

Prevalence and Factors Associated with Surgical Site Infection in Post Caesarean Mothers

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ABSTRACT

Post-cesarean surgical site infection after cesarean delivery is a surgical problem that significantly contributes to maternal morbidity and mortality. In Uganda, admissions due to surgical site infection following cesarean section have been constant activities of health care facilities, but again, there are limited facts on the factors associated with it, making preventive measures less effective. Therefore, this study aimed to assess the risk factors for post-cesarean section surgical site infection at Fort Portal regional referral hospital, Uganda. A cross-sectional study with a retrospective record review was conducted. The data were analyzed using Statistical Package for Social Science Software (SPSS) version 26. Post-cesarean section surgical site infection was measured based on the disease classification and definition of the term by the Center for Disease Control and Prevention. After checking for the presence and degree of association of factors with outcomes, variables were computed through logistic regression analysis. Factors with a P value ≤ 0.2 in the bi-variable logistic regression analysis were included in the multivariable logistic regression analysis, and those variables with a P value of <0.05 in the multivariable analysis were considered statistically significant. From the medical records of women who underwent cesarean sections, 77 (12.4%) of them developed surgical site infections. Rural residence [(AOR = 2.30, 95%CI: (1.29, 4.09)], duration of labor greater than 24 hours [(AOR = 3.48, 95%CI: (1.49, 8.09)], rupture of membrane >12 hours [(AOR = 4.61, 95%CI: (2.34, 9.09)], hypertension [(AOR = 3.14, 95%CI: (1.29, 7.59)], and preoperative hemocrit $\leq 30\%$ [(AOR = 3.22, 95%CI: (1.25, 8.31)] were factors significantly associated with post-cesarean section surgical site infections. The magnitude of post-cesarean section surgical site infection was a significant problem in Fort Portal regional referral hospital. Minimizing prolonged labor, minimizing early rupture of membranes, properly managing patients with comorbidities like hypertension, strengthening prophylaxis and treatment for anemia during antenatal care, and raising awareness among rural residents can reduce the problem. Zonal policy makers should place emphasis on reducing its burden as well as the provision of qualified health care personnel by the government for better prevention and treatment.

Keywords: Cesarean delivery, Post-cesarean, Surgical site infection, Bacteria infection

INTRODUCTION

Cesarean delivery is a major obstetrical surgical procedure aiming to save the lives of mothers and fetuses. The incidence of cesarean deliveries, both repeat and primary, has risen dramatically over the last few decades, with an estimated global number of 22.9 million cesarean deliveries in 2012 [1, 2]. It is one of the 29 WHO-recommended surgical procedures that ought to be accessible at the district level worldwide [3]. As a surgical procedure, cesarean delivery may result in a number of complications, surgical site infection (SSI) being one of them. The rate of surgical site infection (SSI) ranges from 3% to 15% worldwide [4]. Surgical site infections are often localized to the incision site but can also extend into deeper adjacent structures. Signs and symptoms of surgical site infection include purulent discharge from the wound or around the

incision site, increased pain, pyrexia, and dehiscence at the incision site [5, 6]. Bacteria that enter through incisions made during surgery are what cause surgical site infections. Surgical site infections are the most common nosocomial infection, accounting for 38 percent of nosocomial infections [7]. In Pakistan, the rate of incision site infection is 13.0% [8]. Post-cesarean SSI may increase maternal morbidity and mortality [9]. In addition, SSI can be frustrating for the mother trying to recover from the procedure while at the same time taking care of the newborn. It may prolong maternal hospitalization, increase health care costs, and have other socioeconomic implications [10, 11].

