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Incidence and Determinants of Surgical Site Infections in Post-Operative Patients within the Surgical Ward at Fort Portal Regional Referral Hospital

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ABSTRACT

Surgical site infections (SSIs) are a significant post-operative complication globally, contributing to 38.8% of cases. However, the prevalence and associated factors of SSI at Fort Portal Regional Referral Hospital (FRRH) remained unknown, prompting this study. We collected socio-demographic, preoperative, intraoperative, and postoperative data from 210 systematically selected patient files using a pretested checklist questionnaire. Data was analyzed with IBM SPSS version 25.0. The mean participant age was 44.5 years ± 13.2, with a majority of 147 (70.0%) being male. The prevalence of SSI was 9.0%, and significant associations were observed between SSI and age over 51 years (X2=11.009, P=0.011), obesity (X2=12.835, P=0.002), anemia (X2=4.319, P=0.038), and timing of antibiotic prophylaxis (X2=6.902, P=0.032). Compared to developed countries, SSI prevalence at this hospital was higher. Age over 51, obesity, anemia, and postoperative antibiotic initiation were identified as risk factors for SSI. Further nationwide studies are warranted to determine SSI prevalence in Uganda, and establishing a surveillance system for SSI in hospitals is strongly recommended to reduce infection rates, particularly at FRRH.
Keywords: Surgical site infection, Post-operative complications, Patients, Antibiotics, Anaemia.

INTRODUCTION

Surgical site infections (SSIs) are infections of the incision organ or space that occur after surgery typically within 30 days following surgery or within one year following an implant [1]. The Centres for Disease Control (CDC) shows that SSIs continue to be a major cause of morbidity and mortality among postoperative patients and represent about a fifth of all healthcare-associated infections (HAIs) globally [2]. World over, SSIs are one of the most commonly encountered complications after surgery (Dumville et al., 2015). In developed countries, the prevalence of SSIs has been reported to range from 5% to 15% of patients in regular wards and as high as 50% or more of patients in intensive care units (ICUs) [1]. In developing countries, the magnitude of the problem remains mostly underestimated [3, 4]. In a study of the National Healthcare Safety Network (NHSN) involving 850,000 general surgeries performed in the USA, it was found that overall incidence of SSI was 1.9% [1] while in Brazil the incidence of SSI range from 1.4% to 38.8% [5]. SSIs led to grave consequences, including increased costs due to its treatment [6] and increased length of hospital stay [7]. In addition, mortality in patients with SSIs is increased when compared to those who do not develop an infection [8]. The grave consequences suffered by patients who develop SSIs underscore the need for efforts to create more policies for the prevention of this problem. Therefore, identification of risk factors for SSIs can contribute to the early adoption of interventions that aim to minimize this type of postoperative complication. Several risk factors have been reported as predisposing to SSIs. Wound class, duration of Surgery, Body Mass Index (BMI), smoking, blood transfusion, and pre-existing chronic diseases [9, 10, 11, 12] have been highlighted to be associated with SSIs. In Uganda, few studies have been conducted pertaining SSIs among surgical patients. Studies have reported rates of SSI ranging from 9.6%-36.4% [9]. In Fort Portal regional referral hospital, the prevalence of SSIs is not known due to paucity of data. Therefore, this study sought to identify the prevalence and risk factors for SSIs among patients in surgical ward of Fort Portal Regional Referral Hospital (FRRH).

Despite improvements in operating room practices, instrumental 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 [12]. Moreover, in developing countries where resources are limited, even basic life-saving operations, such as appendectomies and caesarean sections, are associated with high infection rates and mortality [13, 14]. There is no doubt that SSIs substantially contribute to prolongation of hospital stay and increase costs. [8] found that the likelihood of death for patients with SSIs was twice that of patients without SSIs. Although the situation of SSIs in Uganda and other East African countries is inadequately documented, few reports available indicate that the situation is not any better [15]. Reports from studies done in Tanzanian and some of the Kenyan hospitals are in harmony that the situation warrants more attention [11, 13]. Despite other overwhelming and relatively severe conditions burdening the patients in resource strained countries like Uganda, it is evidently clear that SSIs is a problem and needs to be attended to [16]. To understand the prevalence and risk factors of SSIs among surgical patients in FRRH, this study was undertaken.

METHODOLOGY

Study design

The study utilized a descriptive cross-sectional study design [17].

