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Incidence of Surgical Site Infections (SSIs) among Patients Undergoing Major Surgery at General Hospital Funtua, Katsina State, Nigeria.

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Abstract: *Surgical site infection is one of the most common preventable complications following major surgery and represents a significant burden in terms of patient morbidity, mortality and hospital costs. A cross-sectional study was conducted involving subjects who have undergone major surgery in surgical wards within the period of study. Questionnaires were administered to the 127 respondents alongside with laboratory investigation procedure to obtain data for the study. Results showed that the minimum age of the subjects ranged from 11years to 65years with mean age of 38years. Over 96% of subjects had operation done in a moderately ventilated operating theatre. More than 95% of subjects had operation with autoclaved instruments. The major findings reveals that 28 (22.05%) of subjects had surgical site infections based on clinical criteria, however, from the subjects with SSI, 25 (19.6%) were based on bacteriological criteria. In conclusion, Surgical Site Infection is a major problem in the surgical wards which is associated with ineffective surgical hand scrub for < 2 minutes, lack of intra-operative antimicrobial use and inadequate operating room ventilation. It is therefore recommended that government, management of hospitals and health care professionals have an important role to play in curbing the incidence of surgical site infections.*

Key Words: *Infection, Surgical Site, Surgery, Patient*

I. Introduction

Health-care associated infection (HAI) is a major global safety concern for both patients and health-care professional (World Health Organization, WHO, 2011). HAI is defined as an infection occurring in a patient during the process of care in a hospital or other health-care facilities that was not manifest or incubating at the time of admission (Center for Disease Control and Prevention CDC, 1992). These include infections acquired in the hospital and any other settings where patients receive health care.

The burden of HAI is already substantial in developed countries, where it attains 5% to 15% of hospitalized patients in regular wards and as many as 50% or more of patients in Intensive Care Units ICUs (WHO, 2011). In 2005, WHO launched the First Global Patient Safety challenge "Clean Care is Safe care" to create a global momentum and Commitment to reduce Hospital Acquired Infection (HAI).

Surgical Wound Infection is a good index of Hospital Acquired Infection (Burk, 2003). Surgical site infections (SSIs) have been reported to be one of the most common causes of nosocomial infections; accounting for 20 to 25% of all nosocomial infections worldwide (WHO, 2011). SSIs have been responsible for increasing cost; morbidity and mortality related to surgical operations and continue to be a major problem worldwide.

Globally, surgical site infection rates have been reported to range from 2.5% to 41.9% (Mawalla, Mshana, Chalya, Inurzalioglu, & Maghalu, 2011). In Tanzania, surgical site infections are still one of the leading causes of morbidity and mortality among patients undergoing major surgery. Previous studies conducted in a district and a tertiary hospital in Tanzania reported the surgical site infections rate of 24% and 19.4% respectively (Jan, 2006).

According to National Institute of Health and Clinical Excellence NICE (2008) surgical site infections have been shown to compose up to 20% of all of health care –associated infections. At least 5% of patients who have undergone a surgical procedure develop a surgical site infection (NICE, 2008). Most surgical site infections are caused by contamination of an incision with microorganisms from the patient's body during surgery. Infection caused by microorganism from an outside source following surgery is less common. The majority of surgical site infections are preventable measures that can be taken in the pre-Intra- and postoperative phases of care to reduce risk of infection.