Surgical site infection (SSI) is one of the commonest complications associated with cesarean section delivery, and it has a global incidence rate of 3%–15%

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[12]. It is a great source of physical and emotional burden on mothers, and it also causes a significant financial burden on the health care system. Surgical site infections are associated with a maternal mortality rate of up to 3% [2]. Puerperal infection remains a notable cause of maternal morbidity and mortality both in developed and developing countries. One predominant risk factor is caesarean section, which increases the risk of puerperal sepsis by 5-fold to 20-fold [13]. Caesarean surgical site infection is a common cause of morbidity and mortality after a caesarean section. It continues to represent about a fifth of all healthcare-associated infections. It leads to an increase in the average duration of stay on the post-caesarean wards, overuse of antibiotic therapy, increased hospital bills, and an increased cost of post-discharge care [14]. Surgical site infections also delay the recovery process. Patients that get SSIs post-CS stay in the hospital for

Study Design

A cross-sectional study design was used. The study also employed both quantitative and qualitative methods. The qualitative and quantitative components of this study design were reflected in a retrospective study regarding incision site infection in post-caesarean mothers and associated factors as per the conceptual framework.

Area of Study

The study was conducted at the Fort Portal regional referral hospital (FRRH) in western Uganda, Kabarole district. It's the regional referral hospital for the districts of Kabarole, Bundibugyo, Kamwenge, Kasese, Ntororoko, and Kyenjojo.

Study Population

The hospital has a bed capacity of 307 beds. Fort Portal RRH offers both general and specialized services and is a teaching hospital at the study site of Kampala International University. The maternity ward is subdivided into the gynecology ward, labor suite, and postnatal wards. The maternity ward in total has a bed capacity of 42 beds, and specifically, the postnatal ward has a bed capacity of 19 beds. The total population of women who undergo a caesarean section in Fort Portal Regional Referral Hospital in a month is approximately 80 women, according to the Ministry of Health report for 2017.

Sample Size Determination

Sample size was calculated using Fisher et al formula [19], which is: $N = Z^2pq/d^2$, where, N is the derived size of the population. Z was the standard deviation at 95% of the degree of confidence which is 1.96, P was the proportion of the target group and is estimated to be 15%, q is $1-p = 1-0.15 = 0.85$, d was the measure of anticipated error as a proportion of

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longer periods of time than patients without infections [15]. Although at least 5% of patients develop an SSI after surgery, these infections seem to cause remarkably little concern, remaining largely unreported in the media [16]. Surgical site infection is still very common in health facilities, even in the best facilities where most modern equipment is used and standard preoperative preparations are adhered to [17]. In Mbarara regional referral, the study carried out on the incidence of incision site infection revealed an incidence rate of 16.4% [18]. However, in Fort Portal Regional Referral Hospital, the information about incision site infection is not available, so there is a need to carry out the study. This study sought to determine the prevalence and factors associated with surgical site infections in post-caesarean section mothers in Fort Portal Regional Referral Hospital in Fort Portal, in western Uganda.

METHODOLOGY

standard deviation about 0.05, $z = 95\% = 1.96$, $p = 15\% (0.15)$, $q = 1 - 0.15 = 0.85$, $d = 0.05$
 $N = (1.96)^2 \times 0.15 \times 0.85 / (0.05)^2 = 622$
Therefore, N (sample size) = 622 respondents

Sampling Method

To determine factors influencing incision site infection in post-caesarean mothers, simple random sampling was used by distributing small pieces of paper numbered 1 to 10, and whoever picked an even number and those who consented were allowed to participate in the study.

Inclusion Criteria

The study included mothers on the post-caesarean ward of Fort Portal Regional Referral Hospital on their third day of post-operation and willing to fully participate in the study.

Exclusion Criteria

The study did not include mothers on their first- and second-days post-operation and those who did not consent.

Data Collection Methods

Data was collected using a pretested questionnaire and checklist guide. Anthropometric measurements were obtained using a weighing scale and a Stadiometer for weight and height, respectively. The researcher and three assistants were used to help in the administration and explanation of questionnaires to the respondent(s) in order to aid and ease the process of data collection. The check list guide was used for clinical assessment.

Data Analysis Plan

Prevalence of surgical site infections in post-caesarean mothers in Fortportal regional referral hospital. The following form was used to analyze the collected data.

$$\frac{\text{number of mothers with SSI}}{\text{Total number of mothers in the study}} * 100\%$$

Data analysis of maternal factors associated with surgical site infections in post-cesarean mothers in the Fortportal regional Referral hospital was done using the following:

- i. **Univariate analysis:** frequencies expressed in percentages were used.
- ii. **Bivariate analysis:** Chi square and a value of significance of $P < 0.05$.
- iii. **Multivariate analysis:** All variables at bivariate analysis with a P value of < 0.2 were considered for the multivariate analysis.

