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Surgical Site Infection among Patients Undergone Orthopaedic Surgery at Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania.

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Background: ***The aim of this study was to determine prevalence and factors associated with surgical site infection at Muhimbili Orthopedic Institute.***
Method: ***This was a cross-sectional study conducted at Muhimbili Orthopaedic Institute (MOI) in Dar es Salaam, from August, 2015 to October 2015. Convenience sampling technique was used to recruit postoperative patients for this study. Standardized questionnaires were used to obtain demographic, social, and clinical information from respondents. Determination of the relationship between outcome and exposure variables was done using chi square test. Multivariate logistic regression was used to measure the association after controlling for confounders. Odds ratio corresponding to 95% confidence interval with a p value of ≤ 0.05 was considered significant.***
Results: ***Out of 300 study participants 75(25.0%) had surgical site infection. This was highly determined by more than 2 hours length of surgical procedure (AOR= 1.4; 95%CI 1.14-6.69; P value=0.05), none prophylactic use of antibiotics (AOR= 3.4; 95%CI 1.6-7.78; P value=0.03), more than one week stay before surgery (AOR=3.3; 95%CI 2.24-3.34; P value =0.00).***
Conclusion: ***The overall prevalence of surgical site infection at Muhimbili Orthopedic Institute was high. This was associated with more than 2 hours length of surgery, lack of prophylaxis use, and pre-operative hospital stay.***

Introduction

Surgical site infections (SSIs) in orthopaedic surgery are globally common and continue to be a major problem among orthopaedic patients [1-3]. A surgical site infection is clinically defined as presence of pain at a surgically created wound, which is accompanied by erythema, induration and local tenderness or presence of purulent discharge at wound site [1, 4]. Surgical

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site infection (SSI) is the infection which occurs within 30 days after surgery or one year if implant left in the site after procedure [5,-7,]. Worldwide, orthopaedic SSI rates range between 1.4 and 41.9% [3, 8]. Surgical site infections in orthopedic practice can have significant effects on quality of life for the patient. They are associated with considerable morbidity, financial burden to the patient and health care providers and extended hospital stay. Other effects of SSIs include revision surgery, delayed wound healing, increased use of antibiotics, all of which have a significant impact on patients and the cost of health care[1-,5-11].

To alleviate the problem of SSIs among orthopaedic cases several measures have been recommended and taken into action. These include appropriate timing of prophylactic antibiotics administration at about 30 minutes prior incision, use of appropriate antiseptic agents and techniques for surgical site skin preparation, reduction of movements and number of staff in the operating rooms and protection of incision site with sterile dressings [3,5,6]. Little is known about the magnitude and risk factors for SSIs among orthopaedic cases in our environment as a limited number of studies about SSIs have been conducted in Tanzania which mainly based on general surgical patients [12]. More over there is no recent survey done on SSI in orthopaedic patients in our setting. Therefore this study determined the magnitude and factors that contribute to post operative surgical site infection in patients with skeletal trauma at Muhimbili orthopaedic institute.

Patients and Methods

This study was conducted at Muhimbili orthopedic Institute which is the main referral hospital for orthopedic cases in Dar es Salaam, Tanzania. This was a hospital based cross-sectional study conducted from August, 2015 to October 2015. The study population included patients who had undergone long bones surgical operation admitted in the wards and those attended at the out patients department (OPD) for follow up. Both elective and emergency operated patients were involved. Patients who had initial trauma surgery at another hospital or those who presented with SSIs after being treated at an outside hospital, those with metastatic fractures, back, spine were not included as they fall under different realms. Hand and finger injuries were also excluded from the study. The sample size was calculated to be 300 participants.

