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Risk Factors of Surgical Site Infections among Post-Operative Patients at FortPortal Regional Referral Hospital

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ABSTRACT

This study aimed at establishing the risk factors of surgical site infections among post-operative patients at Fort Portal Regional Referral Hospital. This was a cross-sectional and analytical study of 129 people operated on during the period of April – June 2022. Logistic regression was used to study the factors associated with surgical site infections. The associations between the dependent variable and the other variables were assessed by the odds ratio (OR) followed by their 95% confidence interval. The prevalence of surgical site infections was 7.81% CI 95% = (5.12–10.51). The factorslinked to the surgical site infections in the studied population were the patient and post admissionmethod [OR = 2.74; 95% CI = (1.08–6.95)] and the length of the postoperative stay [OR = 8.75; 95% CI = (2.83–26.98)]. The PI and direct observation identified health care system dysfunctions,medical errors, patient monitoring and financial unavailability as factors that could favor the onsetof surgical site infections. Interventions should be focused on the factors identified for the effective management of operated patients.
Keywords: Infections, surgical site and medical errors

INTRODUCTION

Surgical site infection (SSI) is an infection that develops within 30 days after an operation or within one year if an implant was placed, and the infection appears to be related to the surgery [1-4].

SSIs remain a major cause of morbidity and death among the operated patients and continue to represent about a fifth of all healthcare-associated infections [5, 6]. Although at least 5% of patients develop an SSI after surgery, these infections seem to cause remarkably little concern, remaining largely unreported in the media [7].

Despite improvements in operating room practices, instrument sterilization methods, better surgical technique and the best efforts of infection prevention strategies, surgical site infections remain a major cause of hospital-acquired infections and rates are increasing globally even in hospitals with most modern facilities and standard protocols of preoperative preparation and antibiotic prophylaxis. Moreover, in developing countries where resources are limited, even basic life-saving operations, such as appendectomies and cesarean sections, are associated with high infection rates and mortality [8–10].

Surgical site infections (SSIs) are real risks associated with any surgical procedure and represent a significant burden contributing to morbidity and mortality, and increased cost to health servicesaround the world [11, 12].

In the United States, between 500,000 and 750,000 SSIs occur annually [13]. According to the guidelines of the U.S. Centers for Disease Control and Prevention (CDC), more than 30 million operations are done each year at U.S. hospitals. Reported rates of SSI range from 2% to 3%, but these figures probably underestimate the true rate. Infections may total three-fourths of a million annually, two-thirds of which are limited to the incision [14].

A few retrospective studies in Nepal, a developing country in Asia have suggested the prevalencerate of SSI to be 4%–7% for all kinds of operation. Prospective studies of the incidence and risk factors for SSI in Nepalese hospitals are generally lacking [15].

In Tanzania, several recent studies done had shown an upward trend in the occurrence of

SSI. A report from Tanzania shows the rate to be 19.4 percent [16].

In Uganda, data about SSI is still scarce and the true incidence and cost per patient is unknown. SSIs are classified as being either incisional or organ/space. Incisional SSIs are divided into thoseinvolving only skin and subcutaneous tissue (superficial incisional SSI), and those involvingdeeper soft tissues of the incision (deep incisional SSI) [17].

The National Nosocomial Infection Surveillance study identified wound class, American Societyof Anesthesiologists (ASA) Physical Status Classification, and prolonged operative time as risk factors for SSI. However, increasing emphasis has been given more recently, to systemic factors such as age, gender, lifestyle, and coexisting morbidities, which are considered determinants in the pathogenesis of SSIs [18].

Patients who develop a SSI require significantly more medical care. If an SSI occurs, a patient is 60 percent more likely to spend time in the ICU after surgery than is an uninfected surgical patient and the development of a SSI increases the hospital length of stay by a median of two weeks [19].

The risk of SSIs continues after discharge. SSIs develop in almost 2 percent of patients after discharge from the hospital and these patients are two to five times as likely to be readmitted to the hospital. In 2012, major operations contributed more than 43% of the total surgical operationsin FRRH [17]. Most of these patients are at risk of getting SSIs postoperatively because of the nature of their disease pre operatively, surgical aseptic technique and underlying comorbidities among others.