Area of Study

The study took place in surgical ward of Fort Portal Regional Referral Hospital. The Hospital lies within the city of Fort Portal, approximately 148kilometres (92 mi), by road, west of Mubende Regional Referral Hospital.[4] This location is approximately 294kilometres (183 mi), west of Mulago National Referral Hospital, in Kampala, Uganda's capital and largest city. The coordinates of the hospital are: 0°39'19.0"N, 30°16'53.0"E (Latitude:0.655278; Longitude:30.281389).

Study population

The study involved patients who had been admitted and operated on in the last six months preceding the study.

Inclusion criteria

i. Patients admitted on surgical ward in the last six months before the study.
ii. Patients operated on.

Exclusion criteria

Admitted but not operated.

Sample size determination

This was determined by using Kish's formula [18] which states that,

$$N = \frac{Z^2(p(1-p))}{\varepsilon^2}$$

Where;

N = the required sample size

p= Proportion of patients with SSIs. A previous study in Mbarara Regional Referral Hospital reported a prevalence of 16.4% [1].

ε = margin of error on p (set at 5%)

z= standard normal deviate corresponding to 95% confidence level (=1.96)

$$N = \frac{1.96^2(0.184(1-0.164))}{0.05^2} = \textbf{approximately, 210.}$$

Sampling technique

The study followed systematic probability sampling method where the researcher used admission register to get the list of all patients who were operated in the last six months. The first patient in the register was picked at random, and then every 5th patient that followed in the register was selected for the study until the required sample was reached.

Data collection methods

This study used a data collection tool (checklist) which collected information from both patient files and theatre register book. The information included demographic characteristics, SSI prevalence, and risk factors [19].

Data Processing and analysis

Collected data was cleaned, coded and entered in SPSS version 25. Categorical factors were summarized and presented in a table of frequencies for uni-variant analysis. A Bivariate regression analysis with Chi-square test was computed to test the relationships. A p-value of ≤0.05 was considered statistically significant.

Quality control

The questionnaire checklist for data collection was pre-tested to ensure that questions were clear and allowed gathering of information needed for the study.

Ethical considerations

Ethical approval was sought from Kampala international university western campus faculty of clinical medicine and granted in form of introduction letter after approval of the proposal. Permission to collect data was sought and granted form the hospital administrator/director [20].

RESULTS

Socio-demographic characteristics of participants

A total of 210 files of patients who had undergone surgery in the past six months preceding the study were reviewed and socio-demographic characteristics are presented in table 1 below. The ages ranged from 19 to 67 with mean age of 44.5 years ±13.2 standard deviation. Majority were males 147 (70.0%), Christians (126 (60%) and were from rural residence 126 (60%).

Table 1: Socio-demographic characteristics of participants

Characteristics	Frequency	Percent
Age (years)		
≤30	42	20.0
31-40	23	11.0
41-50	81	38.6
>51	64	30.5
Gender		
Male	147	70.0
Female	63	30.0
Residence		
Urban	84	40.0
Rural	126	60.0
Education		
Below primary	42	20.0
Primary	84	40.0
Secondary	42	20.0
Tertiary	42	20.0
Occupation		
Casual	63	30.0
Formal employment	42	20.0
Self-employed/business	84	40.0
Unemployed	21	10.0
Religion		
Christian	126	60.0
Muslim	63	30.0
Other	21	10.0

Prevalence of surgical site infection (SSI)

In this study, it was noted that 19 of the total 210 participants developed SSI representing a prevalence of 9.0%. Figure 1.