Data collection was done from Monday to Friday from 8 am to 2 pm and the convenience method of sampling was used to select participants .All post operative patients who met the inclusion criteria were included in the study. Prior to an interview informed consent was obtained and then by using a standardized questionnaire a participant was asked a series of closed questions about their demographic, clinical and social background information which included the age, sex, marital status, education level, length of surgical procedure, antibiotic use, health condition before surgery, place of dressing, HIV status, length of hospitalization, and time of stay prior surgery. Then the wound site was examined for at least one of the following signs or symptoms of wound infection: pain or tenderness, localized swelling, redness and purulent discharge [4, 5]. The patients` files were also reviewed. Data entry and analysis was carried out using SPSS computer software version 20 and frequency tables

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were obtained for all study variables. Descriptive analysis was done by using frequencies, percentages and means where appropriate. Association between explanatory variable and the outcome of interest was done using 2×2 tables. Multivariate logistic regression analyses were used to examine independent variables that influence the outcome variable. Odds Ratios with corresponding 95% confidence interval are presented. All independent variables found significant in the univariate analysis were included in the multivariate analysis. A P-value of ≤ 0.05 was considered statistically significant. Ethical clearance for conducting this research was obtained from the Institutional Research Board of the Hubert Kairuki Memorial University and the permission to carry out the study was obtained from the Muhimbili Orthopedic Institute administration.

Results

The study involved 300 patients. Most of cases were aged below 46 years and the peak age was under 30 years of age. The median age was 46.5(15-78) years and each group of males and females accounted for almost a half of the study population. About 159(53.0%) participants were married and 125(41.7%) had primary education level (Table1).

Table 1. Frequency Distribution of Demographic Data (N=300).

Demographic characteristics	Frequency	Percentage
Age		
15-30	135	45.0
31-46	102	34.0
47-62	48	16.0
63-78	15	5.0
Sex		
Male	152	50.7
Female	148	49.3
Marital status		
Married/living with partner	159	53.0
Not married (single, divorced, widow, widower)	141	47.0
Education level		
Primary	125	41.7
Secondary	89	29.7
Collage/University	78	26.0
No education	8	2.7

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Table 2. Frequency Distribution of Clinical Characteristics of Study Participants

Clinical characteristics	Frequency	Percentage
Length of surgical procedure		
Two hours	208	69.3
More than two hours	92	30.7
Use of prophylaxis		
Yes	270	90.0
No	30	10.0
Health Condition before surgery		
Sick	82	27.3
Well	218	72.7
Place of dressing		
Hospital	276	92.0
Home	24	8.0
HIV Status		
Positive	34	11.3
Negative	201	67 .0
Not tested	65	21.7
Length of hospitalization		
Less than seven days	217	72.3
More than seven days	81	27.0
More than a month	2	0.7
Time of Stay before Surgery		
Two days	82	27.3
More than a week	125	41.7
More than a month	32	10.7
Emergency	61	20.3

The proportion of surgical wound infection among study participants.

Out of 300 study participants surgical wound infection was observed in 75(25.0%) cases. Surgical site infection was common among those aged above 46 years and in HIV negative patients (P values >0.087). Females, unmarried participants, and those with no formal education commonly developed SSI (P values <0.049). But on multivariate logistic analysis this observation was statistically insignificant. The duration of surgery in most of patients, 69.3% (208/300), was less than 2hours and wound sepsis occurred frequently among those who were operated for more than two hours, 35.5% (33/92). This finding was statistically significant even on multivariate logistic regression analysis.

The majority of cases, 90% (270/300), were given prophylactic antibiotics prior incision. SSI occurred commonly among individuals who did not receive prophylactic antibiotics, 56.7 %(17/30), and statistically this result was significant even after controlling for confounders.

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Table 3. Factors associated with Surgical site infection, N=300

