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Factors Associated with Surgical Site Infection among Women Who Delivered by Cesarean Section at Mubende Regional Referral Hospital

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ABSTRACT

Surgical Site Infection is an infection related to a surgical procedure that occurs near the surgical sitewithin 30 days following surgery (or up to 90 days following surgery where an implant is involved). After surgery, the chances of developing SSI are about 1% to 3%. Without timely treatment, sepsis can rapidly leadto tissue damage, organ failure, and death. To determine factors associated with post-cesarean section SSI among postoperative mothers in MubendeRegional Referral Hospital. This was a case-control study design. Post cesarean section mothers with wound infection were the cases and post cesarean section mothers without post cesarean section site infection at the same post-natal Ward,with the same age and with the same exposure like the cases were the controls. Data collected was clear, coded and entered into Microsoft excel, then analyzed using SPSS v.20.Bivariate and Multivariate analysis was done to check for the relationship between dependent and independent variables. Descriptive data werepresented using frequency tables. At a multivariate stage, number of ANC visits, type of surgery, HIV status, type of incision, preoperative antibiotics, duration of labor, diabetes mellitus and BMI were independently associated with SSI after cesarean section. Surgical site infection after cesarean section is still a significant public health challenge. Predictors in include: ANC attendance, type of skin incision, HIV status, duration of labour, diabetes mellitus, BMI, typeof surgery and pre-operative antibiotics. Based on the findings, increased awareness of these risk factors informing development and implementation of protocols may minimize SSI rate after CS. Additionally, provision of health educationto patients and community.

Keywords: Surgical Site Infection, Sepsis, Organ failure, post-cesarean section, HIV status.

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. [1]. SSI is an infection related to a surgical procedure that occurs near the surgical site within 30 days following surgery (or up to 90 days following surgery where an implant is involved). After surgery, chances of developing SSI are about 1% to 3%. And because redness, delayed healing, fever, pain, tenderness, warmth, or swelling (CDC Apr 01, 2022)/ (2022 Up to Date) without timely treatment, sepsis can rapidly lead to tissue damage, organ failure, and death [1]. To be diagnosed with sepsis, a criterion of sepsis with sepsis-induced hypo perfusion, using markers of either systolic blood pressure (SBP) < 90 mm Hg or mean arterial pressure (MAP) < 65 mm Hg persisting despite adequate fluid resuscitation OR lactate > 4 mmol/L (regardless of timing of fluid administration) [2]. And blood culture analysis remains the gold standard for diagnosing sepsis [2]. CDC describes 3 types of surgical site infections: Superficial incisional SSI, infection occurs just in the area of the skin where the incision was made, Deep incisional SSI, infection occurs beneath the incision area in muscle and the tissues surrounding the muscles, and Organ or space SSI. Infection is in any area ofthe body other than skin, muscle, and surrounding tissue that was involved in the surgery such as a body organ or a space between organs. Bacterial pathogens cause most cases of sepsis. And are the most frequent causative agents,

