSIs, those who were having contaminated or dirty surgeries, and immunocompromised patients (like those on long-term steroids or known immune-deficiency diseases) were not included. These groups might be more likely to get infections. This was completed to make it more comparable and decrease the number of factors that could complicate the results. This is to minimise the dissimilarity between patients and reduce potentially confounding factors.

Sample Size: All medical record on the 100 patients were considered in deciding who was eligible for participation. A consecutive sampling technique was used all consenting and eligible patients who met the inclusion criteria within the time limit were included. This approach minimized selection bias and maximized sample representativeness.

Data Collection: Information was retrieved from patient medical records, operation notes and postoperative follow-up documents in a structured data collection form. Pre-operative data collected included statistical account of age and sex, nature of the surgical procedures performed, duration of the surgical procedure and details of the preoperative antibacterial prophylaxis.

Concomitant illnesses including diabetes mellitus, hypertension and obesity were also noted. The postoperative follow-up data were collected within first 30 days after surgery regarding the occurrence of SSIs and its associated complications.

Ethical Considerations: Following permission from the Institutional Ethical Committee, the study was carried out. The informed consent process was not used for this study because it was a retrospective study based on patient information. Privacy and confidentiality of the patients was highly respected using special numbers and identification codes instead of personal profile information.

Statistical Analysis: Data was analyzed by means of SPSS. Descriptive statistics were used to describe the demographic and clinical variables, reported as mean ± standard deviation and frequencies (n) and percentages (%). To analyse risk factors for the presence of an SSI, inductive statistics (logistic regression and chi-squared test) were used. Statistical significance was considered as $P < 0.05$.

Results

Demographic Characteristics: Patients undergoing clean or clean-contaminated surgery were analyzed at study time. The mean age of the subjects was 45.6 ± 14.2 years and majority aged ranged between 31-50 years (42%). 75 (58%) men and 55 (42%) women participated.

Regarding other comorbidities, 28% of patients had diabetes, 22% hypertension and 18% were obese (BMI ≥30 kg/m²). 15% of patients had comorbidities, which means they had more than one disease.

Table 1: Demographic and Clinical Characteristics (n = 100)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	58	58%
Female	42	42%
Age Group (years)		
18–30	20	20%
31–50	42	42%
51–70	30	30%
>70	8	8%
Comorbidities		
Diabetes Mellitus	28	28%
Hypertension	22	22%
Obesity	18	18%

Incidence of Surgical Site Infection: Among 100 patients, 18 of them had surgical site infections and overall incidence of SSI was found to be 18%. Among these, SSI of superficial incision was highest in proportion (11%) followed by deep incisional SSI (5%) and organ/space SSI (2%).

Table 2: Distribution of Surgical Site Infections (n = 100)

Type of SSI	Frequency (n)	Percentage (%)
Superficial Incisional	11	11%
Deep Incisional	5	5%
Organ/Space	2	2%
Total SSI Cases	18	18%

Risk Factors Associated with SSI: SSI was significantly associated with diabetes mellitus (p = 0.01) and obesity (p = 0.03). Longer operations, over 2 hours were accompanied by a higher infection rate (25%) compared to procedures of less than 2 hours duration (10%). There was higher prevalence of SSI in emergency operations (24%) than elective surgeries (14%). In addition, inappropriate timing of antibiotic prophylaxis (either administration before or after incision) was linked to higher SSI rates (27%) compared with appropriate timing (12%).

Microbiological Profile: Culture and susceptibility results were available for all 18 cases of SSI. Staphylococcus aureus (44%) was the most commonly isolated organism, followed by Escherichia coli (28%) and Pseudomonas aeruginosa (17%). Methicillin-resistant Staphylococcus aureus (MRSA) was found in 3 patients. The Gram-negative strains showed moderate resistance for the third-generation cephalosporins, and there were sensitive of most isolated strains to carbapenems and vancomycin.

Table 4: Microbiological Isolates in SSI Cases (n = 18)

Organism	Frequency (n)	Percentage (%)
Staphylococcus aureus	8	44%
E. coli	5	28%
Pseudomonas aeruginosa	3	17%
Others	2	11%

Clinical Outcomes: The patients who developed SSI had a longer hospital stay, with a mean length of 14.2 ± 4.6 days than those without an SSI (mean of 7.5 ± 2.3, $p < 0.001$). Four patients (4%) who experienced SSI required reoperation. There was one (1%) death in a patient with organ/space SSI who developed sepsis. Overall, SSI were correlated with higher morbidity, longer length of hospital stays and more need for surgical intervention.

