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Factors Influencing Prevalence of Surgical Site Infections among Mothers Undergoing Ceaserean Section in Iganga Hospital, Uganda

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ABSTRACT

Caesarean Section as a mode of delivery is the most commonly done surgical procedure in maternity departments all over the world. Surgical site infection complicates about one-third to two-thirds of caesarean sections in low-income countries which is about 9 times higher compared with the high-resource countries. Surgical Site Infection is associated with increased maternal morbidity, prolonged hospital stay and increased medical costs. The development of post-caesarean surgical site infection is hung on a complex interplay of many factors not limited to wound class, immune status, maternal age, hypertensive disorders, ASA classification, number of vaginal examinations, the virulence of the microorganisms, maternal weight, surgical techniques and premature rupture of membrane. The study employed a descriptive cross-sectional and quantitative approach to study the factors influencing the prevalence of surgical site infections among mothers undergoing caesarean section in Iganga Hospital. A sample size of 288 participants were enrolled using a random sampling technique and close-ended questionnaires were employed to obtain the data from participants. Data analysis was done using SPSS version 20 and statistical significance was set at a P-value less than 0.05 at 95% confidence interval. A total of 288 post-caesarean mothers were studied from October – November 2021 in Iganga Hospital. The majority of the participants were married 255(88.8%) and had a secondary level of education 142(49.3%). The mean age of the participants were 25.6 years with 21 as the modal age. The prevalence of surgical site infection among post-caesarean mothers at Iganga Hospital was 20.5% (59 out of 288) and the factors which were statistically influencing the SSI included early rupture of membranes of more than 18 hours (aOR 23.715 95% C.I 5.976-94.117, P 0000) and postoperative haemoglobin (aOR 15.109 95% C.I 3.494-65.333, P 0.000) There's a high burden of SSI among post-caesarean mothers in Iganga Hospital. Earlyrupture of membranes more than 18 hours and post-operative haemoglobin less than 11g/dl are key contributory factors. Aggressive prophylactic and post-operative antibiotic therapy should be considered in mothers with early rupture of membranes and post-operative anaemia.

Keywords: Caesarean Section, Maternal morbidity, Surgical Site Infection, Post-caesarean mothers, Vagina examination.

INTRODUCTION

Cesarean Section (CS) is one of the most commonly performed surgical procedures in the obstetrical gynaecological department. Surgical site infection (SSI) after cesarean section (CS) increases maternal morbidity, hospital stay and medical cost [1], [2]. Although SSIs are among the most preventable HAIs, they still represent a significant burden in terms of patient morbidity and mortality and additional costs to health systems and service payers worldwide [3]. Motherhood is a life-changing event. Successful physiological, as well as psychological, adjustment will be compromised when the arrival of the baby is coupled with

recovery from major abdominal surgery and coping with the pain and discomfort of an abdominal wound. Difficulties are compounded when SSI develops, especially in today's climate of early hospital discharge, which leaves women to cope at home, sometimes with little practical and emotional support [4]. According to the Centers for Disease Control and Prevention (CDC), surgical site infection (SSI) is defined as an infection which occurs within 30 days after a surgical procedure involving the skin, subcutaneous tissue, soft tissue or any other part of the anatomy. In general, in developing countries, the burden of health-care-associated infection including SSIs is assumed to be higher though the problem remains underestimated or even unknown [5], [1].