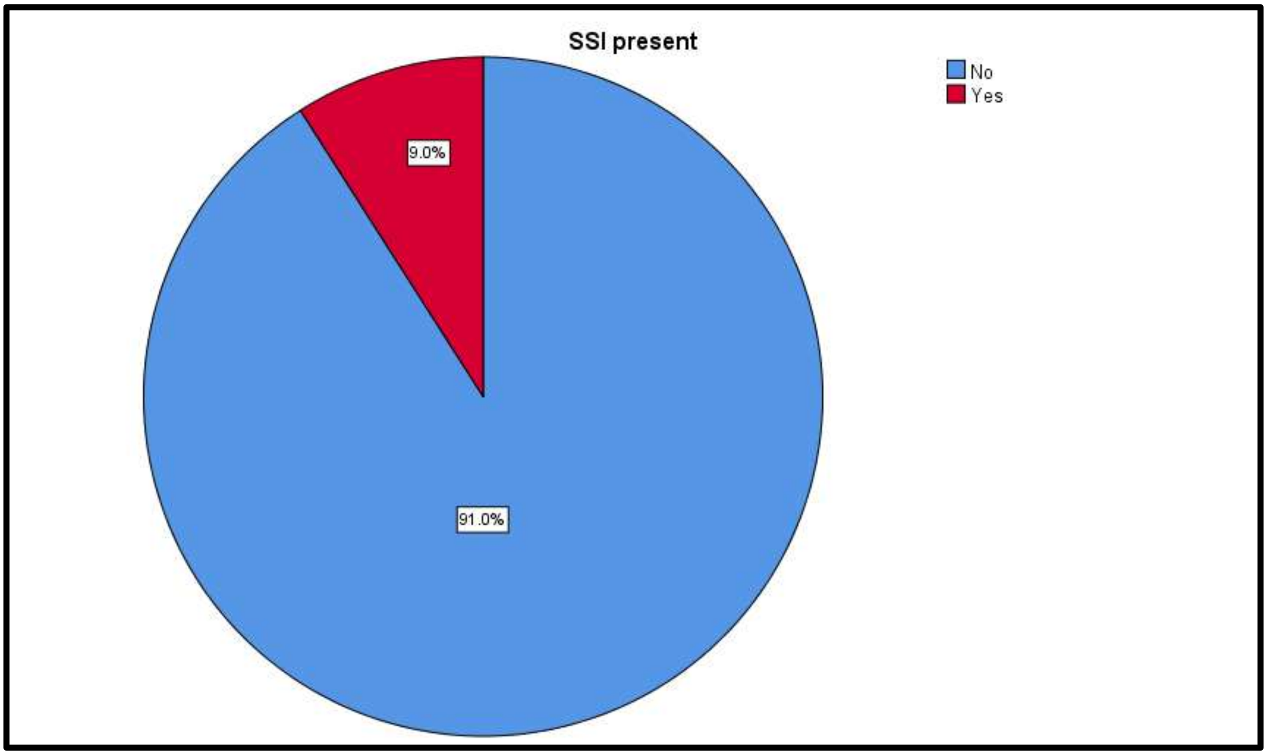

Figure 1: Prevalence of surgical site infection (SSI)

Factors associated with surgical site infections

To establish the factors associated with SSI, chi square analysis was done and results were as shown in table 2 below. Age above 51 years (X^2= 11.009, P=0.011), obesity (X^2=12.835, P=0.002), anemia (X^2 = 4.319, P=0.038), postoperative antibiotics initiation (X^2=6.902, P=0.032) were the only factors significantly associated with SSI.

Table 2: Chi square (X^2) analysis of factors associated with surgical site infection

Variables	STI present		Chi square	P value
	No	Yes	X^2	
Age			11.073	**0.011**
<30	40 (20.9%)	2 (10.5%)		
31-40	21 (11.0%)	2 (10.5%)		
41-50	78 (40.8%)	3 (15.8%)		
>51	52 (27.2%)	12 (63.2%)		
Gender			2.009	0.156
Male	131 (68.6%)	16 (84.2%)		
Female	60 (31.4%)	3 (15.8%)		
Obesity			2.835	**0.002**
No	150 (78.5%)	5 (26.3%)		
Yes	41 (21.5%)	14 (73.7%)		
Chronic disease			1.172	0.279
No	151 (79.1%)	17 (89.5%)		
Yes	40 (20.9%)	2 (10.5%)		
Smoking			1.542	0.119
No	168 (88.0%)	10 (52.6%)		
Yes	23 (12.0%)	9 (47.4%)		
Variables	**STI present**		**Chi square**	**P value**
	No	**Yes**	**X2**	
Alcohol			1.458	0.227
No	136 (71.2%)	11 (57.9%)		
Yes	55 (28.8%)	8 (42.1%)		
Anaemia			4.319	**0.038**
No	165 (86.4%)	6 (31.6%)		
Yes	26 (13.6%)	13 (68.4%)		
Duration of surgery			0.563	0.755
<1 hr	59 (30.9%)	5 (26.3%)		
1-2 hrs.	104 (54.5%)	12 (63.2%)		
>2hrs.	28 (14.7%)	2 (10.5%)		
Nature of surgery			1.420	0.501
Emergency	16 (8.4%)	8 (42.1%)		
Elective	175 (91.6%)	11 (57.9%)		
Type of wound			2.976	0.226
Clean	160 (83.8%)	13 (68.4%)		
Clean contaminated	24 (12.6%)	5 (26.3%)		
Contaminated	7 (3.7%)	1 (5.3%)		
Antibiotics prophylaxis			6.902	**0.032**
Preoperative	14 (7.3%)	3 (15.8%)		
Intraoperative	19 (9.9%)	5 (26.3%)		
Postoperative	158 (82.7%)	11 (57.9%)		

