

Prevalence and Associated Factors Surgical Site Infections Among Adult Patients Admitted in Hargeisa Group Hospital

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ABSTRACT

Aim

Surgical site infections (SSIs) are a common and significant complication following surgery. This study aimed to evaluate the prevalence of SSIs, investigate associated risk factors and comorbidities, and assess the impact of antibiotics on their occurrence among patients treated at Hargeisa Group Hospital.

Methods

Conducted as a cross-sectional study at Hargeisa Group Hospital, Somaliland, 113 patients were selected randomly from 314 surgical cases between May 1 and July 31, 2022. Data analysis was performed using SPSS software.

Results

Among the 97 patients included, 50 were female (51.5%) and 47 were male (48.5%). The prevalence of SSIs was 27% (26 patients). Among these, 65% (17 patients) had superficial infections, 23% (6 patients) had deep infections, and 3 patients experienced organ space infections. The study identified a significant relationship between health status and SSIs, with ASA II patients showing a prevalence of 23.1% compared to 50% in ASA I patients. Diabetes was the most frequent comorbidity, observed in 6 (23.1%) SSI patients compared to 10 (14.1%) non-SSI patients. Antibiotic prophylaxis was provided to 18 (69.2%) of SSI patients, while 21 (29.6%) of non-SSI patients did not receive antibiotics, with a statistically significant p-value of 0.001.

Conclusions

SSIs remain a prevalent issue globally. This study identified a 27% prevalence rate, with diabetes as the most common comorbidity in affected patients.

Keywords

Surgical site infection; prevalence; comorbidity

INTRODUCTION

Surgical site infections (SSI's) remain one of the leading causes of hospital-acquired infections, with rates rising from 2.5% to 41.9% globally¹. In Africa, SSIs occur at a higher rate of 5.6 per 100 surgical procedures, a figure significantly greater than in developed countries². In Sub-Saharan Africa, various study results have shown

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that the rate of SSI ranges from 11 to 18%³. SSI's are associated with significant morbidity, sometimes fatal outcomes, health care costs, patient dissatisfaction and prolonged hospitalization⁴. An infection occurring at the surgical incision or within an organ or cavity within 30 days post-surgery is defined as an SSI. SSIs classified into superficial, deep, and organ-space infections⁵.

Research evidence reported from different settings has shown that several factors contribute to SSIs, including a pre-existing comorbid condition, age, duration of surgery, anemia, nutritional deficiencies, inappropriate wound care during and after surgery, and inappropriate antibiotic prophylaxis⁶.

Although SSI's are preventable, they continue to pose a serious financial burden due to prolonged postoperative hospitalization, additional surgical procedures, treatment in intensive care units and high mortality^{7,8}. Prevention of SSI's is a multifactorial process that starts preoperatively and continues until postoperative care and is based on good operating room rules, administrative process and quality improvement practices of a multidisciplinary team⁷.

In Somaliland, despite advancements in surgical techniques and infection prevention measures, multiple challenges, including limited resources and systemic inefficiencies, contribute to higher SSI rates.

The purpose of this research is to assess the prevalence of SSIs in patients at Hargeisa Group Hospital, explore associated risk factors and comorbidities, and examine the relationship between antibiotic use and SSIs.

METHODS

This study utilized a cross-sectional design and was carried out at Hargeisa Group Hospital, Somaliland, involving 113 patients randomly selected from 314 surgical cases performed between May 1 and July 31, 2022.

The study included adult surgical patients aged 18 to 90 years admitted for clean surgical procedures through outpatient or emergency services. Patients with soft tissue infections such as cellulitis or necrotizing fasciitis, those undergoing radiation therapy, and individuals diagnosed with HIV/AIDS were excluded from the study. Due to these criteria, 26 patients were excluded and the study was conducted with 97 patients. The classification and prevalence of surgical site infections among the cases analyzed in this study are

presented in Figure 1.

All procedures followed ethical guidelines consistent with the principles outlined in the 1964 Helsinki Declaration and its subsequent amendments. The study received approval from the Institutional Review Board (IRB) under reference number HGH/0.1/6409/22. Informed consent was obtained from all individuals who participated in the research. The manuscript's final version was prepared and submitted with the agreement of all contributing authors.

The study utilized a systematic random sampling method to select participants. Data collection was conducted using an adapted WHO-standardized tool, which was integrated into the Kobo Toolbox application. Information was gathered by reviewing postoperative patient records over a three-month timeframe and analyzed using SPSS software.

The data were analyzed using SPSS, with descriptive statistics presented as frequencies and percentages. To evaluate proportional differences between the SSI and non-SSI groups across the variables studied, a Chi-square test was employed. Statistical significance was determined at a p-value threshold of ≤ 0.05 .