In a cross-sectional study of mothers who delivered by Cesarean at Mbarara Regional Referral Hospital 2020, the single most important risk factor for post-partum maternal infection is Cesarean section (C/S) with a 5-20-fold greater risk for infection compared to a vaginal delivery. Post-Cesarean wound infection is diagnosed in 2.5 to 16 per cent of patients [6]. The development of post-CS infection depends on a complex interplay of many factors including wound class, immune status, maternal age, hypertensive disorders, ASA classification, number of vaginal examinations, the virulence of the microorganisms, maternal weight, surgical techniques and premature rupture of membrane. [7] According to a study done in China, 3.34% of cesarean deliveries (CDs) were complicated by SSI incontrast, SSI complicated 12.6% and 24.3% of CDs in (Pakistan) respectively. [4] A prevalence rate of 6.2%.SSI following CDs was reported in a study done in Ankara (Turkey) and a lower rate of SSI (3.7%) was reported in a study done in Israel. [8] A study at Teaching Hospital in Rwanda revealed that 4.9% of CDs were complicated by SSI. [9] However, SSI following CDs was reported on almost half (48.2%) of CDs at Tanzanian Tertiary Hospital. [7] In the Ethiopian context, the prevalence of SSI at Hawassa and Teaching and Referral Hospital was 11%. Meanwhile, 9.4% of CDs were complicated by SSI at Assela Teaching and Referral Hospital. Similarly, a study done at Lemlem Karl General Hospital (Tigray region) revealed 6.8% of CDs had developed SSI. [10], [1]. Pre-operative conditions such as prolonged labour, prolonged rupture of membrane (PROM), more than 5 digital vaginal Examination, chorioamnionitis, American Society of Anesthesiologist (ASA) health status classification ≥3, fewer years of education, higher prior births, prior diagnosis of hypertension and Diabetes Mellitus (DM) were identified as significant factors for SSI followingCDs [9]. Similarly, intraoperative conditions like prolonged duration of surgery, wound contamination class III, vertical skin incision and interrupted skin suturing were associated factors for developing SSI. [10]. In addition, CDs for emergency conditions like non-reassuring fetal heart rate pattern (NRFHRP) were also a significantly associated factor for developing SSI. In addition, Postoperative anaemia was also found to be a post-operative factor associated with SSI. [9] Frequent digital pelvic examination is one of the established preoperative factors that increase the risk of post-cesarean wound infection. Repeated vaginal examinations can introduce endogenous vaginal flora capable of causing SSI to the upper genital tract [1]. Despite every effort to maintain asepsis, almost all surgical sites are contaminated with bacteria, but the degree of contamination and the risk of subsequent infection vary among patients.

Statement of Problem

A mother should heal well without any infection and sepsis after a caesarean section [11]. However, in Iganga Hospital, wound infection and sepsis after post-caesarean section accounted for 40% of all deliveries (Iganga Hospital Report, 2014). Out of 866 deliveries performed in April 2016, 360(41.5%) were caesarean section while in May 2016, out of 872 deliveries 382(44%) were caesarean section. Out of 310 caesarean section cases, 232(75%) develop wound infection. This led to long hospital stays, co-morbidities, high medical bills, disruption of work and death, thus a problem (Iganga Hospital Reports, April and May 2016) The Ministry of Health supplies resources to help in

maternity wards. These included; enough up-to-date equipment, antibiotics and other drugs, a supply of blood, and more midwives among other resources [12]. Also, Iganga Hospital taught mothers about wound infection control and giving necessary medical care. However, wound infections still increased after caesarean section. It was noticed that; outpatient burden, hospital admissions and inpatient deaths increased due to inadequate attention given to wound management [13]. This may affect the social and economic development of communities. Based on the above, the major reasons for increased wound infection specifically in Iganga Hospital are not known which warrants carrying out this study.

Aim of the study

The broad objective of the study was to evaluate the factors influencing the prevalence of surgical site infections among mothers who undergo cesarean delivery in Iganga Hospital.

Specific Objectives

- To establish socio-demographic characteristics influencing the prevalence of surgical site infection among mothers who undergo cesarean delivery in Iganga Hospital.
- To determine pregnancy and labour factors influencing the prevalence of surgical site infection among mothers who undergo cesarean delivery in Iganga Hospital.
- To determine intra and post-operative factors influencing the prevalence of surgical site infection among mothers who undergo cesarean delivery in Iganga Hospital.

