IAA Journal of Scientific Research 10(3):31-40, 2023. ISSN: 2736-7319

Patterns of Surgical Site Infections Among Post Operative Patients at Hoima Regional Referral Hospital

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ABSTRACT

Surgical site infections (SSIs) are the second most common nosocomial infections after urinary tract infections. A study at Hoima Regional Referral Hospital (HRRH) found that 18.9% of patients developed SSIs, with the majority having undergone emergency surgeries. The majority were aged 30-59, males, married, with secondary education, and Anglicans. Symptoms were common for 3-7 days, with HIV as a co-morbidity, BMI 18.5-29.9, non-smokers, and did not take alcohol. Intra-operatively, most patients underwent general anesthesia, had dirty wounds, and had operations lasting 1 hour or less. The incidence rate of SSIs at HRRH is the highest in the country, with patients' factors and intra-operative events being associated with the development of SSIs. This highlights the need for facility-based and national target-specific interventions to curb and control this nosocomial infection.
Keywords: Surgical site infections, post operative patients, nosocomial infection

INTRODUCTION

Surgical Site Infection (SSI) is a type of hospital-acquired infection (HAI) that arises following surgery and it is related to the surgical site [1].Whilst surgical site infection (SSI) has been defined in various ways, the most widely used and accepted definition is the 1992 reclassification and definition by United States of America Centre for Disease Control and Prevention (CDC) which defined SSI as “an infection that occurs after surgery in the part of the body where the surgery took place within 30 days of an operative procedure or within one year if an implant is left in place [2, 3, 4].

SSIs are classified by The Centre for Disease Control (CDC), USA into superficial incisional SSI, deep incisional SSI, and organ/space SSI [5]. Incisional SSIs are divided into those involving skin and subcutaneous tissue (superficial incisional) and those involving deeper soft tissue of surgical incision (deep incisional SSIs). Organ/space SSIs involve any part of the anatomy other than incised body wall layers that were opened or manipulated during an operation [6, 7].

Prior to the introduction of aseptic practices in healthcare system, hospitals were regarded as “gateways to deaths” and dreaded environment where patients care often got complicated by infections. However, following the introduction of aseptic techniques in the late 19th century, discovery of antibiotics, advances in sterilization/disinfection, environmental control measures and other recent advancements in technology, the burden of hospital acquired infections reduced significantly [8, 9, 10].

Despite the numerous preventive measures recommended for its reduction Surgical site infections (SSIs) are the second most common nosocomial (hospital-acquired) infections after urinary tract infections [5] and continue to occur among surgical patients with substantial increase in the cost of healthcare, prolonged hospitalization and jeopardized health outcomes. It is sometimes associated with considerable morbidity and occasional mortality. An approximate of 7–10 additional days on the length of hospital stay has been linked with SSI. Furthermore, an increased relative risk of death and readmission for patients with SSI compared to uninfected patients have been documented [11].

These patients incur higher cost because of longer hospitalizations, more nursing care, additional wound care, potential readmission to the hospital, and further surgical procedures [12, 13, 14, 15] For example in the United States, SSI is found to be a serious complication with an incidence of 2 to 5% in patients undergoing surgery complicating approximately 300,000 to 500,000 surgeries per year and costing the health-care system upward of $1.6 billion [1].

The incidence of SSIs varies widely across countries and surgical procedures; however, it is estimated to occur in at least 2% of surgeries. In low- and middle-income countries (LMIC), SSI incidence may be approximately up to 4 times higher than in high-income countries. In sub-Saharan Africa, various study results showed that SSI rate is higher than in developed counties with incidences ranging from 11 to 18% [1].

These findings reflect a lack of adequate postoperative care and failure to maintain sterility during surgical procedures, inadequate infection control due to poor hygiene, resource and structural constraints, and lack of awareness regarding nosocomial infections among the general population and furthermore technological advances in infection control like use of high-efficiency particulate air (HEPA) filters in theaters to reduce bacterial loads are still lacking in the African setting and this in part may contribute to the high incidence of SSI. Therefore, the high standards of health care in the developed countries remain as the most credible explanation to this difference in the rates of infection observed [12].