Before the routine use of prophylactic antibiotics infection rates were 1-2% or less for clean wounds, 6-9% for clean-contaminated wounds, 13-20% for contaminated wounds and about 40% for dirty wounds. Since the introduction of routine prophylactic antibiotic use, infection rates in the most contaminated groups have reduced drastically. Infection rates in US National Nosocomial Infection Surveillance (NNIS) system hospitals were reported to be 2.1% for clean wounds, 3.3% fort clean-contaminated, 6.4% contaminated and 7.1% for dirty. There is, however, considerable variation in each class according to the type of surgery being performed (Moram , 2006)

Ohajuru, Fajemilihin & Onipede, (2011) reported an incidence of 21% SSI at Obafemi Awolowo University Teaching Hospital Complex. Oni ,Ewete, Gbaja, Folade, Mutiu, Adeyemo, & Bakare,
(2006) revealed that 9.4% incidence of SSI in University College Hospital, Ibadan, report of SSI incidence in AKTH Kano revealed 9.1% following caesarean section (Jido & Garba, 2012)

All these reports are from teaching hospitals and urban centres and there is no base line data from semi urban centre and secondary health care in Nigeria hence it is necessary to establish the incidence, pattern and predictors of SSI in General Hospital Funtua, Katsina state, Nigeria. Therefore this study is designed to determine the incidence of surgical site infections in General Hospital Funtua.

II. Methodology

Research Design

A cross-sectional study was used involving subjects who have undergone major surgery in surgical wards within the period of study at General Hospital Funtua Kastina state.

Study Setting

General Hospital Funtua of Katsina state is in the North-West part of geopolitical zone of Nigeria. It is a secondary healthcare delivery centre with 120 beds capacity. The hospital has eight (8) wards each of which has a surgical unit. The hospital has about one hundred and seventy nurses (170) with an average of about four hundred and twenty surgical patients outflow annually.

Sampling techniques and sample size

A non probability purposive sampling method was used to select subjects that have undergone major surgery during the study period. A total of 127 respondents were used for the study.

Ethical Consideration

Ethical consent was obtained from the ethical review board of the hospital and informed consent was obtained from each subject or subjects care giver before being enrolled in to the study.

Instrument for data collection

A questionnaire was developed using the CDC/WHO Criteria for determining SSIs. The instrument was tested for validity and reliability through pilot study. Also two full-time nurses' assistants were trained on the use of the instrument

Data Collection and Laboratory Procedures

Surgical wounds are inspected after 48hours postoperatively and at the time of first dressing (5th day postoperatively), and wound swabs were collected from a clinically infected wound for bacteriological examination. Superficial surgical site infection was diagnosed; if any one of the following is fulfilled: purulent drainage from the superficial incision, organisms isolated from an aseptically obtained culture of fluid, at least one of the following signs and symptoms of infection: pain or tenderness, localized swelling, redness or heat.
Deep surgical site infection is diagnosed; if any one of the following criteria is fulfilled in addition to culture positivity: purulent drainage from the deep incision but from the organ/space component of the surgical site, a deep incision spontaneously dehisced. The subject as at least one of the following signs or symptoms: fever ($>38^0$), or localized pain or tenderness.

Swabs of the clinically infected wounds detected in a population of studied patients were taken and cultured for aerobic bacteria. The sample specimen were inoculated on blood agar, chocolate and mac Conkey agar and incubated at 37^{0c}, while the choc was incubated in a Candle jar for 24hrs, a gram stained smear was examined under microscope using x100 Objective lens with immersion oil. The colonial morphologies of the organism grown were recorded. A presumptive identification of all isolates were made base on morphology, hemolysis, pigments as well as primary and secondary gram stain appearance (Cowan, 1974). A culture-negative finding does not meet this criterion.

Data analysis

Data were entered into a computer using SPSS software version 16 and analysed using STATA software 10 according to the objectives of the study. Descriptive statistics was used in the analysis.

III. Results

As reflected on table 1, the age of the subjects ranged from 11years to 65years with mean age of 38years. Majority (77%) of subjects are females and 74.8% are married. On the educational level, 59.8% have senior secondary certificate while 14.96% have no formal education.