Research Questions

i. Which socio-demographical factors influence the prevalence of surgical site infections among mothers who undergo cesarean section in Iganga Hospital?

ii. What are some of the pregnancy and labour factors influencing the prevalence of surgical site infection among mothers who undergo cesarean delivery in Iganga Hospital?

iii. What are the intra and post-operative factors influencing the prevalence of surgical site infection among mothers who undergo cesarean delivery in Iganga Hospital.

METHODOLOGY

Study Design

The study used a descriptive cross-sectional study design and data was collected using questionnaires [14]. The study was cross-sectional because of the study's interest in determining the factors associated with surgical site infections among caesarean section mothers in Iganga regional referral Hospital in a short time frame. It is advantageous to the researcher because of its affordability and suitability for a short time frame. A quantitative method of data collection was used because the research wants to assess the factors contributing to surgical site infection among caesarean mothers by establishing the number of infected mothers.

Area of Study

The study was carried out in the Iganga Regional Referral Hospital, located in the southern part of the Eastern region of Uganda in the Busoga Region. The hospital is located on the Jinja-Tororo highway, about 42 kilometres (26 mi), east of Jinja Regional Referral Hospital and approximately 118 km from Kampala. The coordinates of Iganga General Hospital were: 0°36'57.0"N, 33°29'04.0" E (Latitude: 0.615828; Longitude: 33.484431). In 2014, the national population census put Iganga's population at 53,870. Iganga General Hospital is a 100-bed, government-owned hospital that served Iganga District and parts of the districts of Luuka, Mayuge, Bugiri, Namutumba and Kaliro [15]. Over the years, the underfunded, understaffed hospital's infrastructure had deteriorated and the hospital equipment had aged and became antiquated. The overworked staffs were underpaid and of low morale which attributed to the high rate of wound infection among caesarean section

mothers. The obstetric gynaecologylogy department has one obstetrician, one medical officer and around 10 midwives. Iganga Hospital has a high number of caesarean section cases because of the many referrals received from the neighbouring healthcare facilities and districts. These districts include; Luuka, Kaliro, Namutumba, Bugiri, and Mayuge. With inadequate supplies to the hospital and inadequate experienced surgeons, caesarean-section mothers face many complications after surgery and SSI is among the major ones.

Study Population

The target population comprised all caesarean section mothers in Iganga Hospital. The hospital performed an average of 900 deliveries a month with an average of 225 deliveries weekly. Out of these, there were 350 caesarean section cases monthly thus having an average of 88 weekly. Out of 88 caesarean-section mothers, 35(40%) developed wound infection. There was a wound infection range of 35% to 45% among caesarean section mothers in the last three months at Iganga Hospital. This group was chosen because they form the highest hospital admission burden in the maternity ward.

Inclusion Criteria

Mothers who delivered by cesarean section in Iganga Hospital at the time of the study and provided informed consent were included in the study.

Exclusion Criteria

Mothers who delivered by spontaneous vaginal delivery during the time of the study were excluded and mothers who declined to give informed consent.

Sample Size Determination

Sample size determination was based on Kish Leslie's method (1965) to obtain the desired sample size.

Formula; $n=Z^2 P(1-P)/E^2$

Where n=Estimated minimum sample size required.

P=Expected proportion of characteristics being measured in the target population based on previous studies. (For this study is estimated at 75% or 0.75) (Iganga Hospital Reports, April and May 2016)

Z=1.96 (for 95% confidence interval)

E= margin of error. Set at 5%

n= 3.8416×0.75(1-0.75)/0.002

n= 288 participants.

Sampling Procedure

The study used probability sampling to select respondents. Here every mother available at the hospital during data collection has an equal chance of being selected since all the caesareans are concerned aboutthis issue as reported by [16]. The researcher used simple random sampling to select the respondents as every second mother from that available caesarean section was picked. This method was used because the researcher wanted to avail the opportunity to all mothers because all are at risk ofwound infection after caesarean section.