DISCUSSION

Prevalence of surgical site infections

In this study, the prevalence of SSI was 9.0%. This prevalence is lower than that reported in by varies studies in developing countries. For instance, a study in Tanzania reported a prevalence of 26.0% [21] while a study in Ethiopia reported that SSI prevalence was 11.6% [22]. In addition, a study in Mbarara regional referral hospital western Uganda reported an SSI prevalence of 16.4% [1]. The differences in the SSI prevalence rates reported in the current study and above-mentioned studies could be attributed to the differences in the study design and duration of post-surgery follow up. This study was retrospective while these other studies were prospective studies in which patients were followed up for 30 days. In this study, the SSI of 9.0% was based on patients who developed SSI while still in the hospital or reported back to the hospital within 30 days of surgery with signs of SSI. Therefore, it is likely that the prevalence of SSI could have been higher, than the 9.0% reported if the study was prospective and if study participants had been followed up. Perhaps some patients who developed SSI while at home went to other hospitals instead of reporting back to Fort Portal Regional Referral Hospital which have also reduced the number of SSI recorded in this study. Similarly, the SSI prevalence rate in this study is higher than the SSI prevalence reported in developed countries that ranges between 2.5% and 8.2% [23]. The overall SSI rate in USA is about 3% while in UK it is reported to be around 5% [12, 24]. The high standards of health care and technological advances in the developed countries could be a credible explanation to this difference in the SSI rates between this study and those of developed countries. The findings in the present study may reflect inadequate pre and postoperative care and poor sterility during surgical procedures, inadequate infection control due to poor hygiene, resource and structural constraints, and lack of awareness regarding SSI infections.

Factors associated with SSI

In this study, age, obesity, anemia and timing of antibiotics prophylaxis were significantly associated with surgical site infection. Patient's age has long been well-known as an important predictor of the postoperative surgical site infections [11, 23, 25]. In the present study, the risk of SSI was statistically higher in patients above 51 years old (X^2= 11.009, P=0.011) than in other age groups. This finding confirmed previous knowledge that surgeries in elderly patients are associated with higher risk of SSI. Moreover, old age is associated with lowered immunity which partly explains the increased risk of SSI. From this study, there was a significant association between obesity and SSI (X^2=12.835, P=0.002). Similar findings were reported by studies in Benin [26] and USA [27]. Obese individuals are likely to be immunosuppressed due high levels of cortisol hormone which puts then at an increased risk of SSI. This was also confirmed by Rothe and colleagues in their Sub-Saharan Africa study where they reported a 2-fold increased risk to SSI in obese patients [28]. This study found that the level of hemoglobin concentration was significantly associated with SSI (X^2 = 4.319, P=0.038). Anemic patients had a higher risk of getting SSI than those with normal Hemoglobin. This finding concurs with findings in the USA [29]. It is believed that a low hemoglobin concentration creates the risk of SSI through tissue hypoxia which impairs wound healing. In this study, it was found that the timing of prophylactic antibiotics had a significant association with SSI (X^2=6.902, P=0.032). Patients who started receiving antibiotics after surgery had an increased risk of SSI than those who were started pre or intra operatively. In contrast, the study in Tanzania found no difference between the timing of antibiotics and development of SSI [21]. In prevention of SSI, the appropriate use and timing of surgical anti-biotic prophylaxis is very crucial. It is known that, if the prophylaxis is given too soon, the antibiotic levels will fall before the skin incision. If the antibiotic is given too late (i.e., less than 30 minutes before incision), blood and tissue antibiotic levels will be highest just after the period of greatest risk which is the initial phase of surgery [30]. Therefore, it is recommended that antibiotics be given within 30 minutes of start of surgery [1]. When the surgical procedure is prolonged, prophylaxis should be continued beyond one or two doses. Contrary to findings from previous studies [31, 3, 32]. Smoking, alcohol consumption, duration of surgery, nature of surgery and suture material used was not found significant in this study.

CONCLUSION

Based on the findings in this study, the following conclusions are made. The prevalence of SSI among postoperative surgical patients at Fort Portal Regional Referral Hospital is high compared to that in the developed world. However, it was lower and comparable to that in most developing countries. Age above 51 years, being obese, anemic and postoperative antibiotics initiation were the factors that were significantly associated with SSI.

Recommendation

A nationwide study should be done to ascertain the actual prevalence of SSI in Uganda. A surveillance system for SSI in hospitals is highly recommended to reduce the SSI rate in the country and FRRH in particular. Regular nutritional messages should be given to the general population to avoid obesity which puts patients at a high risk of developing SSI.

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