Stepwise logistic regression with a P value of < 0.05 was finally considered significant.

Data analysis of obstetric factors associated with surgical site infections in post-cesarean mothers in the Fortportal regional referral hospital was carried out using the following:

- i. **Univariate analysis:** frequencies expressed in percentages were used.
- ii. **Bivariate analysis:** Chi square and a value of significance of $P < 0.05$.
- iii. **Multivariate analysis:** All variables at bivariate analysis with a P value of < 0.2 were considered for the multivariate analysis.

Stepwise logistic regression with a P value of < 0.05 was finally considered significant.

Ethical Consideration

All the information collected in this study was confidential. This means that all participants' details were kept private and not disclosed to anyone outside the research team. The names of the participants were kept separately from the questionnaires, and this was only accessible to the research team for follow-up purposes. Questionnaires were kept under lock and key. A softcopy of the research was on the researcher's personal computer, protected by a password that was accessible only to the researcher. No names were mentioned in reports or any publications. The study was fully explained to the participant(s), giving them sufficient information, including about the risks and benefits, to enable the participant to make an informed decision to participate or not. Participation in the study was voluntary, and participants were free to withdraw from the study at any time. None of the participants were forced to give information. There were no risks to participants. Wound dressings were routinely removed on postoperative day 3, and this act has no increased risk of wound infection. This is a standard practice in most hospitals in Uganda. Wound infections were picked up early because the wound was inspected for problems and management was instituted earlier. The study also helped inform Fort Portal Regional Referral Hospital of the level of surgical site infection and how to reduce it for the benefit of patients.

RESULTS

From the study population, the mean age of the mothers was 27.67 years with a standard deviation (SD) of 6 in a range of 16–45 years. Most (64.3%) of

them were > 30 years old, $> 50\%$ (58.2%) were from rural areas, most of them are Christians and married.

Table 1. Socio-demographic Characteristics of Women Who Underwent Cesarean in Fort Portal Regional Referral Hospital, Uganda.

Variables	Category	Frequency	%
Age	> 30	400	64.3
	< 30	222	35.7
Religion	Christian	578	92.9
	Muslim	44	7.1
Residence	Urban	260	41.8
	Rural	362	58.2
Marital status	Married	609	97.9
	Others	13	2.1
Educational status	Educated	305	49
	Uneducated	317	51

Obstetric-Related Factors

On parity, nearly half (49.2%) were multi-para, and $> 90\%$ of the study participants (97.4%) had antenatal care visits. Only 15.6% of participants experienced prolonged premature membrane rupture, while

nearly two-thirds (63.3%) had a labor duration of less than 24 hours before surgery. 1–4 times, a vaginal examination was performed for more than three-fourths of women (81.7%).

Table 2: Obstetric-Related Factors of Mothers Who Underwent Cesarean Section at Fort portal Regional Referral Hospital Uganda

Variables	Category	Frequency	Percent
Parity	Primi-Para	282	45.3
	Multi Para	306	49.2
	Grand multi Para	34	5.5
ANC visit	No	16	2.6
	Yes	606	97.4
Duration of labor	Not in labor	122	19.6
	<24hrs	394	63.3
	>24hrs	106	17
Gestational age	<37wks	39	6.3
	37_40wks	490	78.8
	>40wks	93	15
Number of vaginal examinations	Not done	88	14.1
	1-4	508	81.7
	>5	26	4.2
Duration of membrane rupture	Intact	285	45.8
	Ruptured<12hrs	240	38.6
	Ruptured >12hrs	97	15.6
Present of meconium	Yes	132	39.1
	No	206	60.9
Present of chorioamninitis	Yes	24	7.1
	No	314	92.9
History of abortion	Yes	42	6.8
	No	580	93.2
History of previous C/S	Yes	68	10.9
	No	554	89.1

Co-Morbidity Related Factors

1% of the study participants were reactive for HIV and 4.3% of them had gestational hypertension.

