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# Assessment of the Prevalence and Factors Associated with Post-Caesarean Surgical Site Infections among Patients in Fort Portal Regional Referral Hospital

Anyaja Joseph Jacob

Faculty of Clinical Medicine and Dentistry Kampala International University Western Campus Uganda

## ABSTRACT

The global incidence of cesarean section deliveries has significantly increased, resulting in a rise in post-caesarean surgical site infections (SSIs). These infections pose a notable threat to maternal health, often leading to prolonged hospital stays, elevated costs, and direct health consequences, particularly in populations facing low socioeconomic status, limited resources, and conditions involving forced internal displacement due to conflict. Fort Portal Regional Referral Hospital lacked prior studies on SSIs, prompting the initiation of this research to ascertain the prevalence and specific factors linked to post-caesarean SSIs within the Maternity Ward at FPRRH. The study adopted a retrospective cross-sectional approach, utilizing a pretested checklist to gather information from 110 patient files admitted and operated on in Maternity Ward during the six months preceding the investigation. The collected data underwent entry and analysis using IBM SPSS version 25, incorporating the chi-square test to establish relationships between SSIs and associated risk factors. Results were presented through tables and charts. The mean age of study participants was 27.67 years, with a standard deviation of 6 and an age range of 16 to 45 years. A majority (64.3%) were over 30 years old, over 50% hailed from rural areas, and the majority identified as Christians and were married. The overall prevalence of post-caesarean SSIs stood at 12.7%. Statistically significant factors influencing SSIs included gestational age, diabetes mellitus, duration of membrane rupture, chorioamnionitis, preoperative hematocrit levels, and referral to FPRRH. In conclusion, this study revealed a 12.7% prevalence of post-caesarean SSIs, with gestational age, diabetes mellitus, duration of membrane rupture, chorioamnionitis, preoperative hematocrit levels, and referral to FPRRH identified as significant contributing factors. Recognizing and addressing these factors early on could guide obstetricians in enhancing their daily practices, ultimately improving the outcomes of cesarean sections and diminishing the risk of post-caesarean SSIs.

**Keywords:** Cesarean section, SSI, Patients, Post caesarean, FPRRH.

## INTRODUCTION

The Centers for Disease Prevention and Control (CDC) defined Surgical Site Infection (SSI) as an infection which happens within a month following surgical intervention and includes three types: superficial incisional SSIs (primary & secondary), deep incisional SSIs (primary & secondary) and organ/space SSIs [1]. The Centers for Disease Control and Prevention (CDC) defines surgical site infection (SSI) as an infection following surgery in the part of the body where the surgery took place [2]. Surgical site infection (SSI) is one of the most common complications following cesarean section (CS) with a reported incidence of 3–20%. SSI causes massive burdens on both the mother and the healthcare system [3, 4]. Cesarean section (CS) is the most common obstetric surgical Procedure, and its global rates (including both emergency and elective) range from 5 to 20% and the rates continue to rise in both developed and developing

countries [5, 6, 7]. Cesarean section (CS) is among the most frequent surgical interventions in women all over the world [8]. The rate and several risk factors of post-CS SSI were studied to increase public attention and to take full steps to decrease it prophylactically [9]. In Uganda, few documented studies have been done on post-caesarean SSI. One study in a Teaching University Hospital in South Western Uganda (Mbarara Regional Referral Hospital) showed an incidence rate of 15.5% [10]. This makes it difficult to estimate the national SSI rates and identify specific risk factors associated with post-caesarean surgical site infection. In Fort Portal Regional Referral Hospital (FPRRH), the prevalence of SSIs is not known due to scarcity of data. Therefore, the objective of this study was to determine the prevalence and associated factors of post-caesarean SSI among patients in the Maternity Ward at FPRRH.