Data Collection

In this study, qualitative data was collected using questionnaires. The questionnaires were first pre-tested in another similar setting (Jinja Hospital) so as to check for applicability, accuracy and consistency of collected data before the commencement the of study. The questionnaire was written in English and translated into Lusoga language which is the local language for respondents for better understanding and for the researcher to obtain appropriate responses.

Data Analysis

Data were cleaned, coded and entered into Microsoft Office Excel version seven and later exported to Statistical Package for Social Scientists (SPSS) version 20 for analysis. Descriptive (univariate) data will be presented as frequencies and percentages and illustrated using frequency tables. The factors influencing SSI were analyzed at both bivariant and multivariant level analysis. At the bivariant level significance was set at a 95% confidence interval and any variable with a p-value less than 0.05 was carried to multivariant analysis where significance was set at P-value less than 0.05 at 95% confidence interval. The results were presented in the table with both crude and adjusted odds ratios at bivariant and multivariant levels with a P-value set at a 95% confidence interval.

Quality Control

A total of 25 questionnaires were pretested at Jinja regional referral hospital for accuracy and ability to meet the set objectives. Corrections were done where

necessary.

Ethical Considerations

All study protocols were presented for review and approved by the Institutional review board of Kampala International University-Western Campus. Permission to conduct research was obtained from the administration of Iganga regional referral Hospital. Voluntary written informed consent was sought from all study participants before enrolment into the study [17]. For all collected data, confidentiality was maintained using participant identifiers. Data was safely stored in a safety box under lock and key onlyaccessed by the study investigator.

RESULTS

Demographic Characteristics of the Study Participants

The mean age of the study participants was 25.6 years having 21 as the modal age. The majority of the participants were married 255(88.8%) with mostly secondary level of education 142(49.3%)followed by at most primary education 112(38.9%) and tertiary education the least 34(11.8%). The majority of the participants were from Iganga 182 (63.2%) followed by Bugweri 24(8.1%) and Namutumba 23(8.0%) This is as shown in the table below:

Table 1: Shows demographic characteristics of the study participants

Parameter	Frequency	Percentage
Education		
At most primary	112	38.9
Secondary	142	49.3
Tertiary	34	11.8
Marital status		
Married	255	88.5
Single	33	11.5
Residence		
Bugweri	24	8.3
Iganga	182	63.2
Mayuge	17	5.9
Luuka	18	6.3
Namutumba	23	8.0
Others	24	8.3

Prevalence of Surgical Site Infection

The prevalence of surgical site infection among pregnant mothers who underwent caesarean sectionat Iganga Hospital was 20.5% (59 out of 288) as shown in Figure 1

below;