RESULTS

The characteristics of the patients and the incidence of SSI are presented in Table 1. SSIs were mostly seen in surgical patients aged 18-30 years and 51 years and older (26.9% and 46.2%, respectively). However, no significant statistical difference was found between age and surgical site infections (p value=0.830). Surgical site infections were seen in 13 female (26%) and 13 male patients (27.6%) and no statistical difference was found between gender and surgical site infections (p value=0.840). In this study, we observed that the prevalence of surgical site infections among adults was 27% (Figure 1).

Table 2 presents the findings related to the National Nosocomial Infections Surveillance (NNIS) Risk Index factors associated with SSIs. Surgical site infections were seen in most of the surgical patients with mild systemic disease, severe systemic disease and insufficient systemic disease (23.1%, 23.1% and 3.8%, respectively) and a statistical difference was found between ASA and surgical site infections (p value= <0.001).

Surgical site infections were seen in most of the semi-

elective, emergency and urgent surgery patients (30.8%, 23.1% and 23.1%, respectively) and a statistically significant difference was identified between the urgency of the operation and surgical site infections (p value=0.02). In terms of the duration of the operation, surgical site infections were seen in most patients (34.6% and 11.5%, respectively) whose operation lasted 90 to 119 minutes and 120 minutes or more (16.9% and 2.8%, respectively), and a statistical relationship was found between the duration of the operation and surgical site infections ($p=0.039$). Most of the patients with clean-contaminated controlled, contaminated controlled or dirty infected wounds (34.6%, 30.8% and 7.7%, respectively) had surgical site infection. A statistical association was found between surgical wound class and surgical site infection (p value= <0.001).

Comorbidities associated with SSI's are shown in Table 3. When evaluated in terms of comorbid diseases, SSI was identified in 6 patients with diabetes (37.5%), whereas no statistically significant differences were detected in the other groups

Data on antibiotic use and SSI's are shown in Table 4. Surgical site infection was observed in 18 (69.2%) of the surgical patients who required antibiotics and were given antibiotics, whereas no surgical site infection was observed in 21 (29.6%) of the patients who were not given antibiotics.

DISCUSSION

SSI's are a condition that causes prolonged postoperative hospital stay, increases the rate of re-hospitalization, delays return to the hospital, and increases the cost based on the type of surgery performed and the severity of the infection, reoperation, special care and surgery and drug treatment expenses⁹.

The wound classification system that we used is a highly effective tool to predict SSI after surgical intervention, and necessary preoperative preparations and prophylactic drug use can be planned according to this arrangement. In this context, surgical procedures are classified into four categories based on wound type: dirty wounds, contaminated wounds, clean-contaminated wounds, and clean wounds¹⁰. In our study, SSI's were higher among patients with dirty infected wounds, contaminated controlled wounds, and clean-contaminated controlled wounds. Our findings are similar to those of a previous study showing that

SSI rates were 3 times higher in patients who underwent contaminated and dirty operations^{11,12}.

Surgical site infections can result from various contributing factors. Patient-related risk factors include pre-existing infections, malnutrition, obesity, low serum albumin levels, advanced age, smoking, and immune deficiencies. Surgery-related factors that increase SSI risk include dirty or emergency procedures, prolonged surgeries, improper sterilization, inadequate instrument usage, and insufficient antiseptic preparation of the surgical site. Additional conditions that predispose patients to a higher frequency of SSIs include multiple traumas, hemodynamic instability, shock, significant blood transfusions during surgery, and postoperative complications such as hypothermia, hypoxia, and hyperglycemia¹³.

The prevalence of SSI's varies according to the procedure and risk category¹⁴. In our study group, the prevalence of surgical site infections was notably high, reaching 27%. Our results are similar to surgical site infection rates ranging between 8-30% reported in the literature for low middle income countries¹⁵. ASA II, III and IV/V categories increase the likelihood of SSI by 52%, 134% and 89%, respectively, compared with ASA I¹⁶.

The relevance of ASA category may also play a crucial role in the prevention of SSI in the patient¹⁶. Most of the patients in our study group had normal health status (84.5%), but the incidence of SSI' was higher in patients with mild or severe systemic disease according to the American Society of Anesthesia scoring system. Our findings align with those of previous studies, which demonstrate that surgical patients with mild, severe, or systemic disease classified as incompetent according to the ASA classification have a higher risk of SSIs compared to those categorized as normal and healthy. It is possible that mild, severe and incompetent systemic diseases affect immunity and thus patients with wounds are more likely to develop surgical site infections.

An increased incidence of surgical site infections was also observed in surgeries categorized as semi-elective, urgent, or emergent. Our findings are similar to those of previous studies showing a higher incidence of SSI in emergency surgeries^{12,15}. It is possible that the preparation time for these surgeries is short, thus there is insufficient time to mobilize the necessary surgical materials and ensure compliance with aseptic technique precautions such as standard gowning, scrubbing,

gloving, preparing and covering patient skin. Patients are therefore likely to be exposed to pathogens and at increased risk of SSI's.