with Staphylococcus aureus and Streptococcus pneumoniae representing the most relevant Gram-positive species, and Escherichia coli, Klebsiella species, and Pseudomonas aeruginosa dominating. And it can also be as a result of other infections, including viral infections, such as influenza, parasitic or fungal infections. The source of the infection can be any of a number of placesthroughout the body [3]. Worldwide, SSIs after C-section varied from 3 to 15% of patients after operation, and the rate differs according to the environment in which operations are performed, local resources, and a number of patient- and surgery-related factors. Rates are likely higher in LMICs, and one study has shown as much as a 20% SSI rate in women in Africa who have cesarean sections [4]. Surgical site infections are the most common infectious complications among hospitalized patients in developing countries, with a pooled cumulative incidence of 5.6 infections per 100 surgical procedures. The incidence differs depending on the degree of incision contamination [4]. In a study by Angie [4], post cesarean section differs globally. SSI was 3%–11% in HICs and3%–24% in LMICs. Great percentage of surgical site infections after caesarean section were reported in many developing countries with prevalence of 16.2% recorded in a research study from Nigeria, 19% fromKenya, and 10.9% from Tanzania and also 9.7% from Vietnam among others. However, there are no sufficient evidences on the sources of the infection, enormity of the problems they create, and their related risk factors in developing countries [5]. Surgical site infections result in prolonged hospitalization and a greater burden on resource- limited facilities and environments. However, a recent study of post-cesarean SSI rates in four sub-Saharan African countries show results comparable to those in HIC, indicating standardized protocols, peri- operative antibiotics, instrument sterilization, and incision care can be achieved in a low-resource setting. In LMICs, where quality measures are not available or are difficult to assess, post-cesarean SSI could be a proxy for the quality of surgical care [4]. In sub-Saharan Africa, the prevalence of SSI after LSCS ranges from 7 to 48 per cent. Surgical-site infections (SSIs) are an important global public health problem, disproportionately affecting low- and middle- income countries (LMICs), where the burden is 75 per cent higher than in developed countries [6]. Factors associated with SSIs include: Having surgery that lasts more than 2 hours, having other medical problems or diseases, being an elderly adult, overweight, Smoking, cancer, a weak immune system, diabetes, emergency surgery, and abdominal surgery [7]. Common predisposing factors leading to puerperal sepsis are anaemia, prolonged labour, frequent vaginal examinations in labour under unsterilized circumstances, premature rupture of membranes for prolonged period. Though cesarean sections are done under aseptic conditions, the risk of post-cesarean wound sepsis always exists which puts post-cesarean wound sepsis among the most common nosocomial infections. For instance, Italy, China, Mexico and Brazil all have rates higher than 36% with great variation within each nation. Post-cesarean wound sepsis is also associated with maternal mortality rate of up to 3% especially in health units that have no facilities to carryout safe cesarean sections or treat post-cesarean complications. In sub-Saharan Africa, post-cesarean wound sepsis has been shown to be in the range of 1.7% to 10.4% showing that the condition is significant inf the continent [8].

Statement of Problem

Surgical site infection is among the most common complications of cesarean section, and has an incidenceof 3%–15% which imposes physical and emotional hardship on the mother and an enormous financial strain on the health care system and it is the second leading cause of maternal mortality after post-partum hemorrhage [1]. Post-caesarean SSI is an important Health problem. It is a common cause of maternal mortality, second only to birth related haemorrhage [9]. Millennium Development Goal 5A (MDG5A) aimed to reduce maternal death by ¾ by 2015, a goal that was later incorporated

into the Sustainable Development Goal 3.1 (SDG3.1.) [10]. The rates of SSIs has been increasing each year both globally and LMICs, more so in sub Saharan countries [8].

According to the findings during an onsite visit to the Hospital, prevalence of post-caesarean wound sepsis was *16.8%*, yet no known factors are associated with surgical site infection. Hence, thorough identification of associated factors of post-cesarean wound sepsis is important. And develop protocols to reduce its burden and complications. This study therefore aimed at filling this gap at the study center.

METHODOLGY

Study design

A case control study design was adopted. Post cesarean mothers with wound infection were the cases and post cesarean mothers without post cesarean wound infection on the same postnatal Ward, with the same age and with the same exposure like the cases were the controls. The design was appropriate because it is able to determine association.

Source of data

The primary source of data was from post cesarean mothers who were receiving postoperative care on maternity ward of Mubende Regional Referral hospital hospital. The secondary source of data was got from the files of the cesarean section, time at which the membrane raptured to rule out premature rapture of membranes, duration of the operation, type of anesthesia that was used, type of cesarean section, use of antibiotics before and after cesarean section and the rank of the person performing the operation was got from the files and used to answer some of the questions in the questionnaire.