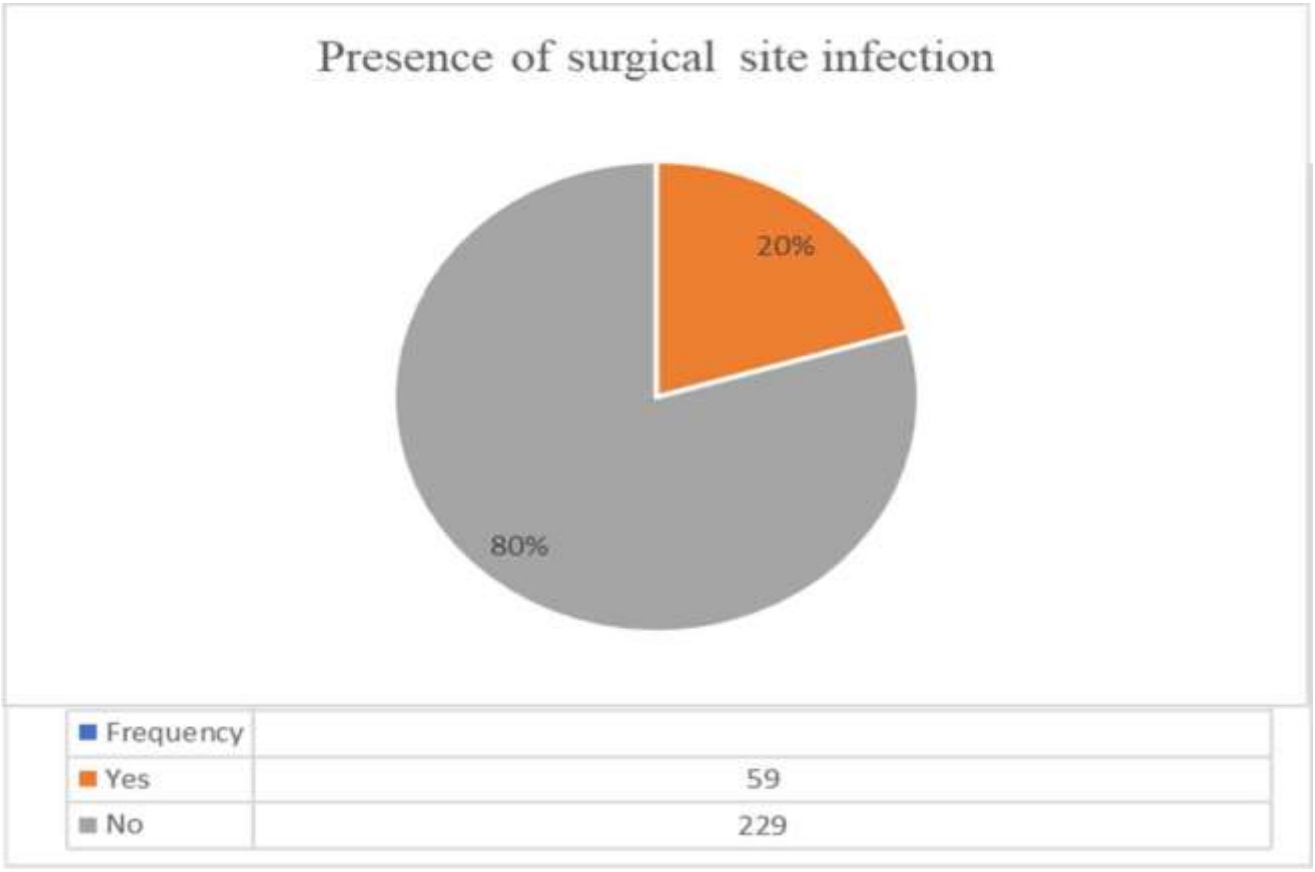

Figure 1: A pie chart showing the prevalence of surgical site infection among participants

Bivariant Level Analysis of Factors Influencing Surgical Site Infection Among Mothers Undergoing Caesarean Section in Iganga Hospital

Social Demographic Factors

Table 2: Shows the bivariant analysis of demographic factors of the study participants

Parameter	Frequency of incision discharge (%)		COR	P-value
	No	Yes		
Age				
<20 years	28(12.2)	9(15.3)	0.643(0.052-7.952)	0.731
20-29 years	140 (61.1)	38(64.4)	0.543(0.048-6.148)	0.543
30-39 years	59(25.8)	11(18.6)	0.373(0.031-4.476)	0.437
≥ 40 years	2(0.9)	1(1.7)		
Education				
At most primary	86(37.6)	26(44.1)	2.267(0.731-7.031)	0.156
Secondary	113(49.3)	29(49.2)	1.952(0.628-5.900)	0.252
Tertiary	30(13.1)	4(6.8)		
Marital status				
Married	206(90)	49(83.1)	1.828 (0.817-4.089)	0.138
Single	23(10)	10(16.9)		

There was no significant factor associated with surgical site infection among thesocio-demographic variables for the study participants.