SSIs are related to type of operation, wound classification, volume of blood loss, blood transfusion, ASA score before operation, risk index, operative duration, diabetes, use of a gastrointestinal or urinary catheter, postoperative drainage, preprocedural WBC, suggesting that all patients having any type of operative procedure should be monitored for potential triggers of SSI in routine clinical practice [16, 17] as well as obesity, altered nutrition, smoking, and neoplastic diseases, and advanced age [18].

METHODOLOGY

Study design

The research used a descriptive prospective cohort study design where the participants were followed up for a maximum period of 30 days post operatively [19]. It was during this time that the outcome of interest was documented.

Study area

The study was conducted in Hoima Regional Referral Hospital in the surgical department.

Study population

Study population will be all patients admitted to Hoima Regional Referral Hospital and have under gone surgery and those who had previous surgery at HRRH 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 discharged immediately after operation and return within 7- 14 days for stitch removal.

Exclusion criteria

The exclusion criteria will include

- Patients transferred or referred to HRRH with sepsis as a complication of a previous surgery done from other health units.
- Voluntary withdraw from the study.
- Patients who will not have consented to participate in the study

Sample size determination

The sample size was calculated using the probability sampling formula below:

By [20],

$N = (pqZ^2)/d^2$

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 margin of error (5%)
If the value of p = 16.4 % [12]
$n = z^2 p (1- p) / d^2$
$= 1.96^2 \times 0.164(1- 0.164) / 0.05^2$
N = 129
However due to unforeseen factors including COVID-19 pandemic, **111 patients** (86% of the sample size) were studied.

Sampling procedures

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

Data analysis

Data was coded and entered in IBM SPSS version 20 for analysis. Analyzed data was presented in form of tables and figures showing frequencies and proportions. Further analysis of data involved cross-tabulation of the independent variables against the dependent variable (Surgical Site Infection) to reveal the proportions of which had the condition.

Ethical considerations

The permission to conduct this study was sought from Kampala International University Research Ethics Committee, Institution Review Committee and Hoima Regional Referral Hospital.
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 [21]. Numbers instead of names were used in all the questionnaires and laboratory forms.

RESULTS

Out of the 111 sampled patients, 21 (18.9%) developed Surgical Site Infection (SSI) while the remaining 90 (81.1%) acquired full recovery. The most common form of SSI was a deep incisional type (12) followed by those who developed organ/space infections (8) and the minority developed superficial type (1). During the time of data collection, the most common type of surgery was emergency operations (70.3%) whereas only 29.7% were elective. Of those who developed SSIs, still majority (14) were those who underwent emergency operation as illustrated in table 1 below.

Table 1: pattern of SSIs among patients at HRRH

VARIABLE	RESPONSES, N= 111		
	Response	**n/N**	**(%) of N**
Developed SSI	Yes	21	**18.9**
	No	90	81.1

		Developed SSI		
VARIABLE		**YES, n**	**NO, n**	**TOTAL, (%)**
Type of surgery				
	Emergency	14	64	**78 (70.3)**
	Elective	7	26	33 (29.7)
	Total	21	90	
Type of SSI developed				**n/21, (%)**
	Superficial incisional	1	0	1 (4.8)
	Deep incisional	12	0	**12 (57.1)**
	Organ/space	8	0	8 (38.1)

Source: Patients' data

Considering their socio-demographics, majority of the patients were aged 40-59 (34.2%), followed by those between 30-39 years (29.7%), 20-29years (20.7%), < 20years (10.8%) and lastly 60 years or more (4.5%). There were more male patients (65) than females (46). Most patients were married (37.8%) followed by those who were divorced/separated (32.4%) and then the singles (29.7%). Majority of the patients had attained primary level education (45), followed by secondary (40), tertiary (18) and then those who didn't have formal education (8). The patients were Anglicans (37), Moslems (32), Catholics (29), SDAs (9), and Born Again (4) in that order. Regarding medical history and examination, out of the 111, majority (42) had had the

symptoms for 3-7days before seeking medical intervention while 35, 23 and11 had the symptoms for less than 3 days, 8-14 days and over 2 weeks respectively. Most patients didn't have co-morbidities (51.4%) however among those who had other conditions; majority had HIV/AIDS (28.8%). 53 (47.7%) patients had a normal body mass index while the majority were neither smoking (86.5%) nor taking alcohol (77.5%) as seen in table 2 below.