METHODOLOGY

Study design

The research was of descriptive prospective cohort study [20] where the participants were followed upfor a maximum period of 30 days post operatively. It is during this time that the outcome of interest will be documented.

Study area

The study was conducted in Fort Portal Regional Referral Hospital (FRRH) commonly Buhinga Hospital in the surgical department.

Study population

Study population was all patients admitted to Fort Portal Regional Referral Hospital and had undergone surgery and those who had previous surgery at FRRH and are readmitted with wound sepsis within 30 days post operation.

Inclusion criteria

- Patients consenting to participate in the study
- Patients who undergo surgical operation and are admitted to the ward and those dischargedimmediately after operation and return within 7- 14 days for stitch removal.

Exclusion criteria

The exclusion criteria include;

- Patients transferred or referred to FRRH with sepsis as a complication of a previous surgerydone from other health units.
- Voluntary withdraws from the study.
- Patients who never consented to participate in the study

Sample size determination

The sample size was calculated using the probability sampling formula below:By [21] i.e.

N= (pq $Z^{2)}$/d^2

Where, n = sample size, when the population size is greater than 10,000.

z = Standard normal deviation, i.e. 1.96, set at 95% confidence level. p = proportion of patients with surgical site infection

q = 1- p

d = Desired degree of accuracy

If the value of p = 16.4 % [22]

$n = z^2 p (1- p) / d^2$

$= 1.96^2 \times 0.164(1- 0.164) / 0.05^2$

= 129

When the population was found to be less than 1000 people, the sample adjusting formula wasapplied. Ie. [23] formulae can be used.

Sampling procedures

Consecutive sampling technique was used to sample the study participants whereby a patient coming in and meets the inclusion criteria will be enrolled into the study.

Data collection methods and management

A full history and physical examination were carried out by the principal investigator or his research assistants on all study participants to identify any preexisting co morbidities, time of exposure to disease, demographics among others. The surgical sites were examined with a naked eye from the 2nd postoperative day and daily until date of discharge for pain, redness, warmth, and swelling or purulent discharge at the incision site.

Presence of Surgical site infection was established using the U.S. Centers for Disease Control and Prevention criteria for Surgical Site Infection.

1. Isolation of a microorganism in the culture of the fluid drained
2. Purulent discharge from the incision, a deep area, or organ/space
3. At least one of the following: excessive pain or tenderness to touch or pressure or localized inflammation (heat, redness, and swelling) extending beyond expected period of wound inflammation.
4. Abscess on images like abdominal or chest radiographs or surgical revision (re laparotomy) Each patient will be followed up from the time of admission until time of the discharge and 30 days postoperatively.

Patients who were discharged soon after their surgery had their wounds inspected at the time of stitch removal at the seventh to the tenth postoperative day for signs of infections like pus dischargeor exudates and afterwards followed up weekly to the 30th post-operative day

A semi structured questionnaires was used to collect data from the study participants.

Data analysis

Analyzed data was presented in tables and figures showing frequencies and proportions. Univariate analysis will be done for continuous variables to report measures of central tendency like mean, median and mode and measures of dispersion like the range, interquartile range and measures of variance like standard deviation for various independent variables.

For categorical variables, data presentation will be through well summarized “2 by 2” tables that show frequencies (percentages) and totals.

For continuous and categorical data, bar graphs, histograms, pie charts will be used where suited to present the data.

Data analysis was performed using STATA software version 11. In order to describe the main study variables, we first used frequency for the qualitative variables and mean, median, and standard deviation (along with interquartile range) for the quantitative variables. Then, using logistic regression in a bivariate fashion, we examined the relationship between each independent variable and the likelihood of surgical site infections at a 20% level. The variables that in bivariateanalysis had a p-value of less than 20% were then added to a stepwise descending multivariate regression model. The final model only contained variables with a p-value of 5% after gradually removing variables with a p-value of 5%. The odds ratio (OR) and its 95% confidence interval (CI) were used to evaluate the relationships between the dependent variable and the independent variables. If the p-value is above the 5% threshold, the final model is suitable.