Factors	Sepsis (%)	Total (%)	χ2	p-value
Age				
15-30	30(22.2)	135(100.0)		
31-46	22(21.6)	102(100.0)	6.73	0.087
47-62	16(33.3)	48(100.0)		
63-78	7(46.7)	15(100.0)		
Sex				
Male	30(19.7)	152(100.0)	11.12	0.025
Female	45(30.4)	148(100.0)		
Marital status				
Married/living with partner	36(22.6)	159(100.0)	9.17	0.049
Not married	39(27.6)	141(100.0)		
Education level				
Primary	30(24.0)	125(100.0)		
Secondary	21(23.6)	89(100.0)	11.01	0.026
Collage/University	18(23.1)	78(100.0)		
No education	6(75.0)	8(100.0)		
Length of surgical procedure				
Two hours	42(20.2)	208(100.0)	8.36	0.006
More than two hours	33(35.9)	92(100.0)		
Use of prophylaxis				
Yes	58(21.5)	270(100.0)	17.83	0.00
No	17(56.7)	30(100.0)		
Health education before surgery				
Sick	31(37.8)	82(100.0)	9.87	0.003
Well	44(20.2)	218(100.0)		
Place of dressing				
Hospital	65(23.6)	276(100.0)	3.87	0.049
Home	10(41.7)	24(100.0)		
HIV Status				
Positive	8(23.5)	34(100.0)		
Negative	55(27.4)	201(100.0)	4.3	0.381
Not tested	12(18.5)	65(100.0)		
Length of hospitalization				
Less than seven days	22(10.1)	217(100.0)	19.58	0.00
More than seven days	53(65.4)	81(100.0)		
More than a month	0(0.0)	2(100.0)		
Time of stay before surgery				
Two days	8(9.8)	82(100.0)		
More than a week	43(34.4)	125(100.0)		
More than a month	10(31.3)	32(100.0)	19.48	0.00
Emergency	14(23.0)	61(100.0)		

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Table 4. Multivariate Logistic Regression on Factors Associated with SSI (n=300)

Factors	Sepsis (%)	Total (%)	AOR	95%CI	P- value
Sex					
Male	30(19.7)	152(100.0)	**1**		
Female	45(30.4)	148(100.0)	**1.624**	**0.343-1.136**	**0.123**
Marital status					
Married/living with partner	36(22.6)	159(100.0)	**1**		
Not married	39(27.6)	141(100.0)	**1.473**	**0.45-5.019**	**0.535**
Education level					
No education	6(75.0)	8(100.0)	**1**		
Primary	30(24.0)	125(100.0)	**0.208**	**0.034-1.261**	**0.08**
Secondary	21(23.6)	89(100.0)	**0.205**	**0.033-1.252**	**0.08**
Collage/University	18(23.1)	78(100.0)	**0.190**	**0.030-1.220**	**0.07**
Length of surgical procedure					
Two hours	42(20.2)	208(100.0)	1		
More than two hours	33(35.9)	92(100.0)	1.4	1.14-6.69	0.05
Use of prophylaxis					
Yes	58(21.5)	270(100.0)	1		
No	17(56.7)	30(100.0)	3.4	1.6-7.78	0.03
Health condition before surgery					
Well	44(20.2)	218(100.0)	1		
Sick	31(37.8)	82(100.0)	1.14	0.04-1.15	0.093
Place of dressing					
Hospital	65(23.6)	276(100.0)	1		
Home	10(41.7)	24(100.0)	1.04	0.467-1.66	0.202
Time of stay before surgery					
Two days	8(9.8)	82(100.0)	1		
More than a week	43(34.4)	125(100.0)	3.3	2.24-3.34	0.00
More than a month	10(31.3)	32(100.0)	2.8	1.13-3.36	0.001
Emergency	14(23.0)	61(100.0)	1.6	0.99-1.8	0.24

Wound dressing in the majority of patients was being done in the health facility, 92.0% (276/300), SSI affected commonly those participants who were being cared for their wounds at their homes, 417% (10/24). But this observation was statistically insignificant when analyzed by multivariate logistic regression. Surgical site infection was common among those who had no HIV infection 27.4% (55/201). Nevertheless this finding was not statistically significant. A total of 83 (27.7 %) of the 300 patients stayed in the hospital for less than 7 days. The majority (52.4%) 0t cases stayed for more than 1 week in the hospital before surgery. Prolonged hospitalization for more than one week duration of hospital stay prior surgery are statistically associated with development of SSI (Tables 3 and 4).

Discussion

Surgical site infection is a major problem among orthopaedic patients [1,5]. The prevalence of SSI in the current study is higher than that reported by other authors [2,3,4,6,7,8,9,10]. However, similar prevalence of SSI was observed in other studies done by [1,12,]. The reasons for high prevalence of SSI in this study could be due to inadequate adherence to aseptic techniques perioperative, a significant number of cases having contaminated wounds during surgery, overcrowding of patients in the wards causing high cross infection, inadequate knowledge and poor adherence to aseptic practice in wound care among health personnel causing wound contamination and infection.