Area of Study

The study was conducted on postnatal ward of Mubende regional referral hospital Mubende district. Mubende Hospital is a regional Referral and Teaching Hospital with a bed capacity of 175 beds. It provides specialist services in Surgery, Internal Medicine, Paediatrics, Obstetrics and Gynaecology, Radiology with x-ray and sonography, Intensive Care, Dentistry and Oral Surgery, Orthopedics including minor fittings, laboratory with serology, microbiology, blood bank, chemistry, parasitology and Accident and Emergency department, major operating theater and anesthesia, Outpatient department, and Accident and Emergency department. The department of Obstetrics and Gynecology is well established. The department delivers over 150 mothers monthly. Maternity ward of Mubende Regional Referral hospital has a postnatal ward where mothers who deliver vaginally and by cesarean section are cared for and within this very ward, there is also a unit where mothers who get post cesarean wound infection are isolated and cared for. The study setting was favorable for the researcher because it offers free cesarean operations where the researcher could get respondents because of high turn up numbers of pregnant mothers in search for free health services.

Target population

All women who delivered from MRRH in Mubende District and neighbouring districts of Mityana, Kiboga and Kyankwanzi.

Accessible population

Cases: These included all post cesarean mothers with post cesarean wound sepsis receiving Postoperative care at Mubende Regional Referral hospital.

Controls: These included all post cesarean mothers without post-operative wound infection receiving post-operative care at Mubende Regional Referral hospital with the same age, admission, and operative dates, same exposures like hypertension diabetes mellitus, obesity, HIV status among other things like the cases.

Study population

All post cesarean mothers receiving care at Mubende Regional Referral hospital on postnatal ward of Mubende Regional Referral hospital who were eligible and consented to participate in the study.

Inclusion criteria for the cases

Post cesarean mothers diagnosed with post cesarean wound infection on postnatal ward in Mubende Regional Referral hospital, Mubende District.

Inclusion criteria for controls

Post cesarean mothers without post

cesarean wound sepsis on maternity ward of Mubende Regional Referral hospital hospital, Mubende District.

Exclusion criteria for the cases

Post cesarean mothers with wound infection who did not consent to participate in the study for reasons best known to themselves and post cesarean mothers with wound infection that occurred after 30days from the operating time. Post cesarean mothers with wound infection who were unconscious and who delivered from elsewhere and referred to MRRH.

Exclusion criteria for controls

Post cesarean mothers without wound infection who could not consent to participate in the study for reasons best known to themselves.

Sample size determination

Table 1: Sample size was calculated using open Epi info 7 software system

Two-sided confidence level	**99.99%**		**Kelsey**	**Fleiss**	**Fleiss w/CC**
Power	80%	Exposed	59	48	56
Ratio (Unexposed: exposed)	0.2	Unexposed	12	10	12
% Out-come in exposed group	3.0%	Total	**71**	58	68
Risk ratio	25.37				
Odds ratio	102.95				
% Outcome in exposed group	76.1%				

The sample size chosen for this study according to Kelsey was 71.

Sampling procedure

Post cesarean mothers with wound infection were selected using consecutive Sampling from postnatal ward of MRRH. A consecutive sampling is where all the people who meet the inclusion criteria and are conveniently available, as part of the sample where the post C/S mothers that are selected for inclusion inthe sample are easy to access. This allows the researcher to achieve the targeted sample with relative costand time needed to carry out a consecutive sample is small compared to size in a relatively first and inexpensive way.

Dependent variable

The dependent variable in this research study was surgical wound infection

Independent variables

These include the following:

Socio-demographic factors which included

Age

Employment status, Marital status, educational status, Parity Monthly income.

Obstetric and Maternal factors included; Antenatal care attendance during pregnancyPreoperative HB (hemoglobin).

HIV status Hypertension Obesity (BMI) Diabetes mellitusDehydration.

Premature rupture of membranes (<8hrs) Prolonged labor (> 12hrs).

Vaginal examination >4 times Facility related factors.

Type of skin incision (vertical / transverse).

Duration of the operation > 1 hour.

Rank of operating surgeon (Type of surgeon, junior/ senior)Type of C-section (emergency/elective C section).

Antibiotics used before and after C section

Type of anesthesia used.