Ethical considerations

1. The permission to conduct this study was sought from Kampala International University Research Ethics Committee, Institution Review Committee and Fort Portal Regional Referral Hospital. The study was be granted an ethical clearance certificate.
2. Participants to be enrolled were requested to sign consent after thorough explanation of purpose of the study, risks involved and use of data to be collected [24].

Numbers instead of names were in all the questionnaires and laboratory form.

RESULTS

The operated patients ranged in age from 3 years to 89 years, with an average age of 49. Of the patients studied, 53.1% of individuals who underwent surgery as a group were admitted to the FRRH. With a male/female sex ratio of 4.26, men were the more prevalent sex. The majority of applicants (84.6%) came from within, making this way of admission the most representative. 124of the 129 patients who underwent surgery had previously planned the procedure. More than half of patients who underwent surgery had no additional chronic pathology to the surgical condition, and 80.6% were still receiving antibiotic therapy. Only 9.6% of patients with the surgical illness had an acute pathology as shown in Table 1 and Figure 1.

Figure 1: Column graph showing Sociodemographic characteristics and clinical data of those operated at FRRH

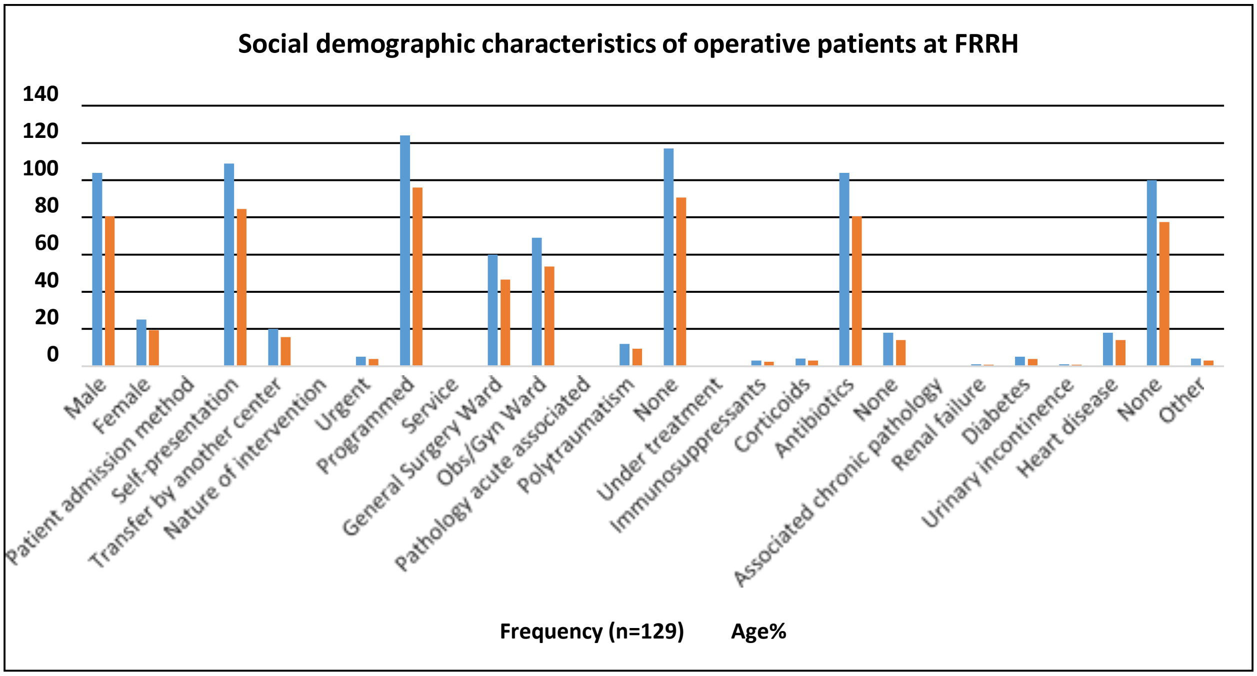


Table 1: Sociodemographic characteristics and clinical data of those operated at FRRH