Table 2: showing patient factors contributing to SSIs among patients at HRRH

VARIABLE	DEVELOPED SSI		
	Yes, n	**No, n**	**Total, (%)**
SOCIO-DEMOGRAPHIC FACTORS			
Age			
<20 yrs	3	9	12 (10.8)
20-29	5	18	23 (20.7)
30-39	6	27	33 (29.7)
40-59	6	32	**38 (34.2)**
60 years and more	1	4	5 (4.5)
Sex			
Male	12	53	**65 (58.6)**
Female	9	37	46 (41.4)
Marital Status			
Single	6	27	33 (29.7)
Married	10	32	**42 (37.8)**
Separated/Divorced	5	31	36 (32.4)
Level of Education			
None	3	5	8 (7.2)
Primary	5	40	**45 (40.5)**
Secondary	9	31	40 (36.0)
Tertiary	4	14	18 (16.2)
Religion			
Anglican	8	29	**37 (33.3)**
Catholic	7	22	29 (26.1)
Moslem	5	27	32 (28.8)
SDA	0	9	9 (8.1)
Born Again	1	3	4 (3.6)
MEDICAL HISTORY AND EXAMINATION			
Duration with symptoms			
Within 72 hours	4	31	35 (31.5)
3 – 7days	10	32	**42 (37.8)**
8 – 14 days	4	19	23 (20.7)
15 days or more	3	8	11 (9.9)
Other co-morbidities			
Diabetes	3	5	8 (7.2)
HIV/AIDS	7	25	32 (28.8)
Heart and/or vascular disease	3	7	10 (9.0)
Thyroid disease	0	1	1 (0.9)
Others	1	2	3 (2.7)
None	7	50	**57 (51.4)**
Body Mass Index (kg/m2)			
<18.5	3	7	10 (9.0)
18.5 – 24.9	8	45	**53 (47.7)**
25 – 29.9	8	25	33 (29.7)
30 – 34.9	1	11	12 (10.8)
35 and more	1	2	3 (2.7)
Current or past smoking			

	Yes	2	13	15 (13.5)
	No	19	77	**96 (86.5)**
Current or past alcohol intake				
	Yes	7	18	25 (22.5)
	No	14	72	**86 (77.5)**

Source: Patients' data

From table 3 below, majority (43.2%) of the patients were operated between 6 -11 hours after admission, followed by those operated after 12 – 24 hours (25.2%), more than 24 hours (21.6%) and then those within less than 6 hours (9.9%). The big percentage (80.2%) of the patients was clinically stable before operation. Almost all (98.2%) patients received pre-op prophylaxis before operation. Using the ASA scoring system for eligibility for anesthesia, majority fell under score 1 (55), followed by those in score 2 (37) and then score 3 (19).

Table 3: showing pre-operative factors associated with SSIs

VARIABLE	DEVELOPED SSI		
	Yes, n	**No, n**	**Total, (%)**
PRE-OP FACTORS			
Interval between admission and operation			
< 6hours	2	9	11 (9.9)
6 – 11 hours	11	37	**48 (43.2)**
12 – 24 hours	5	23	28 (25.2)
>1day	3	21	24 (21.6)
Pre-op patient clinical stability			
Stable	17	72	**89 (80.2)**
Unstable	4	18	22 (19.8)
Pre-op antibiotics prophylaxis			
Received	21	88	**109 (98.2)**
Didn't receive	0	2	2 (1.8)
ASA Score			
1	13	42	**55 (49.5)**
2	3	34	37 (33.3)
3	5	14	19 (17.1)