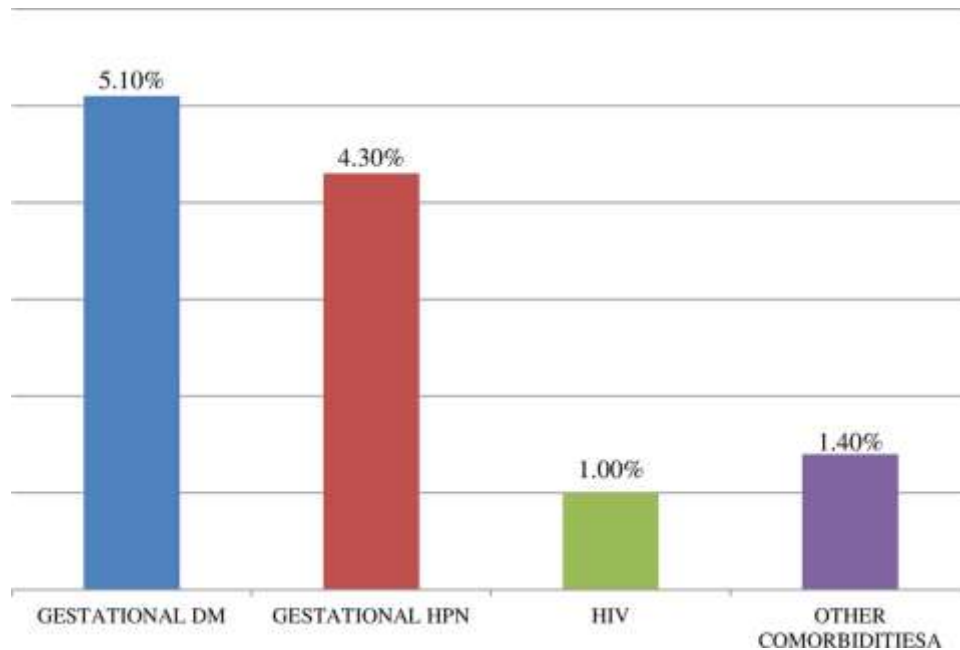


Figure 1. Co-Morbidity Related factors of Women who underwent Cesarean Section at Fort portal Regional Referral Hospital Uganda

Operation and Anesthesia-Related Factors

Antibiotic prophylaxis was provided. Pre-operatively for the majority (95.8%) of the participants, and post-operative antibiotics were given to all study participants. Most of the study participants (95.7%) had a preoperative hematocrit > 30%, and three-

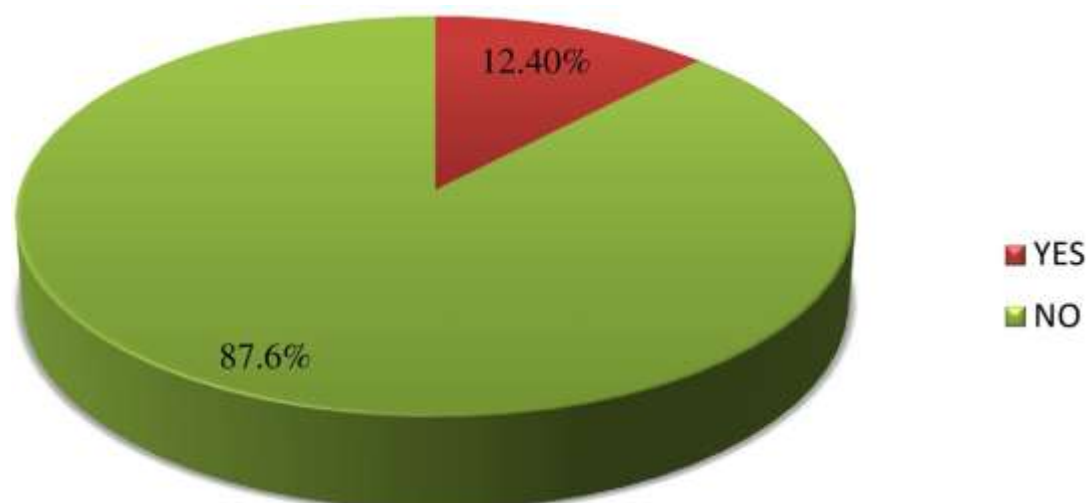
fourths of them (80.1%) had < 8 days of post-operative hospital stay (Table 3). The highest indication for cesarean section was non-reassurance fetal heart rate (NRFHR) (27.33%), followed by cephalo-pelvic disproportion (CPD) (21.7%).