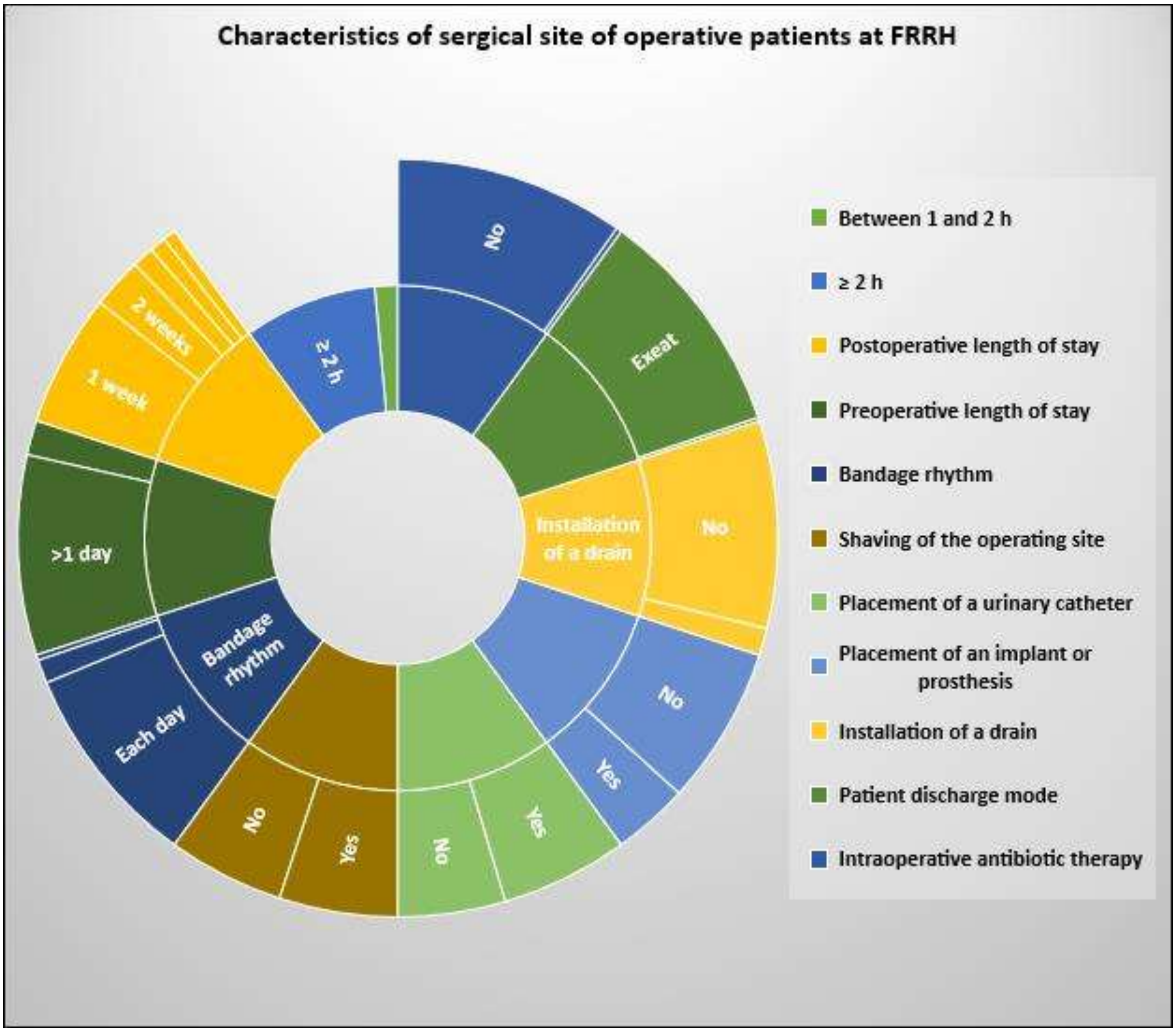
Variables	Frequency (N=129)	Percentage (age%)
Sex		
Male	104	80.6
Female	25	19.4
Patient admission method		
Self-presentation	109	84.5
Transfer by another center	20	15.5
Nature of intervention		
Urgent	5	3.9
Programmed	124	96.1
Service		
General Surgery Ward	60	46.5
Obs/Gyn Ward	69	53.5
Pathology acute associated		
Polytraumatism	12	9.3
None	117	90.7
Under treatment		
Immunosuppressants	3	2.3
Corticoids	4	3.1
Antibiotics	104	80.6
None	18	14.0
Associated chronic pathology		
Renal failure	1	0.8
Diabetes	5	3.9
Urinary incontinence	1	0.8
Heart disease	18	14.0
None	100	77.5
Other	4	3.1