### Statement of Problem

The rate of births delivered by cesarean section (CS) has gone up substantially all over the world. Post-cesarean surgical site infection (SSI) is a common cause of maternal morbidity and mortality that results in a prolonged period of hospitalization with increased cost and direct health implications, especially in low socioeconomic populations, resource-restricted settings, and war-related conditions with internal forced movement [9]. In general, infection (sepsis) in the postpartum period is considered one of the leading causes of maternal mortality and morbidity from which SSI shares the principal proportion [11]. In cesarean deliveries, SSI is a common postoperative complication, with reported rates of 3–15%. SSI causes considerable

morbidity as well as a substantial burden to the health system, given such high Cesarean Delivery rates. It also increases hospitalization length and costs of community care following discharge [12]. In Uganda, few documented reports indicate a high post-caesarean SSI incidence rate of 15.5%. [10] compared to a lower post-caesarean SSI incidence rate of 9.4% in Ethiopia [13], an incidence rate of 7.7% in Tanzania [14] and an incidence rate of 3.5% in Rwanda [15]. Therefore, it is clear that post-caesarean SSI is a problem and needs to be attended to in Uganda. To understand and create more awareness of the incidence and specific risk factors of post-caesarean SSIs among patients in FPRRH, this study was done.

## METHODOLOGY

### Study design

The study utilized a cross-sectional retrospective.

### Area of Study

The study was conducted in the Maternity ward at Fort Portal Regional Referral Hospital, Kabarole district.

### Study population

The study involved patients who were admitted and operated on in the last six months preceding the study.

### Inclusion criteria

- Patients admitted to the Maternity ward in the last six months before the study.
- Patients operated on.
- Well filled patient files.

### Exclusion criteria

- Admitted but not operated
- Incompletely filled patient files

### Sample size determination

This was determined by using Kish's formula [16] which states that,

$$N = \frac{Z^2(p(1-p))}{\epsilon^2}$$

Where;

N = the required sample size

p = Prevalence of Post-Cesarean SSI (15.5%) as reported by a recent study in a Teaching University Hospital in South Western Uganda (Mbarara Regional Referral Hospital) [11].

$\epsilon$  = margin of error on p (set at 5%).

z = standard normal deviate corresponding to 95% confidence level (=1.96)

$$N = \frac{1.96^2(0.086(1-0.086))}{0.05^2} = \text{approximately, } 110.$$

### Sampling technique

The study used a systematic probability sampling method where the researcher used an admission register. Every 4<sup>th</sup> patient in the admission register was taken for the study.

### Data collection methods

This study used a questionnaire checklist which collected information on demographic characteristics, SSI prevalence, and associated factors [17].

### Data Processing and Analysis

Collected data was entered in IBM SPSS version 25. Categorical variables were presented in tables of frequencies for descriptive statistics. A Chi-square test was computed to test the relationships between associated factors and the prevalence of SSI. A p-value of  $\leq 0.05$  was considered significant.

### Quality control

The questionnaire checklist for data collection was pre-tested to ensure that questions were clear and allow the gathering of information needed for the study. The questions that showed ambiguity during pre-testing were revisited and modified as required.

### Ethical considerations

Ethical approval was sought from Kampala International University Western Campus Faculty of Clinical Medicine in the form of an introduction letter after approval of the proposal. Permission to collect data was sought from the hospital administrator. All information collected in this was kept confidential [18]. This meant that all used patient files' details were kept private and not disclosed to anyone outside the research team. The names of patients whose files were used were kept separate from the questionnaires and this was only accessible to the research team for follow-up purposes. The softcopy of the research was kept on. The researcher's personal computer was protected by a password which was accessible by only the researcher. No names would be mentioned in the reports or any publications. Results from this study would help to inform healthcare care professionals and Administrators about the prevalence and associated factors of post-caesarean SSI in FPRRH and to take full steps and informed decisions to reduce post-caesarean

SSI prophylactically for the Benefit of the

Patients.

## RESULTS

### Patient profile

The study participants' mean age was 27.67 years with a standard deviation (SD) of 6 in a range of 16 to 45 years. The majority (64.3%) of them were above 30 years old, more than 50% were from rural areas and most of them were Christians and married. (Table 1)

### Host-related factors

1% of study participants were HIV positive.

### Pregnancy and labour related factors

More than 90% of the study participants had attended Antenatal Care, Nearly, half (49.2%) of them were multipara 4.3% of study participants had Gestational Hypertension (Figure 2). Those with prolonged rupture of the membrane were only 15.6% of the participants and about two-thirds (63.3%) had labour less than 24 hours before the operation. 1 to 4 times Vaginal examination was

performed in more than 81.7% of the women (Table 2).