Data collection techniques and instruments

A structured questionnaire, prepared in line with the objectives of the study was employed to collectPrimary data from the respondents. Secondary data in the questionnaire was filled in by the research assistant after checking for the required information from the participants' files. An English pre tested questioner was used to collect data from thestudy participants and consisted of closed ended questions to which participants in the study would respond. The decision by the researcher to use a questionnaire was due to the ease with which a questionnaire can be administered to the respondents and generation of data. Participants who were literate were given self-administered questionnaires and those who were illiterate were interviewed in vernacular using the same questionnaire. The purpose of data collection techniques and instruments was to measure the degree of constancy in responses hence establishing the reliability of the instruments.

Pre-test

Pre testing of the questionnaire was done on eleven post cesarean mothers on postnatal ward of Hoima Regional Referral Hospital to determine reliability and improve clarity of the instrument. This would help the Researcher to ensure appropriateness in gathering the required data that could be used to determine the content validity. The researcher also carried out in a way that eliminates inaccuracies and bias in data. The researcher used the guidance and expertise of the university supervisor to ensure validity of theresearch instrument which would answer the objectives of the study.

Data management

The researcher managed the data to ensure confidentiality and its security. Questionnaires were checked for mistakes and missing data before leaving the study site and the participants were requested to correct the mistakes or fill in the missing data. Questionnaires were coded for easy verification and also to prevent losses. Training and supervision of research assistants was done to ensure collection of quality data.

Data that was analyzed is tabulated to show the statistics and the relationship between the study variables. The relationship between factors associated with post cesarean section was analyzed by use of bivariate and multivariate analysis. Odds ratio and precision determined the strength of association. To ensure accuracy and reliability of data, data was collected and, exported to computer SSPS software for analysis. Reliability was the dependability or trust worthiness of the research results or the degree to which themeasuring instrument consistently measures what is supposed to be measured [11].

Descriptive analysis

Numerical data was summarized and presented as mean, standard deviation, median and interquartile (IQR) range. Categorized data was summarized in proportions and percentages presented in tables.

Objectives I, II, III

The relationship between independent and dependent variables was determined by logistic regression and the effect was odds ratio. The significance of the relationship was determined at α=0.05 and the relationship with p<0.2 was considered significant (having a relationship with post cesarean wound infection). Factors that were significant at bivariate analysis were carried to multivariate analysis where logistic regression analysis was used to assess the relationship between an independent variable and dependent variables. At multivariate analysis factors with P-value <0.05 were considered to be independently associated with SSI. Measure of association was the odds ratio and level of precision around the odds ratio was and dependent variable for post cesarean wound infection while keeping other factors constant. Results were presented as adjusted odds ratio, p-value and 95% C.I. These were presented as tables. Data was analyzed using the computer SSPS software. Continuous variables were expressed as mean ± standard deviation. Results were, presented using bar graphs, pie charts and frequency tables.

Quality control issues

The major focus was the content validity. Content validity of the instruments was ensured throughcriticisms of 3 colleagues with extensive expertise and experience in questionnaire construction.

Reliability of the instruments was improved through piloting and pre testing on post cesarean Mothers who were not part of the respondents. Reliability and validity of the results was achieved through member checks to assist indicate whether the findings appeared to match with the perceived authenticity. This limited the distorting effects of random errors on the findings. Pre testing and training of research assistants was done to ensure quality control.

Ethical issues

Permission to carry out the study was sought from Kampala International University and thereafter from MRRH research committees. Before initiating the research, an informed consent was sought from respondents clearly stating the advantages and disadvantages of participating in the study. Participants were informed that participating in the study was voluntary and they could withdraw from the study any time if they wish. Names or person identification numbers were not reflected on the questionnaire except the questionnaire numbers which were reflected for the purpose of data identification during data analysis and interpretation.