Research evidence reported from different settings has shown that several factors contribute to SSI's including a pre-existing comorbid condition, age, duration of surgery, anemia, nutritional deficiencies, inappropriate wound care during and after surgery, and inappropriate antibiotic prophylaxis⁶.

The most prevalent comorbidities in our study were obesity, followed by hypertension. Similar to a 2013 study conducted in the UK, high BMI, tobacco use, chronic hypertension, leukocytosis, anemia, and extended surgical duration was associated with a higher risk of incisional infection. A study in the United States also identified obesity, diabetes, and hypertension as significant risk factors for SSIs. In Mexico, diabetes, hypertension, and immune thrombocytopenia were linked to SSI rates of 6.9%, 4.1%, and 1.3%, respectively. Among the participants in our study, 5.3% had some form of cancer, which is lower than the 17.1% prevalence reported in a 2016 study by Vargas et al. in Mexico City. Additionally, nearly 12.8% of these patients were rehospitalized due to SSIs, making SSI the leading cause of rehospitalization in this population¹⁷.

Chronic conditions such as diabetes, heart disease, and renal failure are linked to an increased likelihood of developing SSIs compared to patients without these conditions. Diabetes, in particular, is thought to impair host defenses by reducing leukocyte mobilization, chemotaxis, and phagocytic activity, which predisposes individuals to SSIs^{6,18,19}. In our study, diabetes emerged as the most common condition linked to SSIs. This finding is consistent with previous research, which suggests that diabetes may independently increase the risk of surgical site infections.

Our study showed that SSI's are also common among surgical patients requiring and receiving antibiotics, a result that has also been reported in other studies²⁰. Drug resistance is possible; therefore, surgical site infections continue to develop in patients despite the administration of antibiotics as prophylaxis.

CONCLUSION

SSI's continue to be a serious problem worldwide. In this study, the prevalence of surgical site infection was 27% and diabetes was the main comorbid disease

in the majority of patients undergoing surgery. We recommend conducting further assessments of the prevalence of surgical site infections and the related contributing factors across all hospitals in Somaliland. This will help improve the overall health outcomes for surgical patients and enhance the quality of care for those admitted for surgery. We believe that meticulous application of preoperative asepsis-antisepsis rules, taking necessary precautions against comorbid conditions, prophylactic use of appropriate antibiotics in patients with indications and appropriate wound care after surgery will reduce surgical site infections.

STATEMENT OF ETHICS

All procedures performed were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards, and ethics committee approval was obtained from Ministry of Health Development and Hargeisa Group Hospital to conduct the hospital. Informed consent was obtained from all individual participants included in the study. Each author hereby acknowledges that the final state of this manuscript is prepared and sent with his/her approval having been taken.

DISCLOSURE STATEMENT

The corresponding author and all co-authors declare that there are no conflicts of interest. The authors also affirm that this manuscript is not under simultaneous consideration by any other journal or electronic publication and has not been published elsewhere. All authors have adhered to and read the requirements outlined in the Instructions to Authors.

FUNDING SOURCES

The corresponding author and all co-authors declare that no source of funding exists, and that they have no direct or indirect commercial financial incentive associated with publishing this article.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

Adnan Sayid Abdo: Project development, protocol

development, literature search, data collection and management, data analysis, manuscript writing/editing, critical revision, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Orhan Alimoglu: Project development, protocol development, data collection and management, critical

revision, final approval of the version to be published, agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Table 1. Sociodemographic Factors and Surgical Site Infections

Variable	Surgical Site Infection n=26	No Surgical Site Infection n=71	P value
Age			
18 to 30 years	7 (26.9%)	17 (23.9%)	0.830
31 to 50 years	12 (46.2%)	38 (53.5%)	
51 and above years	7 (26.9%)	16 (22.5%)	
Sex			
Female	13 (50.0%)	37 (52.1%)	0.84
Male	13 (50.0%)	34(47.9%)	

Table 2. National Nosocomial Infections Surveillance Risk Index Factors Associated with Surgical Site Infections

Variable	Surgical Site Infection, n=26	No Surgical Site Infection, n=71	P value
ASA			
Normal healthy person (Category 1)	13 (50.0%)	60 (84.5%)	<0.001
Mild systemic disease (Category 2)	6 (23.1%)	11 (15.5%)	
Severe systemic disease (Category 3)	6 (23.1%)	0 (0.0%)	
Incapacitating systemic disease (Category 4)	1 (3.8%)	0 (0.0%)	
Urgency of Surgery			
Elective	6 (23.1%)	41 (57.7%)	0.020
Semi-elective	8 (30.8%)	11(15.5%)	
Urgent	6 (23.1%)	11(15.5%)	
Emergency	6 (23.1%)	8 (11.3%)	
Duration of Surgery			
30-59 minutes	1 (3.8%)	11 (15.5%)	0.039
60-89 minutes	13 (50.0%)	46 (64.8%)	
90-119 minutes	9 (34.6%)	12 (16.9%)	
120 and above minutes	3 (11.5%)	2 (2.8%)	