As regards to studied factors that contribute to SSI various factors were significantly associated with occurrence of SSI. There is a direct relationship between development of surgical site infection and the length of surgery. Orthopaedic surgeries done for more than 2 hours are at higher risk of infection [3,7,10,11,12,13,14] . Similar finding was noted in the present study. High risk of infection in prolonged surgeries may be due to increased tissue and surgical instruments exposure to the environmental bacteria, surgical team exhaustion enhancing poor adherence to aseptic techniques and decreasing of patient`s micro-organisms systemic defenses as same as it was explained by others [7, 11].

The use of anti microbial prophylaxis in orthopaedic surgery is important as it helps to minimize or eradicate endogenous microbes and prevent SSI. Prophylactic antibiotics help to decrease SSI rates to 1-3% compared with 4-8% without prophylactic antibiotics. Timing of antimicrobial prophylaxis is extremely important as it is related to the rate of SSI. Antimicrobial prophylaxis should be administered ideally within 30 minutes to 1 hour prior incision [(5,15)]. The above explanation given by[(6)] is confirmed by this survey as most of the patients who did not use prophylactic antibiotics developed SSI and equal observations were reported by other surveyors[2,14].

Prolonged hospital stay generally pause a higher risk of developing surgical site infection[2,4,5,9,,13,14]. This is evidenced by the findings of this current analysis whereby prolonged hospitalization for more than a week was noted to be highly a risk factor for SSI. In particular to preoperative duration of hospital stay the present study observed a significant association between prolonged preoperative length of stay for more than 7 days and occurrence of SSI which is corresponding to the findings obtained in other previous studies [2,11]. The likely explanation for these observations may be increased preoperative hospital stay period predisposes to skin colonization by hospital microbes that are resistant to antibiotics and so it is important to minimize preoperative hospitalization period in order to lower SSI rate [2,8,11]. However [(8)] found preoperative length of hospitalization not to have any association with development of SSI. This difference might be reflecting low rate of hospital acquired cross infection or absence of overcrowding there setting. It may also be due to the fact that compared their cases based on more or less than 4 days pre operative hospital stay while in the current and other studies based on seven days.

Although SSI was high in aged patients (>45 years of age) in the present analysis, but this finding was not statistically significant likewise the findings of the study done by [2, 3, 10] indicating age alone not to be a risk factor for SSI. However other authors [1, 11, 13] stress old age to be a risk factor for development of SSI probably mainly due to the elderly associated morbid conditions like depression of the body immunity, reduced appetite causing poor nutrition status and diabetes mellitus [11].

Post surgical appropriate wound care is among the important aspects in reduction of SSI rate. Experts reports that inappropriate wound care contributes to as high as 10% of SSI [14, 16]. In this survey some patients were being cared for their wounds at their home places by health care personnel and this was not associated with occurrence of SSI depicting place of wound dressing not to be a mere risk factor for SSI rather than aseptic dressing techniques and other already explained factors

The presence of the underlying disease processes, systemic infections, metabolic imbalance or endocrine disorders increases the incidence of postoperative SSI. Failure of the immune system in HIV infected patients increase the possibility of developing surgical site infections post operatively [17, 18 ,19]. In the current study HIV infection was not statistically significantly associated with development of SSI as similar as it was documented by other surveyors [(20, 21)] reflecting HIV per se not to be a major risk factor for SSI development in orthopaedic practice. However, this observation might be due to small sample size analysed in these studies. In this analysis gender had no influence on occurrence of SSI as same as it was documented in other studies,[4, 5, 7, 8,11 13]. Also in this study, marital status and level of education were not found to influence development of SSI.

Conclusion and Recommendation.

Surgical site infection rate is high at MOI and the independent risk factors for SSI were length of surgical procedure for more than two hours, lack of use of prophylactic antibiotics, prolonged pre operative hospital stay and prolonged hospital stay for more than 1 week. It is therefore recommended that the hospital staff to adhere to aseptic practices and appropriate use of prophylactic antibiotics. The hospital management should try to set the environment that will ensure that cases are managed promptly and discharged home early to minimize acquisition of cross infection.

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