RESULTS

Socio-demographic characteristics of the study participants

Table 2: Socio-demographic characteristics of Cases and Controls

	Cases(n=71)		Controls(n=71)	
Variable	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Age(Years)				
13-30	45	58.4	38	49.4
31-45	26	36.6	33	42.9
Marital status				
Married	41	53.2	56	72.7
Single	14	18.2	08	10.4
Divorced	09	11.7	05	6.5
Widow	07	9.1	02	2.6
Parity				
≤3	43	55.8	31	43.7
≥4	28	36.4	40	56.3
Educational level				
None	29	37.7	11	14.3
Primary	23	29.9	18	23.4
Secondary	12	15.6	27	35.1
Tertiary	07	9.1	15	19.5
Employment status				
Civil servant	03	3.9	13	16.9
Unemployed	22	28.6	18	23.4
Peasant	31	40.3	25	32.5
Self employed	15	19.5	15	19.5

The study included 71 cases and 71 controls. Majority of the cases 41(53.2%) and 56(72.7%) were married, parity ≤3 (55.8%) and 31(40.3%) of cases and 25(32.5%) of controls were peasants. Majority of the cases 29(37.7%) had no

formal education, had parity ≤3 43(55.8) while 27(35.1%) of controls attained secondary education and 40(56.3%) had parity ≥4 as shown in the table above.

Maternal and Obstetric characteristics of the study participants

Table 3: Maternal and Obstetric characteristics of study participants

Antenatal care attendance during pregnancy			**Cases (n=71)** **Controls(n=71) Frequency** **Percentage (%) Frequency** **Percentage (%)**	
Yes	69	97.2	71	98.6
No	02	2.8	01	1.4
Number of ANC visits				
≤4	25	35.2	07	9.9
≥4	46	64.8	64	90.1
Hypertension				
Yes	05	7.0	02	2.8
No	66	93.0	69	97.2
Diabetes mellitus				
Yes	03	4.2	01	1.4
No	68	95.8	70	98.6
BMI				
≤18.5	05	7.0	00	0.0
18.6-24.9	47	66.2	57	80.3
25-29.9	17	23.9	13	18.3
≥30	03	4.2	01	1.4
HIV status				
Positive	14	19.7	03	4.2
Negative	57	80.3	68	95.8
Duration of labour(Hours)				
≤12	46	64.8	65	91.5
≥12	25	35.2	06	8.5
Number of vaginal examinations				
≤4times	54	76.1	62	87.3
≥4times	17	23.9	09	12.7
Duration of rupture of membranes(Hours)				
≤8	52	73.2	60	84.5
≥8	19	26.8	11	15.5
Preoperative Hemoglobin(g/dl)				
<7.0	04	5.6	00	0.0
7.0-11.0	08	11.3	05	7.0
>11.0	59	83.1	66	93.0

Majority of the study participants in both cases 69(97.2) and controls 71(98.6) attended ANC, 46 (64.8%) of the cases and 64(90.1%) of the controls attended ANC ≥4times. 66(93.0%) of the cases and 69(97.2%) of the controls did not have hypertension, 68(95.8%) of the cases and 70(98.6%) of the controls did not have diabetes mellitus. Majority 57(80.3%) of cases and 68(95.8%) of controls were HIV negative. 46(64.8%) of cases and 65(91.5%) of controls had labour lasting for ≤12hours. 52(73.2%) of cases and 60(84.5%) had a duration of rupture of

membranes ≤8hours. Majority 54(76.1%) of cases and 62(87.3%) of controls had ≤4 vaginal examinations done on them. 59(83.1%) of cases and 66(93.0%) of controls had preoperative hemoglobin >11.0g/dl as shown in the table above

Health facility characteristics

Table 4: Health facility characteristics

Variable	Cases		Controls	
Type of skin incision	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Vertical	14	19.7	06	8.5
Transverse	57	80.3	65	91.5
Cadre of operating Surgeon				
Junior	49	69.0	37	52.1
Senior	22	31.0	34	47.9
Type of surgery				
Emergency	54	76.1	35	49.3
Elective	17	23.9	36	50.7
Antibiotics given before the procedure				
Yes	58	81.7	69	97.2
No	13	18.3	02	2.8
Antibiotics given after the procedure				
Yes	64	90.1	71	100.0
No	07	9.9	00	0.0
Type of anesthesia				
General	11	15.5	03	4.2
Spinal	60	84.5	68	95.8