### Procedure-related factors

The highest indication for caesarean section was non-reassuring fetal heart rate (NRFHR) at 27.33% followed by cephalo-pelvic disproportion (CPD) at 21.7%. The majority (95.8%) of the participants received preoperative antibiotic prophylaxis and all of them were administered postoperative antibiotic prophylaxis. Above 80.1% of the participants had less than 8 days duration of Hospital stay (Table 3).

### Prevalence of post caesarean surgical site infection

12.7% of the study participants developed post-caesarean surgical site infection. (Figure 1).

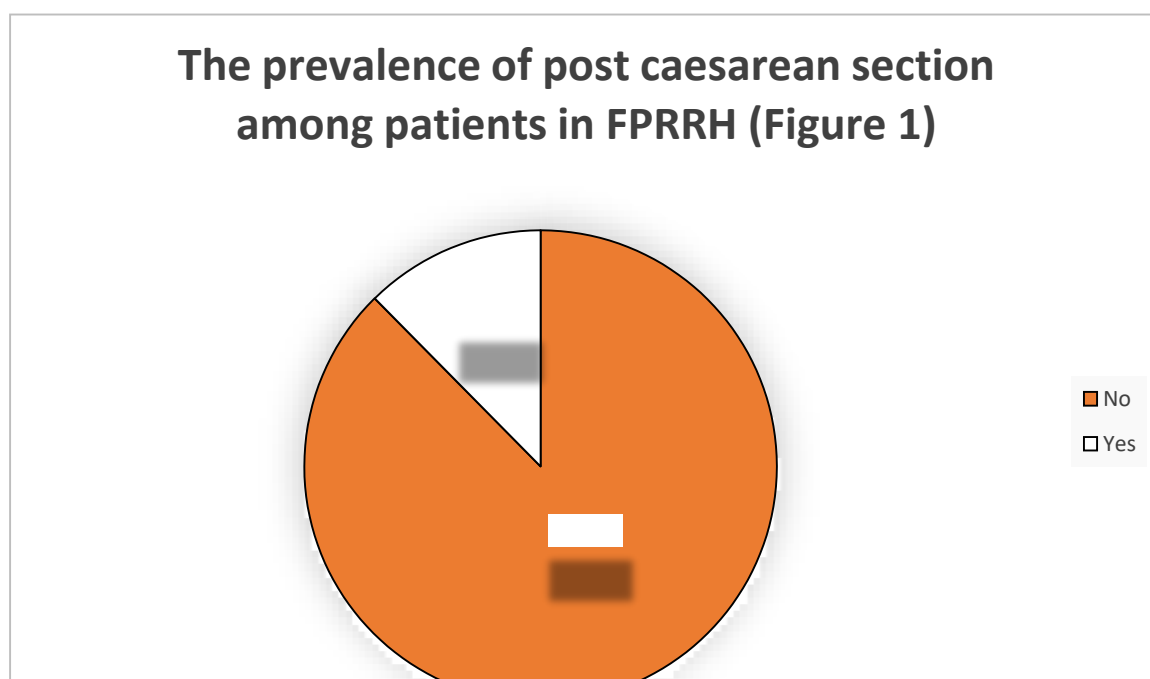
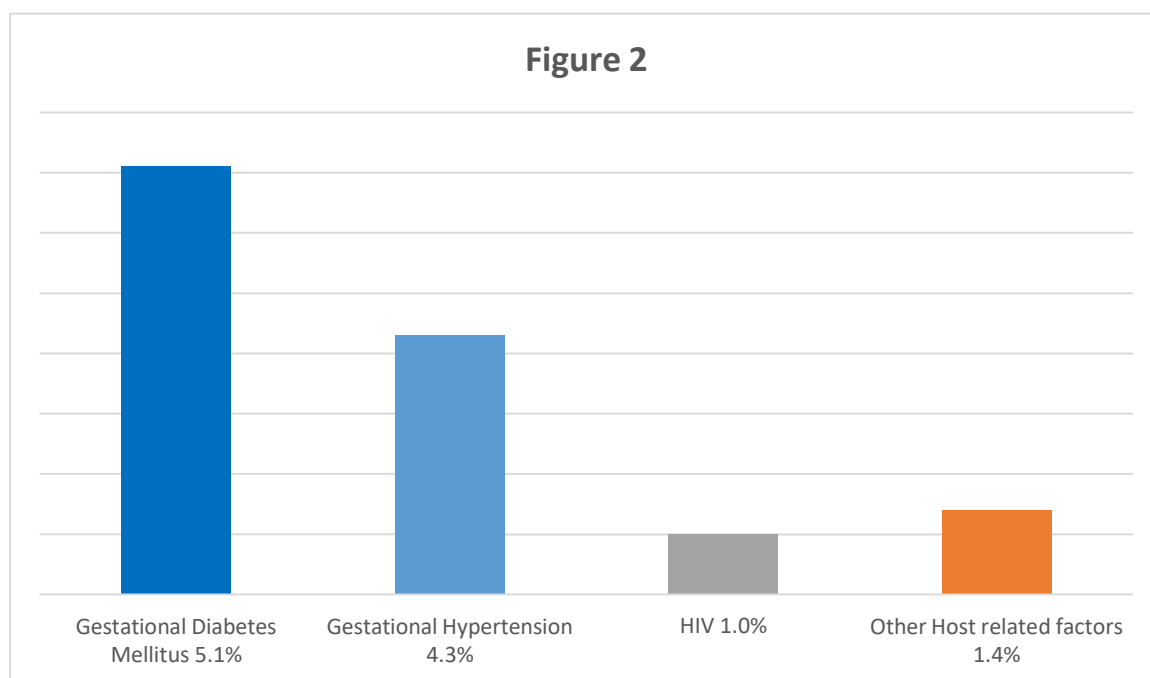