Of the patients studied, 85.1% of patients had surgeries that lasted more than two hours. A postoperative stay of one week was required for more than half of the patients (56.9%). In 87.9% of the patients who underwent surgery, the dressing was changed daily. In 50.26% of instances, the operation field was shaved. 208 surgical patients had their bladders catheterized; 125 had implants placed; and 45 had drains. In 98.7% of situations, the patient discharge procedure worked perfectly. 97.8% of the patients who had surgery did not receive intraoperative antibiotic treatmentas shown in Table 2 and Figure 2.

Table 2: Characteristics related to the surgical site in those operated on at FRRH

Variables	Frequency (n=129)	Percentage (%)
Duration of intervention		
Between 1 and 2 h	19	**14.7**
≥ 2 h	110	**85.3**
Postoperative length of stay		
1 week	73	**56.6**
2 weeks	28	**21.7**
3 weeks	12	**9.3**
4 weeks	7	**5.4**
≥5 weeks	9	**7.0**
Preoperative length of stay		
1 day	19	**14.7**
>1 day	110	**85.3**
Bandage rhythm		
Each day	113	**87.6**
1 day of 2	13	**10.1**
1 day of 4	3	**2.3**
Shaving of the operating site		
No	64	**49.6**
Yes	65	**50.4**
Placement of a urinary catheter		
Yes	70	**54.3**
No	59	**45.7**
Placement of an implant or prosthesis		
No	87	**67.4**
Yes	42	**32.6**
Installation of a drain		
No	114	**88.4**
Yes	15	**11.6**
Patient discharge mode		
Dead	2	**1.6**
Exeat	127	**98.5**
Intraoperative antibiotic therapy		
No	126	**97.7**
Yes	**3**	**2.3**

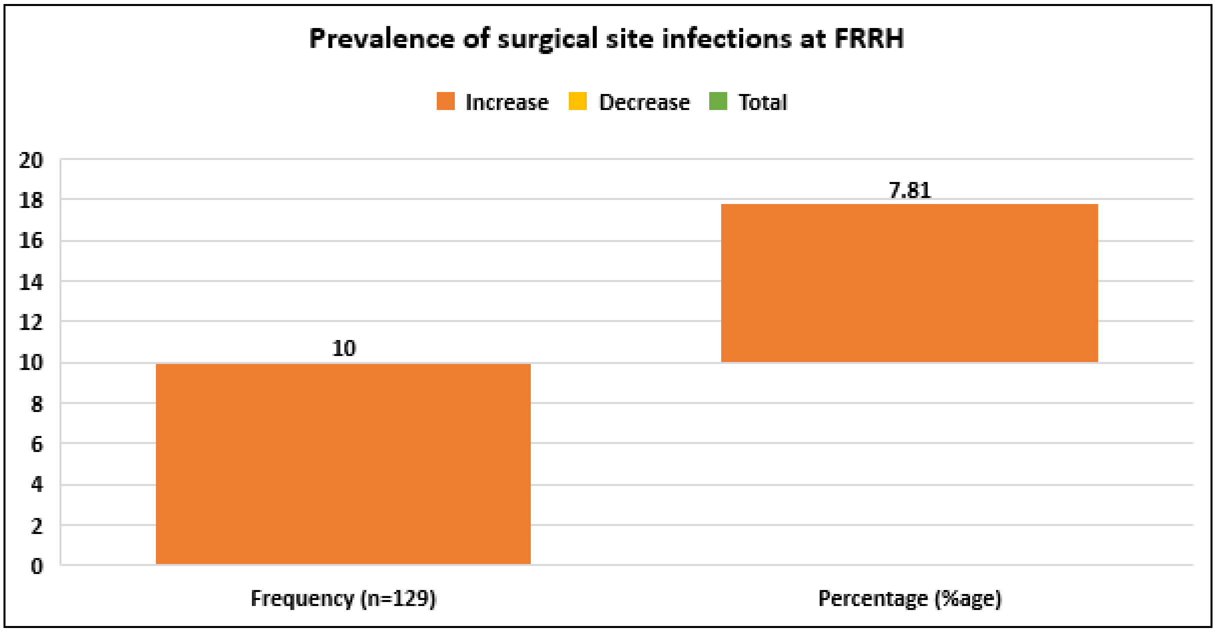
Figure 2: Sunburst graph showing characteristics related to the surgical site in those operated on at FRRH