Majority of the study participants of both cases 57(80.3%) and controls 65(91.5%) had transverse skin incisions. 58(81.7%) of cases and 69(97.2%) of controls were given antibiotics preoperatively. 64(90.1%) of cases and 71(100.0%) of the controls were given antibiotics postoperatively. 60(84.5%) of the cases and68(95.8%) of the controls were given spinal anesthesia. 49(69.0%) of cases and 37(52.1%) of the controls were operated by junior surgeons. The majority of 54(76.1%) cases had emergency surgeries while the majority of 36(50.7%) of the controls had elective surgeries as shown in the table above.

Socio-demographic factors associated with post cesarean section SSI

Table 5: Bivariate analysis of the Socio-demographic factors associated with post cesarean section SSI

Variables	Cases n=71(%)	Controls n=71(%)	COR	95% CI	P-Value
Age(Years)					
15-30	45(58.4)	38(49.4)	1.50	1.18-2.86	0.35
31-45	26(33.8)	33(42.9)	Reference		
Education level					
No formal education	29(37.7)	11(14.3)	3.83	3.20-4.86	0.53
Primary	23(29.9)	18(10.4)	1.41	1.05-2.65	0.46
Secondary	12(15.6)	27(35.1)	0.33	0.07-5.58	0.05
Tertiary	07(9.1)	15(19.5)	Reference		
Employment status					
Peasant	31(40.3)	25(32.5)	1.44	1.20-2.54	0.56
Self employed	15(19.5)	15(19.5)	1.00	0.05-5.70	0.51
Unemployed	22(28.6)	18(23.4)	1.32	0.03-2.88	1.00
Civil servant	03(3.9)	13(16.9)	Reference		
Marital status					
Widow	07(9.1)	02(2.6)	5.50	2.23-7.54	0.39
Single	14(18.2)	08(10.4)	1.92	1.05-5.23	0.04
Divorced	09(11.7)	05(6.5)	1.88	1.13-4.00	0.70
Married	41(53.2)	56(72.7)	Reference		
Parity					
≤3	43(55.8)	31(43.7)	1.97	1.68-5.19	0.49
≥4	28(36.4)	40(56.3)	Reference		

***P<0.2, CI-Confidence Interval, COR-Crude odds ratio**

Education level and marital status were associated with SSI among post cesarean section mothers and were therefore considered for multivariate logistic regression.

Maternal and Obstetric factors associated with SSI

Table 6: Bivariate analysis of maternal and obstetric factors associated with SSI

Variable	Cases n=71(%)	Controls n=71	COR	95%CI	P-Value
ANC attendance					
No	02(2.8)	01(1.4)	3.00	0.03-6.62	0.61
Yes	69(97.2)	70(98.6)	Reference		
Number of ANC visits					
≥4	46(64.8)	64(90.1)	Reference		
≤4	25(35.2)	07(9.9)	4.91	2.21-7.89	0.04
Hypertension					
Yes	05(7.0)	02(2.8)	8.00	6.30-12.56	0.45
No	66(93.0)	69(97.2)	Reference		
BMI					
≤18.5	05(7.0)	-	-	-	-
18.6-24.9	47(66.2)	57(80.3)	0.48	0.21-2.31	0.36
25-29.9	17(23.9)	13(18.3)	Reference		
≥30	03(4.2)	01(1.4)	4.00	2.50-10.81	0.01
HIV status					
Positive	14(19.7)	03(4.2)	6.25	4.13-9.29	0.07
Negative	57(80.3)	68(95.8)	Reference		
Duration of labor(Hours)					
≥12	25(35.2)	06(8.5)	6.00	2.07-20.47	0.15
≤12	46(64.8)	65(91.5)	Reference		
Number of vaginal examinations					
≥4	17(23.9)	09(12.7)	2.07	1.267-2.38	0.68
≤4	54(76.1)	62(87.3)	Reference		
Duration of rupture of membranes (Hours)					
≥8	19(26.8)	11(15.5)	2.06	1.33-4.49	0.20
≤8	52(73.2)	60(84.5)	Reference		
History of diabetes mellitus					
Yes	03(4.2)	01(1.4)	4.00	2.00-69.33	0.15
No	68(95.8)	70(98.6)	Reference		
Preoperative Hemoglobin(g/dl)					
<7.0	04(5.6)	0(0.0)	-	-	-
7-11	08(11.3)	05(7.0)	1.63	0.51-4.35	0.73
>11.0	59(83.1)	66(93.0)	Reference		