Figure 1: Prevalence of post-caesarean surgical site infection.

**Table 1: Patient Profile of the post caesarean mothers in Fort Portal Regional Referral Hospital (FPRRH)**

VARIABLE	CATEGORY	FREQUENCY	PERCENTAGE (%)
Age	>30	71	64.6
	<30	39	35.4
Residence	Rural	64	58.2
	Urban	46	41.8
Religion	Christian	102	92.9
	Muslim	8	7.1
Marital status	Married	107	98.1
	Others	3	1.9
Education status	Educated	54	49
	Uneducated	56	51



**Figure 2: Pregnancy and Labour related factors**

**Table 2: Pregnancy and Labour related factors among the post caesarean mothers inFPRRH**

VARIABLE	CATEGORY	FREQUENCY	PERCENTAGE (%)
Parity	Primi-para	50	45.5
	Multipara	54	49.2
	Grand multipara	6	5.5
Antenatal Care (ANC)	Yes	3	2.6
	No	107	97.4
Duration of labour	Not in labor	22	20
	Less than 24hours	70	63.6
	Above 24hours	18	16.4
Gestational age	Less than 37weeks	7	6.4
	Above 37weeks	103	93.6
Number of vaginal examinations			
	1 to 4 times	90	81.8
	Above 4 times	20	18.2
Membrane rupture duration	Intact	50	45.5
	Ruptured <12hours	41	37.3
	Ruptured >12hours	19	17.2
Chorioamnionitis Presence	Yes	8	7.3
	No	102	92.7
Previous caesarean section History	Yes	12	10.9
	No	98	89.1

**Table 3: Procedure-related factors among post-caesarean mothers in FPRRH.**

VARIABLE	CATEGORY	FREQUENCY	PERCENTAGE (%)
Who performed the operation	Emergency Surgeon	103	93.6
	Obstetrician and gynaecologist	7	6.4
Type of caesarean section	Emergency	105	95.5
	Elective	5	4.5
Type of anaesthesia	Regional	100	90.9
	General	10	9.1
Operation Duration	Less than 1 hour	89	80.9
	Above 1 hour	21	19.1
Type of abdominal incision	Transverse	97	88.2
	Vertical	13	11.8
Preoperative Hct	<30	8	7.3
	>30	102	92.7
Preoperative antibiotic prophylaxis	Yes	105	95.5
	No	5	4.5
Blood transfusion	Yes	10	9.1
	No	100	90.9
Duration of Hospital stay	Less than 8 days	88	80
	Above 8 days	22	20