In 69.6% of instances, there was fluid discharge in addition to the illness. In 87.5% of infected cases, the skin and subcutaneous tissue above the aponeurosis were the most severely afflicted organs. Pain and swelling were the most often cited local infection symptoms among people whounderwent surgery.

Among the 129 operated, 10 developed an infection of the surgical site (7.8%), 95% CI = (5.12- 10.51) as shown in Figure 3.

Figure 3: Waterfall column graph showing prevalence of surgical site infections at FRRH



Patient age, patient admission technique, and department all had a substantial impact on the likelihood of surgical site infection. When the other factors were taken into consideration, patients over the age of 60 had a higher risk [OR = 19.17; 95% CI = (10.25-35.85)] of developing an infection at the surgical site than patients under the age of 30. Patients who were moved from other centers had a higher risk of developing a surgical site infection than patients who arrived at their own facility (OR = 3.11; 95% CI= (1.37-7.04). Surgery patients hospitalized in orthopedic traumawere more likely than those operated on in urology to develop an infection at the surgical site [OR = 2.59; 95% CI = (1.12-5.99)] as presented in Table 3.

Table 3: Relationship between the infection of the surgical site, the socio-demographic characteristics and the clinical data of those operated on at FRRH

Variables	OR	Confidence interval	*p*-Value
Age			
<30 years	1	-	
30–60 years	5.48	(2.40–12.52)	0.000*
>60 years	19.17	(10.25–35.85)	0.000*
Sex			
Male	1	-	
Female	1.94	(0.84–4.43)	0.115
Profession			
Officials	1		
Housewife	4.81	(0.85–27.09)	0.074
Farmers	2.52	(0.22–27.72)	0.449
Students	2.40	(0.45–12.87)	0.304
Trader	1.02	(0.39–5.16)	0.585
Patient admission method			
Self-presentation	1	-	
Transfer by another center	3.11	(1.37–7.04)	0.006*
Under treatment			
Antibiotics	1	-	
Corticoids	0.70	(0.08–5.89)	0.743
None	0.19	(0.01–3.49)	0.226
Service			
General Surgery Ward	1	-	
Obs/Gyn Ward	2.59	(1.12–5.99)	0.025*
Pathology acute associated			
Polytraumatism	1	-	
None	0.04	(0.01–1.09)	0.944

*Significant.

The length of the preoperative stay, the technique of patient discharge, the location of the urine catheter, the rate of dressing, and the time spent performing the surgery were not significantly associated with surgical site infection. A surgical site infection was 2.52 times more likely to occur in patients who did not shave the surgical site prior to surgery than in those who did [OR = 2.52; 95% CI = (1.12-5.67)]. In our study, the patient used a BIC razor to shave in the operating room on the day of the procedure after settling in. Patients who underwent urgent surgery had a surgicalsite infection 1.20 times more frequently than patients who underwent scheduled surgery [OR = 1.20; 95% CI = (1.01-4.10)]. Patients who stayed for at least three weeks were at a higher risk of getting sick. When all other factors were taken into consideration, patients who stayed in the postoperative period for more than 5 weeks were 8.55 times more likely than those who stayed for less than a week to develop an infection at the surgical site [OR = 8.55; 95% CI = (2.81-26.02)] aspresented in Table 4.