***P<0.2, CI-Confidence Interval, COR-Crude odds ratio**

From 5 above, number of ANC visits, HIV status, Diabetes mellitus, BMI and duration of labour were associated with SSI and therefore considered for logistic regression analysis.

Health facility factors associated with SSI after cesarean section

Table 7: Bivariate analysis of health facility factors associated with post cesarean section SSI

Variables	Cases n=71(%)	Controls n=71(%)	COR	95%CI	P-Value
Type of incision					
Vertical	14(19.7)	06(8.5)	2.78	1.04-6.16	0.01
Transverse	57(80.3)	65(91.5)	Reference		
Cadre of operating surgeon					
Junior	49(69.0)	37(52.1)	2.04	1.06-3.55	0.003
Senior	22(31.0)	34(47.9)	Reference		
Type of surgery					
Emergency	54(76.1)	35(49.3)	3.28	0.13-10.43	0.07
Elective	17(23.9)	36(50.7)	Reference		
Preoperative antibiotics given					
No	13(18.3)	02(2.8)	7.33	4.03-8.93	0.003
Yes	58(81.7)	69(97.2)	Reference		
Postoperative antibiotics given					
No	07(9.9)	-	-	-	-
Yes	64(90.1)	71(100.0)	Reference		
Type of anesthesia					
General	11(15.5)	03(4.2)	4.5	0.04-7.87	0.340
Spinal	60(84.5)	68(95.8)	Reference		

***P<0.2, CI-Confidence Interval, COR-Crude odds ratio**

Type of incision, Cadre of operating surgeon, type of surgery and preoperative antibiotics were associated with SSI after cesarean section and considered for logistic regression analysis.

Multivariate analysis of factors associated with post cesarean section SSI

Table 8: Multivariate analysis of socio-demographic, maternal and obstetric and health facility factorsassociated with SSI after cesarean section

AOR	95% CI		P-Value
Variables			
Number of ANC visits			
≥4times	0.17	0.12-4.72	0.004
≤4times	Reference		
Marital status of respondents			
Single	2.02	0.69-6.41	0.185
Divorced	1.86	1.26-13.09	0.535
Widow	1.64	1.00-10.30	0.451
Married	Reference		
Type of surgery			
Emergency	1.06	0.19-5.95	0.005
Elective	Reference		
HIV status			
Positive	1.97	0.91-4.29	0.001
Negative	Reference		
Type of incision			
Vertical	3.48	1.60-8.07	0.002
Transverse	Reference		
Preoperative antibiotics			
No	0.15	0.04-0.89	0.021
Yes	Reference		
Cadre of operating surgeon			
Junior	0.76	0.11-4.27	0.676
Senior	Reference		
Duration of labour(Hours)			
≥12	1.34	0.63-2.86	0.013
≤12	Reference		
Diabetes mellitus			
Yes	1.25	0.44-3.51	0.025
No	Reference		
BMI			
≤18.5	-	-	-
18.6-24.9	1.27	1.12-5.64	0.231
25-29.9	Reference		
≥30	0.32	0.12-3.52	0.001

***P<0.05; AOR=Adjusted odds ratio, CI= confidence interval**

At multivariate analysis, number of ANC visits, type of surgery, HIV status, type of incision, preoperative antibiotics, duration of labour, diabetes mellitus and BMI were independently associated with SSI after cesarean section as shown in the table above.