Pregnancy and Labour Factors

Table 3: A table showing the pregnancy and labour factors of the study participants

Parameter	Frequency of incision discharge (%) No	Yes	COR	P-value
Chronic illness				
No	227(98.3)	55(96.5)	2.06(0.369-11.556)	0.400
Yes	4(1.7)	2 (3.5)		
Body Mass Index				
<18	8(3.5)	6(10.5)	0.3(0.043-2.112)	0.227
18.5-<25	194(84.0)	35(61.4)	0.072(0.013-0.387)	0.002
25-<30	27(11.7)	11(19.3)	0.163(0.027-0.970)	0.046
≥30	2(0.9)	5(8.8)	1	
Parity Primiparity	114(53.5)	35(61.4)	0.765(0.278-2.102)	0.603
Multiparity	85(39.9)	16(28.1)	0.459(0.156-1.348)	0.157
Grand parity	14(6.6)	6(10.5)		
Gestation Age Preterm	26(11.3)	7(12.3)	0.906(0.372-2.206)	0.828
Term	205(88.7)	50(87.7)		
Antenatal attendance				
No	0(0)	6(10.5)	5.529(4.313-7.089)	0.000
Yes	231(100)	51(89.5)		
Times of ANC <3 times	21(9.9)	19(33.3)	2.262(0.791-6.466)	0.128
3-5 times	172(80.8)	31(54.4)	0.474(0.185-1.214)	0.120
≥6 times	20(9.4)	7(12.3)		
Preeclampsia No	214(92.6)	53(93.0)	0.950(0.307-2.941)	0.929
Yes	17(7.4)	4(7.0)		
Caesarean section type Elective	5(2.2)	1(1.8)	1.239(0.142-10.817)	0.846
Emergency	226(97.8)	56(98.2)		
EROM ≤ 18 hours	63(98.4)	15(42.9)	84.00(10.433-676.293)	0.000
>18 hours	1(1.6)	20(57.1)		
Chorioamnionitis	No 231(100.0)	53(93.0)	0.187(0.146-8)	0.000
Yes	0(0.0)	4(7.0)		

Pregnancy and labour factors influencing surgical site infection at bivariate level analysis includebody mass index (p-value 0.002), Antenatal attendance (P-value 0.000), Early rupture of membranes (P-value 0.000) and Chorioamnionitis (P-value 0.000).

Table 4: A table showing the intra and post-operative factors of study participants

Parameter	Frequency of incisiondischarge (%)		COR	P-value
	No	Yes		
Incision type Pfannenstiel	231(100.0)	56(98.2)	0.195(0.154-0.247)	0.054
SUMI	0(0.0)	1(1.8)		
Postoperative HB No anaemia	219(94.8)	31(54.4)	15.306(7.012-33.410)	0.000
Anaemia	12(5.2)	26(45.6)		
Suture Technique Subacute	231(100.0)	55(96.5)	0.192(0.152-0.244)	0.064
Interrupted vertical mattress	0(0.0)	2(3.5)		
Duration of procedure < 1 hour	33(15.5)	0(0.0)	1.289(1.207-1.378)	0.002
1hour and above	179(84.0)	44 (77.2)		
Treatment given Ceftriaxone and Metronidazole	219(94.8)	56(98.2)	0.326 (0.041-2.560)	0.262
Ceftriaxone,Metronidazole and Gentamycin	12(5.2)	1 (1.8)		

At bivariant level analysis, the intra and post-operative variables influencing surgical site infection among mothers delivered by caesarean section in Iganga hospital were post-operative Haemoglobin (cOR 15.306, P-value 0.000) and duration of surgical procedure (cOR 1.289, Pvalue 0.002). Incision type, suture technique and treatment given were found statistically not significant with p-values of 0.054,0.064 and 0.262 respectively.