Table 3: Operation and anesthesia related factors of mothers who underwent cesarean section at Fort portal Regional Referral Hospital Uganda

Variables	Category	Frequency	%
Who perform the operation	Emergency surgeon	584	93.9
	Gynecologist	38	6.1
Preoperative HCT	<30%	27	4.3
	>30%	595	95.7
Type of CS	Emergency	593	95.3
	Elective	29	4.7
Type of anesthesia	Regional	565	90.8
	General	57	9.2
Duration of operation	<60minutes	502	80.7
	>60minutes	120	19.3
Type of abdominal incision	Transverse	608	97.7
	Vertical	14	2.3
Prophylactic antibiotics	Yes	596	95.8
	No	26	4.2
Post-operative antibiotics	Yes	622	100
Number of dose of antibiotics	Multiple dose	622	100
Post-operative HCT	<30%	43	6.9
	>30%	579	93.1
Length of hospital stay	<8 days	498	80.1
	>8 days	124	19.9
Blood transfusion	Yes	55	8.8
	No	567	91.2

Magnitude of Post Cesarean Section Surgical Site Infection

(12.4%) of the study participants developed post-cesarean section surgical infection [95% CI: (9.8% - 14.9%)].

**Figure 2: Magnitude of Post Cesarean Section Surgical Site Infection at Fortportal Regional Referral Hospital Uganda**

Factors Associated with Post Cesarean Section Surgical Site Infection

During bivariate logistic regression analysis, those variables with a P-value of ≤ 0.2 were considered in multivariate logistic regression. Out of the 37 independent variables, ten were linked in a way that was significant at the 0.2 level in a bivariate analysis. These were age, residence, parity, duration of membrane rupture, duration of labor, length of hospital stay, hypertension, duration of surgery,

ante-partum hemorrhage, and preoperative HCT. These variables were then used in a multivariate logistic regression analysis. If the membranes ruptured for more than 12 hours, labor went on for more than 24 hours, the woman had high blood pressure, or her HCT level was less than 30% before surgery, there was a higher chance of getting an infection at the surgical site after a cesarean section (p-value < 0.05 with a 95% confidence interval).

Table 4: Bi-Variate and Multivariate Logistic Regression Analysis of Factors Associated with Post-Cesarean Section Surgical Site Infection at Fort Portal Regional Referral Hospital Uganda.

Variables	Category	Post CS SSI		COR(95% CI)	AOR(95%CI)	P-Value
		Yes	No			
Residence	Urban	20	240	1	1	
	Rural	57	305	2.243(1.311,3.836)	2.304(1.295,4.098)	0.005
Membrane status	Intact	20	265	1	1	
	Ruptured<12hrs	28	212	1.75(.959,3.194)	1.427(0.752,2.706)	.277
	Ruptured>12hrs	29	68	5.651(3.013,10.598)	4.609(2.336,9.094)	.001
Labor status	Not labor	10	112	1	1	
	Labor >24 hrs.	36	358	1.126(.542,2.342)	.922(0.421,2.020)	.838
	Labor >24 hrs.	31	75	4.629(2.142,10.003)	3.477(1.495,8.086)	.004
Parity	Primi-Para	28	254	1	1	
	Multi-Para	40	266	1.364(.817,2.278)	1.300 (0.695,2.433)	.411
	Grand-Para	9	25	3.266(1.387,7.687)	2.2510(0.723,7.011)	.162
Duration of Operation	< 1hr	53	449	1	1	
	> 1hr	24	96	2.118(1.246,3.599)	1.596(0.872,2.921)	.129
Age	<30 years	42	358	1	1	
	>30 years	35	187	1.595(.985,2.584)	1.085(.574,2.050)	.803
Hypertension	Yes	9	23	3.067(1.363,6.901)	3.135(1.294,7.593)	.011
	No	68	522	1	1	
APH	Yes	7	23	2.270(.939,5.483)	1.823 (.588,5.651)	.298
	No	70	522	1	1	
Preoperative HCT	>30%	68	527	1	1	
	<30%	9	18	3.3.875(1.674,8.968)	3.221(1.249,8.309)	.016
Length of hospital stay	<8 days	57	441	1	1	
	>8 days	20	104	1.488(.856,2.585)	1.698(0.920,3.135)	.090