Table 4: Relationship between the Variables and Post caesarean SSI

VARIABLE	POST SURGICAL INFECTION(SI)	CAESAREAN SITE	TOTAL	-square( $X^2$ )	P-value
	NO	YES			
<b>Maternal age</b>					
>30	63	8	71		
<30	33	6	39	0.385	0.532
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Residence</b>					
Rural	55	9	64		
Urban	41	5	46	0.246	0.618
<b>Total</b>	96	14	110		
	87.6%	12.7%	100%		
<b>Gestational age</b>					
<37weeks	4	3	7		
≥ 37	92	11	103	6.095	0.008
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Hypertensive disorders***</b>					
No.	93	12	105		
Yes	3	2	5	3.492	0.057
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Diabetes mellitus**</b>					
No.	94	10	104		
Yes	2	4	6	16.687	0.005
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Referral</b>					
No.	76	6	82		
Yes	20	8	28	8.441	0.002
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Duration of membranerupture</b>					
Intact	47	3	50		
<18hours	37	4	41	12.301	0.002
≥ 18hours	12	7	19		
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Number of Vaginal examinations before caesarean section.</b>					
<4 times	81	9	90		
≥ 4 times	15	5	20	3.262	0.066
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Chorioamnionitis</b>					
No.	92	10	102		
Yes	4	4	8	12.680	0.005
<b>Total</b>	96	14	110		
	87.3%	12.7%	100%		
<b>Preoperative Antibiotics Administration No.</b>					
Yes	3	2	5	3.488	0.057
<b>Total</b>	93	12	105		
	96	14	110		
	87.3%	12.7%	100%		
<b>Preoperative Hct</b>					
<30	4	4	8		
>30	92	10	102	10.676	0.004
	96	14	110		

<b>Total</b>	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		
<b>Type of caesarean section</b>	<b>4</b>	<b>1</b>	<b>5</b>		
Elective	<b>92</b>	<b>13</b>	<b>105</b>	<b>0.248</b>	<b>0.616</b>
Emergency	<b>96</b>	<b>14</b>	<b>110</b>		
<b>Total</b>	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		
<b>Type of surgical incision</b>	<b>10</b>	<b>3</b>	<b>13</b>		
Vertical	<b>86</b>	<b>11</b>	<b>97</b>	<b>1.419</b>	<b>0.23</b>
Horizontal	<b>96</b>	<b>14</b>	<b>110</b>		
<b>Total</b>	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		
<b>Duration of Operation</b>	<b>79</b>	<b>10</b>	<b>89</b>		
<1 hour	<b>17</b>	<b>4</b>	<b>21</b>	<b>0.935</b>	<b>0.33</b>
≥1hour	<b>96</b>	<b>14</b>	<b>110</b>		
<b>Total</b>	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		
<b>Blood transfusion</b>	<b>88</b>	<b>12</b>	<b>100</b>		
No.	<b>8</b>	<b>2</b>	<b>10</b>	<b>1.692</b>	<b>0.189</b>
Yes.	<b>96</b>	<b>14</b>	<b>110</b>		
<b>Total</b>	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		
	<b>79</b>	<b>9</b>	<b>88</b>		
	<b>17</b>	<b>5</b>	<b>22</b>	<b>2.476</b>	<b>0.111</b>
	<b>96</b>	<b>14</b>	<b>110</b>		
	<b>87.3%</b>	<b>12.7%</b>	<b>100%</b>		



### ANC- Antenatal Care

\*\*\*Chronic hypertension and Preeclampsia.

\*\*Pre-gestational and Gestational diabetes mellitus

There was a significant relationship between Gestational age and post-caesarean SSI ( $X^2=6.095$ ;  $P=0.008$ ). Diabetes mellitus\*\* was found to be statistically associated with post-caesarean SSI ( $X^2=16.687$ ;  $P=0.005$ ). The results showed a significant relationship between the Duration of membrane rupture and post-caesarean SSI ( $X^2=12.301$ ;  $P=0.002$ ) and a statistically significant relationship between post-caesarean SSI and Chorioamnionitis ( $X^2=12.301$ ;  $P=0.002$ ), Preoperative Hct ( $X^2=10.68$ ;  $P=0.004$ ) and referral to FPRRH ( $X^2=8.441$ ;  $P=0.002$ ). The

duration of stay on the ward was not found statistically significant ( $X^2=2.476$ ;  $P=0.111$ ) No significant relationship was found between

Maternal age and SSI ( $X^2=0.385$ ;  $P=0.532$ ). The results showed no significant relationship between post caesarean SSI and Residence of the patient ( $X^2=0.246$ ;  $P=0.618$ ), Preoperative Antibiotics Administration ( $X^2=3.488$ ;  $P=0.057$ ), Type of caesarean section ( $X^2=0.248$ ;  $P=0.616$ ), Type of surgical incision ( $X^2=1.419$ ;  $P=0.23$ ), Hypertensive disorders ( $X^2=3.492$ ;  $P=0.057$ ), Duration of Operation ( $X^2=0.935$ ;  $P=0.33$ ), Number of Vaginal examinations ( $X^2=3.262$ ;  $P=0.066$ ) and Blood transfusion ( $X^2=1.692$ ;  $P=0.189$ ).