The anthropometric measures as revealed by table 2 shows that the height of the subjects ranged from 1.31m to 1.8m with the mean height of 1.57m and SD. of ±0.08m.The weight of the subjects ranged from 38kg to 80kg with the mean of 55.3kg and SD. of ±8.94. In regard to Body Mass Index, the minimum BMI recorded was 16.41kg/$(m)^2$ and the maximum was 31.25kg/$(m)^2$. Majority of the subjects ranged from 20 to 35 with the mean BMI of 22.42 and SD. ±2.81 respectively. Table 3. showed that over 90% of the subjects had pre-operative shaving in the morning of the surgery, and 7.9% a day before surgery. More than 96% had combination of all the antiseptics used for skin preparation during surgery.

Table 4. shows that majority124 (97.6%) , of subjects had surgeries scrubbed by the surgical team for less than <2minutes . Over 96% of subjects had operation done in a moderately ventilated operating theatre and more than 95% of subjects had operation with an autoclaved instruments.

Table 5. revealed that 118 (92.90%) subjects had layer-by-layer surgical wound closure and 9 (7.1%) had mass closure. 119(93.70%) had clean surgeries, 5 (3.9%) had clean contaminated surgeries and 3(2.4%) had contaminated surgeries. There were no cases recorded for dirty surgeries.

Figure 1. revealed the incidence rate of surgical site infection. Out of the total studied subjects (127) only 28 (22.05%) had surgical site infection based on clinical criteria, 25 (19.6%) based on bacteriological criteria and 99 (78%) did not manifest with surgical site infection.

Table 1 Socio-demographic Data

Frequency distribution of respondents by demographic characteristics		
Variable	**Frequency**	**Percent**
Age (grouped)		
11-20	50	39.40
21-30	35	27.60
31-40	24	18.90
>40	18	14.20
Total	**127**	**100.0**
Sex		
Male	29	22.80
Female	98	77.20
Total	**127**	**100.0**
Marital Status:		
Single	32	25.20
Married	95	74.80
Total	**127**	**100.0**
Highest Education Level:		
No Education	19	14.96
Primary	17	13.38
Junior Secondary	12	9.45
Senior Secondary	76	59.84
Higher Education	3	2.37
Total	**127**	**100.0**

Table 2: Distribution of Respondents According to Anthropometric Measures

Variables	**Frequency**	**Percent**
Height(in metres):		
<1.40	2	1.6
1.41-1.51	45	35.40
1.52-1.63	59	46.50
1.64-1.74	17	13.40
>1.74	4	3.10
Mean: 1.57m		
SD:± 0.083m		
Total	**127**	**100.0**
Weight(in Kg):		
<45	15	11.80
46-53	42	33.10
54-61	46	36.20

62-69	8	6.30
>69	16	12.60
Mean: 55.35kg		
SD:± 8.94kg		
Total	**127**	**100.0**
BMI:		
<20	19	15.0
20-24	79	62.20
25-29	26	20.5
30-34	2	1.6
>35	1	0.8
Mean: 22.42kg/m^2		
SD:± 2.81kg/m^2		
Total	**127**	**100.0**

Table 3: Distribution of Subjects Based on Pre-operative Care

Variables	Frequency	Percent
Pre-operative shaving		
Morning of surgery	115	90.6
A day before surgery	10	7.9
Night of surgery	1	0.8
Nil	1	0,8
Total	127	100
Use of skin antiseptics		
Iodine only	4	3.10
Methylated sprit	1	0.8
Combination of all	122	96.1
Total	127	100

Table 4 Distribution of Subjects Based on the State of Operating Theatre

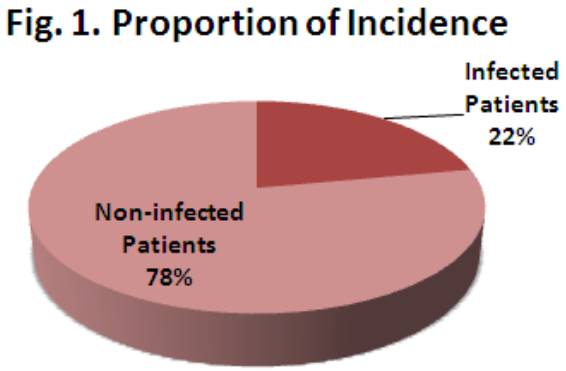
Variables	Frequency	Percent
Duration of surgical Hand scrub by surgical team		
<2 minutes	124	97.6
≥5 minutes	3	2.40
Total	127	100
Operating Room Ventilations		
Well ventilated	5	3.90
Moderately ventilated	122	96.1
Total	127	100
Sterilization Techniques		
Autoclaving	121	95.3
High level disinfectants	5	3.90
Use of cidex	1	0.80
Total	127	100