Women who were from rural areas were 2.3 times more likely to develop post-CS infection than those from an urban setting [AOR = 2.30, 95% CI: (1.295, 4.098; P = 0.005)]. The odds of developing post-CS infection among women who had a history of rupture of membrane greater than 12 hours before surgery were 4.6 times higher than those who had intact membrane [(AOR = 4.61, 95%CI: (2.336, 9.094, P = 0.001)]. Women who had a duration of labor greater than 24 hours were 3.5 times [(AOR = 3.48, 95%CI:

(1.495, 8.086, P = 0.004)] more likely to develop post-CS infection than those who were not in labor. Similarly, hypertensive women were 3.1 times [(AOR = 3.14, 95%CI: (1.294, 7.593, P = 0.011)] more likely to have post-CS infection than non-hypertensive women. The odds of developing a post-CS infection among women who had preoperative HCT levels 30% and below were 3.2 times [(AOR = 3.22, 95% CI: (1.249, 7.8.309; P = 0.016)] as compared to the counterpart (Table 4).

DISCUSSION

This study aimed to assess the prevalence and factors associated with incision site infections in post-cesarean mothers in Fort Portal Regional Referral Hospital in Uganda. The findings showed that 12.4% of mothers who had cesarean section developed a

surgical site infection. This is similar to a related study in Mbarara which recorded SSI rate as 16.4% [18]. SSI can pose a significant health care burden due to prolonged hospitalization, increased workload for healthcare providers, and the risk of complications

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leading to maternal and neonatal mortality [13]. The study lower than rates in Ethiopia and Tanzania, and could be attributed to dissimilar quality in surgical procedures, use of prophylactic antibiotics, institutional-based settings, and similar definitions of surgical site infections [20, 21]. Differences in population and study area may also contribute to the discrepancy in magnitude of post-cesarean section surgical site infections. Mothers from rural settings were 2.3 times more likely to develop post-CSSSI than those from urban areas, possibly due to lack of awareness, poor dietary habits, poor personal hygiene, and low socioeconomic status. Women with a duration of labor greater than 24 hours prior to cesarean section were 3.5 times more likely to have a surgical site infection, suggesting the need for early detection of labor dystocia. Premature rupture of

CONCLUSION

This study concludes that the post-caesarean surgical site in post-cesarean mothers in Fort Portal Regional Referral Hospital in Fort Portal in western Uganda was found to be higher, which was 12.40%. A list of factors, including prolonged labor, prolonged rupture of membrane, rural setting, preoperative HCT count \leq 30%, and gestational hypertension, were significantly associated with post-cesarean section surgical site infection.

Recommendation

At the end of the study, the researcher recommended the following measures to prevent post-cesarean section surgical site infections:

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membranes during pregnancy can also increase the risk of infection, suggesting the need for health education and guidance to prevent pregnant women from suffering from infections like vaginitis. Pregnancy-induced hypertension increases the risk of SSI in women, with hypoperfusion of wounds and edematous wound edges contributing to infection [22]. Healthcare workers should monitor hypertensive women before cesarean sections. Preoperative HCT below 30% is significantly associated with post-cesarean section infection, with women with HCT below 30% being 3.2 times more likely to develop SSIs. Medical personnel should educate mothers about iron-rich foods and provide ferrous tablets during antenatal care. Ferrous tablets reduces the incidence of anemia during pregnancy, post-partum and in children [23].

- i. Health care providers and zonal health policy makers should place emphasis on the prevention of SSI to reduce its health care burden and associated mortality.
- ii. The management of Fort Portal Regional Referral Hospital should take good measures to prevent and treat post-cesarean section surgical site infections.
- iii. The government should provide more prophylactic antibiotics and good health care personnel for the prevention and treatment of post-cesarean section surgical site infections.

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