Table 4: Relationship between the infection of the surgical site and the characteristics linked to the care of the operated on at FRRH

Variables	OR	Confidence interval	*P*-Value
Exit mode			
Healed	1	-	
Exited	0.12	(0.01–1.15)	0.512
Shaving of the operating site			
Shaving of the operating site	1	-	
No shaving of the operating site	2.52	(1.12–5.67)	0.025*
Nature of intervention			
Programmed	1	-	
Urgent	1.20	(1.01–4.10)	0.000*
Urinary catheter			
No urinary catheter	1	-	
Presence of urinary catheter	0.83	(0.41–1.67)	0.601
Preoperative length of stay			
1 day	1	-	
>1 day	1.04	(0.01–1.10)	0.656
Postoperative length of stay			
1 week	1	-	
2 weeks	0.86	(0.22–3.28)	0.829
3 weeks	4.07	(1.26–13.17)	0.019*
4 weeks	6.01	(1.63–22.20)	0.007*
≥5 weeks	8.55	(2.81–26.02)	0.000*
Bandage rhythm			
Each day	1	-	
1 day of 2	1.04	(0.03–2.52)	0.232
1 day of 4	1.09	(0.05–5.85)	0.661
Duration of intervention			
Between 1 and 2 h	1	-	
≥2 h	1.03	(0.01–2.03)	0.190

*Significant.

When confounders were controlled in a multivariate in model, only patients transferred from other centers [OR = 2.74; 95% CI = (1.08-6.95)] and a 5-week postoperative stay [OR = 8.75; 95% CI = (2.83-26.98)] were found to be independent predictors of the occurrence of SSI after the introduction of the independent variables significantly associated with the occurrence of SSI. In fact, after accounting for the other factors in the model, it was shown that patients who were transported by another facility had a 2.74 times higher risk of developing an infection at the operating site than those who arrived independently. Adjusted for the other variables in the model, patients who had a postoperative length of stay of 5 weeks and more were 8.75 times more likelyto have a surgical site infection than those who had a 1-week length of stay while taking into account the other variables as presented in Table 5.

Table 5: Variables associated with infection of the surgical site at FRRH

Variables	OR	Confidence interval	*P*-value
Patient admission method			
Self-presentation	1	–	
Transfer by another center	2.74	(1.08–6.95)	0.034*
Duration of postoperative stay			
1 week	1	–	
2 weeks	0.79	(0.20–3.06)	0.743
3 weeks	3.55	(1.07–11.75)	0.037*
4 weeks	4.70	(1.22–18.11)	0.024*
≥5 weeks	8.75	(2.83–26.98)	0.000*

DISCUSSION

The prevalence of infection of the surgical site FRRH was 7.81%. This way lower than reported in some studies. For example, in a study on surgical wound infections at the Ouidah zone hospital in 2008 reported a prevalence of 22.8%, which is higher than that of our study. This difference could be explained by the fact that his study was carried out at the lowest level of the health pyramid where the technical platform is failing [7].

The prevalence reported in a study conducted in 2018 at the CNHU-HKM in the University Trauma Clinic was 9.59%, which was higher than the results from our study. The efforts made ininfection prevention and control at the hospital level may help to explain this [25].

Another study reported that 19.1% of SSIs in general and visceral surgery and 14.8% in orthopedics are common in Tunisia. These prevalences are higher than those found in our study, and the difference may be due to the relatively larger sample size of their study [26].

In another study in Tunisia, according to a report, digestive surgery patients had an infection prevalence of 3.53%, which is much lower than the results of our study. The prevalence of SSIs found in the current study is much lower than the 46% found at CHU HASSAN II in Fez [27].