Multivariant Level Analysis of the Factors Influencing Surgical Site Infection Among Mothers Undergoing Caesarean Section in Iganga Hospital

Table 5: Shows the multivariant logistic regression of study variables influencing surgicalsite infection among study participants

Variable	P-value aOR	95% C.I. for aOR	Lower	Upper
Body Mass Index				
<18	**0.285**			
18.5-<25	0.266	0.274	0.028	2.684
25-<30	0.201	0.160	0.010	2.658
≥30	0.584	2.695	0.077	94.102
Early rupture of membrane				
≤ 18 hours	-1-	-1-		
>18 hours	0.000	23.715	5.976	94.117
Chorioamnionitis				
No	-1-	-1-		
Yes	0.811	0.754	0.075	7.626
Post-Operative HB				
No anaemia	-1-	-1-		
Anaemia	0.000	15.109	3.494	65.333
Surgical duration				
< 1 hour	0.084	6.701	0.775	57.907
1hour and above	-1-	-1-		

At multi-variant level analysis, only early rupture of membranes and post-operative haemoglobin were statistically associated with surgical site infection among mothers delivered by caesarean section. Early rupture of membranes of more than 18 hours increased the risk of surgical site infection by 23.715 times (aOR 23.715(5.976-94.117)) and it was statistically significant with a p-value of 0.000. Additionally, having a post-operative haemoglobin of less than 11.0g/dl (anaemic) was associated with 15.109 increased odds (AOR 15.109 (3.494-65.333) of surgical site infection with a significance of 0.0000 P-value at 95% confidence interval.

DISCUSSIONS

The prevalence of surgical site infection among pregnant mothers who underwent caesarean section at Iganga Hospital was 20.5% (59 out of 288). This is higher than the 15.6% observed in the Cochrane review in sub-Saharan Africa [18] and in Bwindi community hospital of 3.5% [19]. The wound sepsis rate was 16.8% in Hoima Regional referral hospital [20]. However, the prevalence was lower than that observed in New Delhi of 24.2% of mothers doing lower segment caesarean section

[21]. This couldbe because this was a cross-sectional study and might have missed out on mothers who developed SSI post-discharge. The factors statistically associated with post-caesarean surgical site infection included early rupture of membranes (aOR 23.715(5.976-94.117) and post-operative haemoglobin (aOR 15.109 (3.49465.333) Early rupture of membranes of more than 18 hours increased the risk of surgical site infection by 23.715 times and it was statistically significant with a p-value of 0.000. this is attributable to thefact that a break in the sterility of the uterine cavity gives an opportunity for entry of ascending infections and thus increases the risk for SSI. The study findings agree with case study findings in Sierra Leon where early rupture of membranes increased the risk of SSI by 50 % [22]. Furthermore, a meta-analysis in Africa found a 6 times increased risk for SSI [23] While in Ethiopia it increased by 2.27 [24].

Additionally, having a post-operative Hemoglobin of less than 11.0g/dl (anaemic) was associated with 15.109 increased odds of surgical site infection with a significance of 0.0000 P-value at a 95% confidence interval. This is attributable to the hypo perfusion of the wound secondary to the low haemoglobin concentration thus limiting oxygen supply to the wound thus increasing the risk of wound infection by a compromised macrophage activity and wound healing process [25]. The study finding was in agreement with [25] who found 4.51 increased odds for SSI in mothers with post-operative Hb <11g/dl in Ethiopia while in Goyeneche Hospital of Arequipa, moderate and mild anaemia increased the odds by 2.71 and 2.80 respectively [26]-[29]. In Mwanza, Tanzania severe anaemia increased the risk of SSI by 3.8 [7].

CONCLUSIONS

There was a high prevalence of surgical site infection among post-caesarean mothers at Iganga Hospital. There was no demographic factor that was influencing surgical site infection among mothers delivered by caesarean section at Iganga Hospital. Early rupture of membranes for more than 18 hours was 23.7 times associated with increased occurrence of surgical site infection among mothers delivered by caesarean section in Iganga Hospital. Post-operative haemoglobin below 11g/dl increases the odds of surgical site infection by 15 times among mothers delivered by caesarean section in Iganga Hospital.

Recommendations

Aggressive prophylactic and post-operative antibiotics therapy should be considered in mothers withearly rupture of membranes and post-operative anaemia.

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