Source: Patients' data

Considering intra-operative events, for most of the patients it was iodine (52.3%) that was used as a skin prep solution, followed those where chlorohexidine (44.1%) was used and then where other solutions (3.6%) were applied. Majority (44.1%) of the patients were given general anesthesia while 36.9% received spinal and 18.9% received local. The majority of the wound were classified as clean (43), followed by dirty ones (36), contaminated (23), and clean contaminated (9). In 85.6% of the patients, the surgical site was not shaved and it was only in 14.4% where the surgical site was shaved. Most operations (49.5%) were conducted by senior house officers (SHOs), followed by surgeons (30.6%) and then Interns (19.9%). Majority of the operations were laparatomies (55), followed by others operations (44) and then Amputation procedures (12). Most operations (57.7%) took 1 hour or less followed by those which lasted 2 – 4 hours (32.4%) and then those which lasted over 4 hours (9.9%). Almost all (97.3%) skin suturing was done by non-absorbable sutures. The majority (89.2%) of the wounds were closed using interrupted suturing technique while only 10.8% were closed using the continuous technique. In majority (79) of the patients, post-operation drains were not used with only 32 patients where the drains were utilized as illustrated in table 4 below.

Table 4: showing Intra-op factors associated with SSIs

VARIABLE	DEVELOPED SSI		
	Yes, n	No, n	Total, (%)
INTRA-OP FACTORS			
Skin Prep Solution			
Chlorohexidine	10	39	49 (44.1)
Iodine	11	47	**58 (52.3)**
Others	0	4	4 (3.6)
Type of anesthesia			
Local	5	16	21 (18.9)
Spinal	7	34	41 (36.9)
General	9	40	**49 (44.1)**
Wound Classification			
Clean	6	37	**43 (38.7)**
Clean Contaminated	2	7	9 (8.1)
Contaminated	6	17	23 (20.7)
Dirty	7	29	36 (32.4)
Was Surgical Site Shaved			
Yes	3	13	16 (14.4)
No	18	77	**95 (85.6)**
Cadre of Surgeon			
Intern	5	17	22 (19.9)
Senior House Officer	13	42	**55 (49.5)**
Surgeon	3	31	34 (30.6)
Type of Operation			
Laparatomy	7	48	**55 (49.5)**
Amputation	2	10	12 (10.8)
Others	12	32	44 (39.6)
Duration of Operation			
1 hour or less	12	52	**64 (57.7)**
2 – 4 hours	6	30	36 (32.4)
>4 hours	3	8	11 (9.9)
Type of skin suture			
Absorbable	0	3	3 (2.7)
Non-absorbable	20	88	**108 (97.3)**
Suturing Technique			
Interrupted	18	81	**99 (89.2)**
Continuous	3	9	12 (10.8)
Was drain used			
Yes	8	24	32 (28.8)
No	13	66	**79 (71.2)**

Source: Patients' data

In table 5 below, almost all (99.1%) patients received post-op antibiotics and with the majority receiving it by intravenous route (87.4%), followed by intramuscular route (10.8%) and thenoral route (1.8%). A big proportion (78.4%) of the patients got their stitches removed by day 7 post-operation, followed by those for whom they were removed within 8 – 14 days (19.8%) and only a few took long than 2 weeks (1.8%).

Table 5: showing post-op factors associated with SSIs

VARIABLE		DEVELOPED SSI		
		Yes, n	No, n	Total, (%)
POST-OP FACTORS				
Was Post-op antibiotics given				
	Yes	21	89	110 (99.1)
	No	0	1	1 (0.9)
Route of administration				
	I.V	19	78	97 (87.4)
	I.M	2	10	12 (10.8)
	Oral	0	2	2 (1.8)
Days taken before removal of stitches				
	7days	13	74	87 (78.4)
	8 – 14 days	7	15	22 (19.8)
	>14days	2	0	2 (1.8)

Source: Patients' data

DISCUSSION

From this current study, 21 (18.9%) of the operated patients (111) developed SSIs of whom the majority (14/21) had undergone emergency operations. Additionally, of those who had SSIs, the biggest proportion (57.1%) had deep incisional type while 38.1% had organ/space SSIs and 4.8% had superficial incisional type.