DISCUSSION

Socio-demographic factors

According to the study, there was no observed association between socio-demographic factors and SSI after cesarean section. This is inconsistent with the finding of Ayala and colleagues (2021) who found an association between socio-demographic factors and SSI. Accordingly, another study reported an association between socio-demographic factors and SSI after CS [12]. The difference may be due to variation in participant characteristics and the research methodology.

Maternal and Obstetric factors

At multivariate analysis, number of ANC visits, HIV status, duration of labour, diabetes mellitus and BMI were independently associated with SSI after cesarean section. This study established that mothers who attended ANC≤4 times and living with HIV (50.0%) had higher odds of developing SSI. Infrequent ANC visits were associated with SSI according to a study [13]. Comorbidities are addressed during antenatal care therefore reducing the risk of SSI. My finding is congruent with a study in Ethiopia which concluded that no antenatal care attendance and living with HIV were predictors of surgical site infections [14]. HIV infection reduces patients' immunity hence predisposing to various infections including surgical site infections. The current study found out that occurrence of SSI was high among mothers with labor lasting ≥12hours, diabetes mellitus and BMI ≥30). This is consistent with the findings of a study in Ethiopia which revealed high likelihood of occurrence of SSI among mothers who had prolonged labor [15-20]. Prolonged labor contributes to contamination of amniotic fluid by bacteria from the Genito-urinary tract which may lead to surgical wound contamination. These findings are also in accordance with a study in Ethiopia which revealed that Diabetes mellitus and Obesity were significant risk factors for post-cesarean surgical site infection [16]. This is also supported by a study in Nepal which revealed a significant association between SSI with diabetes mellitus, obesity and prolonged of labour [17]. Diabetes mellitus reduces the body's defense against invasion by various pathogens hence increasing the likelihood of SSI occurrence.

Health facility factors

There was an observed association between type of surgery, preoperative antibiotics and type of incision with Post cesarean section SSI. SSI was significantly high among patients who had vertical surgical incisions, had emergency surgery and those who did not receive preoperative antibiotics. Similarly, a study in Egypt revealed that emergency cesarean section was significantly associated with post-cesarean surgical site infection [16]. This may be attributed to rapid and inappropriate preparation in response to fetal and maternal distress. A study in Ethiopia reported that mothers who had vertical incisions were more likely to develop SSI compared to those with horizontal incisions [14], [21-24]. This could be attributed to procedural elements as it takes longer for vertical incisions increasing the likelihood of contamination. Similar to my study, use of preoperative antibiotics reduces risk of surgical site infection according to literature [12]. This may be because of reduction of microbial load with administration of antibiotics.

Limitation

This study was limited by small sample size due to limited study period, restricted movement to study areato collect data due to Ebola outbreak in Mubende district epicenter.

CONCLUSION

Surgical site infection after cesarean section is still a significant public health challenge. Predictors in include: ANC attendance, type of skin incision, HIV status, duration of labour, diabetes mellitus, BMI, type of surgery and pre-operative antibiotics.

Recommendation

i. Increased awareness of these risk factors informing development and implementation of protocols may

minimize SSI rate after CS.

ii. Provision of health education to patients and community.

iii. Early and full attendance of ANC as good prenatal care is a key preventive measure against SSIs. Proper nutrition and weight management to maintain normal weight since obesity is a key factor associated with SSIs.

iv. Have their blood sugars monitored and properly controlled and also avoid smoking while pregnant.

v. Lastly, to protect themselves against HIV/AIDS that also increaseschances of SSIs.

vi. Health education on HIV/AIDS prevention to be offered regularly to the clients of the facility especially women attending family planning and ANC.

vii. More awareness creation on SSIs and more specifically education on the modifiable risk factorssuch as obesity and cigarette smoking.

viii. Lastly, but most definitely not the least, health outreaches and camps to reach those of rural areas remote from the health facility and provide services to them to prevent cases of Chorioamnionitis brought about by for example prolonged rupture of membranes.

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