Variable	Surgical Site Infection, n=26	No Surgical Site Infection, n=71	P value
Surgical Wound Class			
Clean	7 (26.9%)	48 (67.6%)	0.001
Clean-contaminated controlled	9 (34.6%)	16 (22.5%)	
Contaminated uncontrolled	8 (30.8%)	5 (7.0%)	
Dirty infected	2 (7.7%)	2 (2.8%)	

Table 3. Association between Comorbidities and Surgical Site Infections

Variable	Surgical Site Infection n=26	No Surgical Site Infection n=71	P value
Comorbidities			
Diabetes	6 (23.1%)	10 (14.1%)	0.005
Heart diseases	0 (0.0%)	1 (1.4%)	
Renal failure	0 (0.0%)	1 (1.4%)	
Renal failure and Heart disease	1 (1.4%)	0 (0.0%)	
Others*	7 (26.9%)	4 (5.6%)	
No Comorbidities	12 (46.2%)	55 (77.5%)	

*patients received chemotherapy, radiation and those who have cancers and malnutrition

Table 4. Antibiotics Use and Surgical Site Infections

Variable	Surgical Site Infection n=26	No Surgical Site Infection n=71	P value
Antibiotic given			
Required and given	18 (69.2%)	21 (29.6%)	0.001
Required and not given	1 (3.8%)	2 (2.8%)	
No prophylaxis required	7 (26.9%)	48 (67.6%)	

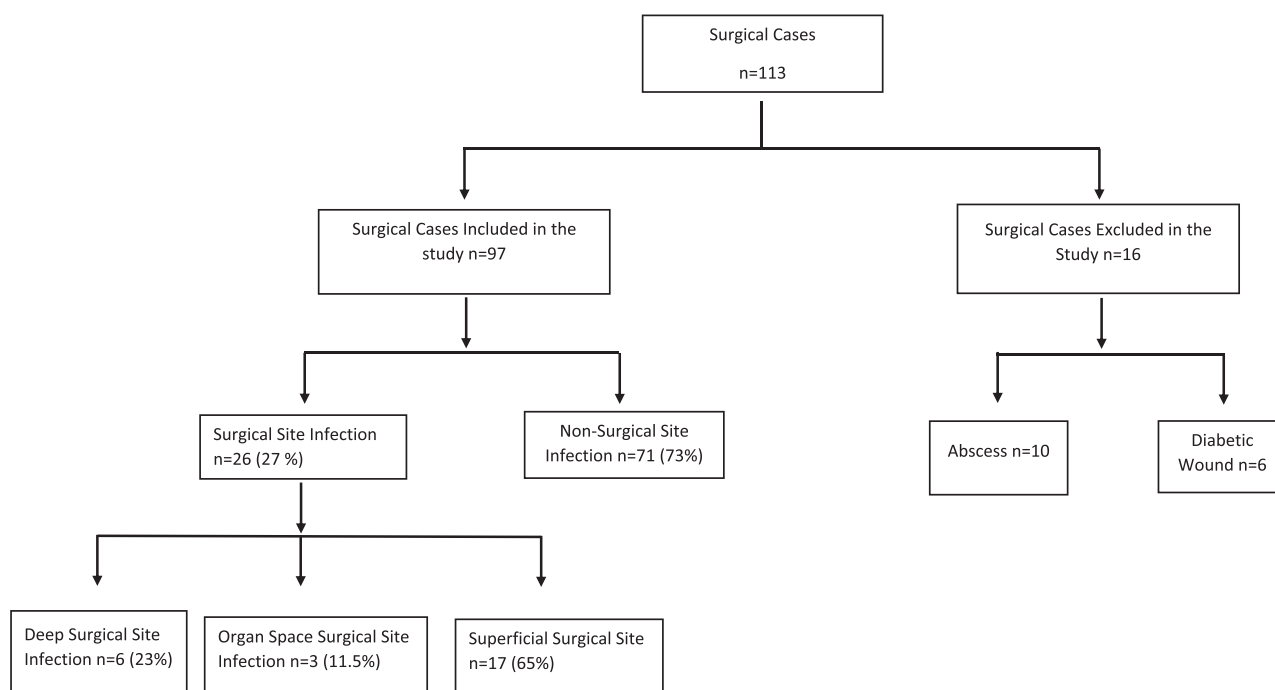


Figure 1. Flow chart of surgical cases included in the study with type of surgical site infection and the prevalence of surgical site infection

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