The above findings are slightly higher as compared to discoveries in selected Sub-Saharan African countries 3 years earlier which revealed an incidence rate ranging from 11 to 18% [1] but divergently higher as compared to findings in the US (1.9%), in Brazil (3.4%), Turkey (4.1%) and India (5.0%) [22]. However, similar to findings at General Surgery Unit (GSU) at Erciyes University Hospital in Turkey (15.2%) [23], at Mbarara Regional Referral Hospital (16.4%) amongst emergency postoperative patients [12] and among non-diabetic patients (16.5%) at St. Francis Hospital Nsambya [24]. This difference in the incidence could rather be due to the fact that during this study the majority of the operations were emergent as opposed to similar studies were the majority were elective procedures. However, further individual factor specific relationship is required to draw the exact trend in this locality.

On the contrary, the individual proportions of type of SSIs are divergent as related to a prospective hospital-based study conducted at Kilimanjaro Christian Medical Center general surgical wards which found that Superficial SSIs constituted (61.1%) while deep SSI constituted (27.8%) and organ/space (11.1%) [25]. This could partly be explained as far as differences in hospital equipment, endemicity of pathogens and other regional or provincial protocols in patient management.

Findings from this current study have shown an association between developing SSIs and a couple of patients whereby out of the patients who developed SSIs, majorities were aged 30 – 59 years, males, married, had attained secondary education, and were Anglicans. In the same trend majorities had had symptoms for 3 – 7 days, had HIV as a co-morbidity, were normal weight or obese, non-smokers and didn't take alcohol.

Overall, concerning age these findings were slightly divergent as opposed to earlier discoveries which showed that risk of SSIs was high in extreme ages [11]. However, obesity has still posed a risk factor as it was in a study done at Ayub Teaching Hospital which concluded that the incidence of SSIs in patients with obesity was higher than non-obese patients [5]. Similarly previous studies have shown that patients with co-morbidities, such as HIV/AIDS infection, Malignancy and DM are at high risk of developing SSI due to their low immunity [24, 5] including one in Northwestern Tanzania which found the rate of SSI to be significantly higher in HIV positive

patients than non-HIV patients [26] and another by Akoko et al, 2013 which showed that the odds of developing SSI by HIV status was five times higher as compared to HIV negatives [27].

This current study has discovered that of the patients who developed SSIs, majorities had a 6 – 11hours interval between admission and operation; and surprisingly many were stable, had received pre-op prophylaxis and had an ASA score of 1. However, there was no concrete association between these factors and the tendency to develop surgical site infections. Additionally, these results are based on patients who were able to access health care during the COVID 19 pandemic. Furthermore, current findings reveal that of the patients who developed SSIs, intra-operatively majorities had undergone general anesthesia, had dirty wounds, their surgical site was not shaved, operation tool less than an hour and no drain was placed. The class of wounds greatly affects the risk of developing SSI and earlier findings showed that the odds of developing SSI increased dramatically from wound class I to class IV [27]. Statistically the risk of SSI is higher in dirty and contaminated wounds than in clean and clean contaminated wounds probably due to increased microbial load in the operative field [12]. This study has shown that post-operatively, patients who developed SSIs received post-op antibiotics and mostly by intravenous route and had their stitches removed after 7days. This could be explained by the fact that most patients had undergone emergency operations and a couple of other factors were involved including co-morbidities and other intra-operative events.

CONCLUSION

Regardless of other factors, the incidence rate of Surgical Site Infections at the hospital is on the rise almost highest in the country with majorly patients' factors and intra-operative events showing association to the development of SSIs.

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CITE AS: Kunihira Mark (2023).Patterns of Surgical Site Infections Among Post Operative Patients at Hoima Regional Referral Hospital. IAA Journal of Scientific Research 10(3):31-40.