### DISCUSSION

#### Prevalence of post-caesarean SSI.

The prevalence of post caesarean surgical site infection in our study was **12.7%**. This prevalence was comparable with a previous study in Uganda conducted in Mbarara Regional Referral Hospital which was **15.5%** [11]. Also, this rate was slightly above the range of post-caesarean surgical site infection in Sub-Saharan Africa which was 7.3% (range 1.7–10.4 %) [19]. However, our obtained prevalence was lower when compared with an incidence of **16.2%** in Nigeria [20]. In contrast, our prevalence was relatively high compared to previous studies in China "**3.34%**" [19] and Israel "**3.7%**" [2]. These differences and variations might be attributed to the differences between studies related to the design, sample size, settings and duration and also attributed to the difference in the quality of both surgical care provisions and service among Hospitals.

#### Associated factors of post-caesarean SSI

The associated factors found in our study were Gestational age ( $X^2=6.095$ ;  $P=0.008$ ), Diabetes mellitus\*\* ( $X^2=16.687$ ;  $P=0.005$ ), Duration of membrane rupture ( $X^2=12.301$ ;  $P=0.002$ ), Chorioamnionitis ( $X^2=12.301$ ;  $P=0.002$ ), Preoperative Hct ( $X^2=10.68$ ;  $P=0.004$ ) and referral to FPRRH ( $X^2=8.441$ ;  $P=0.002$ ). These risk factors were also identified in researches conducted with a larger number of patients in Egypt in Minia Maternity and Children University Hospital [21]. Mothers with Diabetes mellitus are prone to post-caesarean SSI due to their immunocompromised state, reduced wound healing potential, and poor micro-vascularization [22]. The idea of improper white blood cells function, and the metabolic abnormalities of diabetes lead to impaired migration of neutrophils and macrophages to the infected wound, in line

with chemotaxis reduction, [23]. Mothers who were in labour for over eighteen hours were more likely to develop wound sepsis due to factors such as early rupture of membranes and multiple vaginal examinations which could lead to ascending infections leading to chorioamnionitis which in turn leads to infection of the post-Cesarean wounds. The mothers who had more than four vaginal examinations in labour were more likely to develop wound sepsis due to enterococci contamination from the anorectal region leading to ascending infection of liquor [11]. Emergency CS has been linked to SSI through more frequent vaginal examinations with greater opportunity for membranes to rupture before delivery, highly urgent operation, less concern about sterility, and absence of prophylactic antibiotics on time [10] and also emergency CD may result into suboptimal operative site preparation and insufficient prophylactic antibiotic treatment in this urgent situation. A high volume of blood loss is usually associated with poor control of bleeding, increased tissue damage from prolonged retraction and manipulation, and more sutures. Suture, a foreign body, can promote contamination and reduce local resistance mechanisms [2]. The rupture of membranes before CS was attributed to SSI risk factors. An infected amniotic fluid may transfer pathogens into CS incisions with chorioamnionitis could be a final result [9]. Pre-operative antibiotics used for Cesarean were found to be protective against the development of post-Cesarean wound sepsis. Administration of pre-operative antibiotics within 30 to 60 Minutes of skin incision reduces the risk of postoperative infection by almost 70% and maximizes concentrations at the surgical site [11].

### CONCLUSION

The prevalence of post caesarean SSI in our study was **12.7%** which is relatively lower than other previous studies from developing countries. Multiple factors are associated with the

development of post caesarean SSI and the associated factors were Gestational age, Diabetes mellitus\*\*, Duration of membrane rupture, Chorioamnionitis, Preoperative Hct and referral

### Recommendations

Considering our study findings, early identification and targeting of these associated

factors would lead obstetricians to pay more attention during daily practice to improve the outcome of caesarean sections and reduce the risk of developing post-caesarean SSI.

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