Discussion

This retrospective study of 100 surgical patients, the general incidence of SSI was 18%, and that of superficial incisional (11%), deep incisional (5%)

and organ/space (2%). SSI was significantly associated with diabetes mellitus, obesity, prolonged operative time, emergency surgery and inappropriate timing of antibiotic prophylaxis. S. aureus, E. coli, and P. aeruginosa were the most common pathogens isolated with remarkable pattern of antimicrobial resistance. Clinically, SSIs complications included prolonged hospitalization, reoperations and one mortality was noted.

Comparison with Previous Literature: The 18% SSI rate noted in our cohort is higher than that reported from many high-income countries but similar to rates reported from tertiary care centers in low- and middle-income settings. [13,14] generally demonstrate the presentation of SSI in 2–5% following clean and clean-contaminated surgeries due to strong infection control measures as well as perioperative protocols. [15] have reported rates ranging from 10% to 25%, due to differences in health care infrastructure, resource availability or clincial characteristics of the patient population. These estimates are similar to this study on SSI rate and illustrate the high prevalence of SSIs in resource-limited settings.

Interpretation of Risk Factors: In this study, several patient- and procedure-related risk factors were statistically related to the occurrence of SSI. Prolonged duration of surgery demonstrated to be the most crucial risk factor, due to increased tissue exposure, prolonged microbial contamination, longer infection times and surgeon fatigue.

Diabetes mellitus played a key role as inadequate glycemic control affects wound healing and causes an immunodeficiency. Obesity led to a significant increase in the risk of SSI, perhaps due to poor tissue perfusion, extended operation time, and technical difficulty during surgery. SSIs of emergency surgeries were higher than those of elective procedures, which can be due to lack of preoperative preparation and more contamination. Improper timing for prophylactic antibiotics also significantly contributed to the risk of SSIs in this study, emphasizing the significance of adherence to guideline-based administration methods regarding antibiotic use.

Microbiological Trends: On microbiological analysis, Staphylococcus aureus was the most common pathogen isolated similar to reports of various national and international studies. Gram-negative bacteria including Escherichia coli or Pseudomonas aeruginosa were also common negative isolated organisms, especially for deep and organ/space infections. The resistance to frequently used antibiotics raises concern for the increasing problem of antimicrobial resistance. The resistance to common antibiotics shown, expose reasons for concern about antimicrobial resistance. Augmented susceptibility to higher-end antibiotics highlights the importance of judicious use of antibiotic as an attempt to avoid multidrug-resistant strains, and to preserve antimicrobial efficiency.

Strengths and Limitations: The strength of this study is the SSI were consistently defined clinical and microbiological data. Nevertheless, there are certain limitations that need to be acknowledged. Study was from single unit and the sample size might be small. It is possible that the retrospective study design and short follow-up length resulted in underestimation of late SSIs. These results will have to confirmed within further multicenter prospective studies with longer follow-up.

Conclusion

The researchers looked at 100 patients who underwent surgery and found that 18 percent had an SSI. The most frequent was superficial incisional infections. Diabetes, obesity, a long surgery duration, an emergency versus elective procedure and failure to receive proper antibiotic therapy were the major risk factors. SSIs were found to be related to longer hospital stays and increased treatments.

This serves as evidence of the extent to which they are altering the efficacy and utilization of health services. These results underscore the necessity of comprehensive prevention strategies that include rigorous hand hygiene, effective antibiotic protection, and ongoing monitoring following surgery. Targeted treatments that deal with risk factors that can be changed and it can help lower the incidence of SSI and improve patient safety. Increased attention to SSI rates and participation of the surgical team are essential for making sustainable progress.

Recommendations

According to the results of this study, hospitals should reinforce their policies on infection control by the enforcement of aseptic surgical technicalities and standard perioperative protocols. General infection prevention and specific antibiotic stewardship policies should be taught to surgical staff on an annual basis. Post-exposure prophylactic antibiotics after surgical intervention should be promptly administered. Continuous SSI surveillance and periodic audit can contribute to early detection and prevention of infection.

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