In this study, patients under the age of 60 had a higher risk of developing a surgical site infectionthan patients between the ages of 30 and 60. This outcome was consistent with a study from Ethiopia of a similar setting like FRRH [28].

Our study's findings showed that there was no statistically significant link between gender and surgical site infections. This outcome supports research from Mbarara Regional Referral Hospital (MRRH) that found an association between. This may be understood by the fact that all of the patients who underwent surgery at the Traumatology-Orthopedics and Reconstructive Surgery Clinics of MRRH were men [22].

The high percentage of men in our sample may be responsible for the significant association between surgical site infection and the inpatient department in our study. In our study, there was no correlation between the current therapy and acute pathology in the patients who underwent surgery (p = 0.94), which could be attributed to a preoperative assessment that was either insufficient or, in some cases, nonexistent due to the need to rule out other causes before surgery. In our study, patients without ongoing care were 0.19 times more likely than those receiving antibiotics to develop a surgical site infection [29].

The operative risk is influenced by shaving before surgery as well. In our study, patients who did not shave their surgical site before surgery had a higher risk of getting an infection at the surgical site. In our study, the patient used a BIC razor to shave in the operating room on the day of the procedure after settling in. This was consistent with the findings of other studies [30].

The operative risk is influenced by shaving before surgery as well. In our study, patients who did not shave their surgical site before surgery had a higher risk of getting an infection at the surgical site. In our study, the patient used a BIC razor to shave in the operating room on the day of the procedure after settling in. This was consistent with the findings of other studies. The risk of site infection increases with the length of the postoperative stay. Thus, as reported by several authors in their studies, we discovered in our study that patients who stayed in the postoperative period for 5 weeks or longer were more likely to develop an infection at the surgical site than those who stayed for only one week [19, 31].

Over a two-hour operation seems to pose a particularly high risk of surgical site infection. The risk of an operation lasting more than two hours was 1.03 in our study. This increased risk is attributed to a number of factors, including an increase in wound contamination, intensification of surgical trauma, an increase in the number of sutures, an increase in blood loss, and a decrease in the effectiveness of prophylactic antibiotics. This outcome is in line with what other studies have found [32, 33].

Apart from the presence of other risk factors, a prolonged preoperative stay would raise the risk of infection. In our research, there was no correlation between the length of the preoperative stay and surgical site infection [19]. However, this association has been cited as significant in some studies and in the literature. The difficulty in determining the date of admission prior to the operative act in our study may be the cause of this discrepancy [34].

Previous studies' literature clearly identifies the factors we identified as risk factors, including the patient's mode of admission and the length of postoperative stay [18, 35, 36, 32, 37].

There is a need for ongoing staff training on nosocomial infections in order to strengthen their understanding of the risk infectious, according to interviews conducted with the staff of the university clinics of traumatology, orthopedics, and urology of the FRRH. Despite the Hospital Hygiene Clinic and the Committee for the Fight against Nosocomial Infections (CLIN) building staff capacity, there is still much to be done to increase nursing staff awareness of the prevention and control of infections. Knowing the perspectives, expertise, and behaviors of patients and caregivers would have been fascinating and more accurately reflect the setting in which the operated person works [32, 38, 22, 37].

Other research had suggested that using sterile gloves and washing hands in between dressings would greatly lower the incidence of nosocomial infections. Most of our hospitals and health facilities don't operate consistently like this [28, 32, 37].

CONCLUSION

Infections at surgical sites are still a significant public health issue in Uganda today. 10 of the 129 (7.81%) patients who underwent surgery at FRRH experienced surgical site infection. The identified factors primarily focused on the patient's current treatment, the type of wound, the associated chronic pathology, the mode of admission, the profession, the department, and the mode of discharge of the patient, as well as the shaving of the operating site and the rhythm of the bandage. We also emphasized the need for staff training on surgical site infections given their lack of familiarity with the condition. These findings demonstrate how patient and care factors continue to influence the occurrence of surgical site infections. Because of insufficient hygiene precautions, SSIs were more likely to occur. For a significant improvement in health, it is urgent to invest in the prevention and effective management of these factors.

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