Table 5.: Distribution of Subjects Based on Surgical Closure Technique.

Variables	Frequency	Percent
Surgical Wound Closure Technique:		
Layer-by-layer	118	92.90
Mass closure	9	7.10
Total	127	100.0
Classification of Tissue Trauma:		
Clean wound		
Clean contaminated	119	93.70
Contaminated wound	5	3.90
	3	2.40
Total	**127**	**100.0**

Figure 1. Incidence Rate of Surgical Site Infections among the Subjects

Total Incidence Rate = $\left(100 * \frac{28}{127}\right)$ = 22.05%



IV. Discussion Of Findings

The study revealed that most of the subjects are in the age group between 21-30 years and showed a female preponderance .Similar demographic observation was reported by another study in Aminu Kano Teaching Hospital Kano, Nigeria (Jido & Garba, 2012).The rate of SSI was significantly higher in female subjects than in male .This could be explained by multiple risk factors in females such as high caesarean section rate and high BMI.

The study found that majority of the subjects with surgical site infection were of Body Mass Index of between 20-24, this is not consistent with report of previous study (William, 2006).

The study reveals that the overall incidence rate of surgical site infection was 22% based on clinical criteria and 19.6% based on bacteriological criteria as opposed to 4.9% (Oni et al, 2006) . Similar study on surgical site infection rate was found in a Tanzanian study 24% by (Nguyen, 2011).The study findings reported relatively higher incidence of SSI as opposed to 7.8% (Glenys, Russo, Grade, Spelman, Borrell, & Watson,2004). The study findings on SSI incidence rate based on clinical criteria are relatively consistent with 21% reported by WHO (2011). The study discovers that the SSIs incidence rate of 19.6% based on bacteriological criteria is contrary to 38% WHO (2011). The study findings is also consistent with 22% incidence rate in OAUTHC, (Ohajuru, 2010),but contrary to 9.1% incidence at AKTH Kano, (Jido & Garba, 2012).

The study revealed high incidence of SSI of 22% as shown in fig 1, contrary to the reports of other study 2%, (Margaret, Nepple, Riew, Lenke, Bridwell, Mayfield, & Fraser, 2008).This could be due to characteristics of the hospital environment, limitation of perioperative care, and economic constraints.

V. Conclusion And Recommendation

Surgical Site Infections are major problem in the surgical wards at General Hospital Funtua, Katsina State, and its incidence is higher than that reported in developed countries (Margaret,et al, 2008). Ineffective surgical hand scrub , lack of intra-operative antimicrobial use, inadequate operating room ventilation are associated with SSIs at General Hospital Funtua, Katsina State. Sterilisation technique by the use of high level disinfectant is an independent predictor of SSIs at General Hospital Funtua, Katsina State. A better Surveillance system for surgical site infection with feedback of appropriate data to surgeons is highly recommended to reduce the SSI rate in secondary health care centres. Development of an African based standard instrument for SSIs to include post-operative factors associated with SSIs, such as bed spacing (50cm) to reduce cross-infection, wound dressing trolley for every patient, universal precaution during dressing, duration of urethral catheter removal post-operatively and time of drainage tube removal are also recommended. Creation of awareness on infection control measures to all health care personnel through workshops, conferences and continuing education programs. Government and Hospital Management should provide adequate resources needed in operating theatre and also available to ensure the prevention of SSIs.

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