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Surgical site infection surveillance among post caesarean section patients in a tertiary hospital, Nepal

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Abstract

Introduction: Surgical site infection (SSI) is a common complication in post-caesarean section patients. SSIs after caesarean section can increase maternal mortality and morbidity, lead to longer hospital stays, and impose an economic burden on the patient and their family. The aim of this study was to determine the incidence, timing of occurrence and the contributing factors for SSIs following caesarean at the tertiary care hospital.

Method: This was a descriptive cross-sectional study conducted in Department of Obstetrics and Gynaecology Chitwan Medical College, Nepal, from Mar 2024 to Apr 2025, after taking ethical approval. Patients who developed post-caesarean section SSIs during their hospital stay or were admitted with for SSIs were included. Data were collected using a self-structured proforma including demographics, surgical and obstetric risk factors, signs and symptoms, and time of SSIs. The SPSS version 20 was used for descriptive n(%) analysis.

Result: Out of 1,021 patients who underwent caesarean sections, 32(3.13%) developed SSIs, 24(75%) following emergency caesarean. Most cases, 19(59.37%) had surgery duration of >1 hour. Majority of SSIs, 25(78.12%), occurred after hospital discharge, and were superficial SSIs, 31(96.87%), 22(68.75%) among parity >2 and 21(65.62%) had previous caesarean, 4(12.5%) had gestational diabetes. Organism was identified in only 1(3.12%).

Conclusion: In this study common risk factors for developing SSIs (3.13%) following caesarean sections were emergency procedures, surgery >1 hour, and multiparity. In most cases, SSIs are diagnosed after hospital discharge. Therefore, continuous surveillance and implementation of infection prevention measures is essential to reduce the incidence of SSIs.

How to cite

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Introduction

Caesarean section is the most common life-saving surgical procedure performed among obstetric surgeries, and nearly 1 in 5 women give birth via caesarean section.[1] Despite of its advantages, there are several complications associated with the procedure, including infections, postpartum hemorrhage, and increased risks in future pregnancies.[2] Among healthcare-associated infections, surgical site infection (SSI) is the most common type, particularly in low- and middle-income countries, and is associated with increased morbidity and mortality among surgical patients.[3,4] It has been reported that at least 3–18% of patients undergoing caesarean section experience SSIs within 30 days of hospital discharge. [5]

In Nepal, studies conducted in various hospitals have reported varying SSI rates after caesarean sections, 12.6% at Dhulikhel Hospital,[6] 2.86% at Tribhuvan Univ Teaching Hospital,[7] and 6.9% at Chitwan Medical College.[8] In other countries, SSIs have been reported as 7.8% in Ethiopia,[9] 5.63% in India,[10] 9.6% in Pakistan,[11] and 6.3% in Japan.[12]

The related factors for developing SSIs in post-caesarean section patients include age, obesity, parity, lifestyle, type of incision, type of suturing, frequency of per-vaginal examinations during antenatal care, and postoperative laboratory investigations such as elevated CRP levels.[7,11,12]

The surveillance of SSIs and the provision of appropriate recommendations to the surgical team in the obstetrics and gynecology department are essential for reducing the future risk of SSIs and for planning appropriate care and treatment for post-surgical patients.[13] Aim of this study was to determine the occurrence of SSIs and risk factors after caesarean at a tertiary care teaching hospital.

Method

This was a cross-sectional, descriptive study conducted at Chitwan Medical College, Teaching Hospital, Nepal from Mar 2024 to Apr 2025. All patients who developed SSI during their hospital stay or were admitted to the postnatal ward with post-caesarean SSIs during the study period were included.

Chitwan Medical College is a 750-bedded tertiary-level hospital located in Chitwan, Bagmati Province, Nepal. A total of 1,021 women underwent caesarean section during the study period in the Department of Obstetrics and Gynaecology.

Ethical approval was obtained from the Institutional Review Committee, Chitwan Medical College (IRC/079/080-045), and written informed consent was taken from all participants.

This study followed the WHO 2020 criteria for the analysis of SSIs. An SSI was considered present if the infection occurred within 30 days of the operative procedure and involved the skin and subcutaneous tissue of the incision site, along with at least one of the following: localized pain or tenderness, localized swelling, erythema, heat and diagnosis of superficial incisional SSI by a physician, purulent drainage from incision, organism(s) identified from an aseptically obtained specimen from the wound, and/or deliberately opened by a surgeon.

A self-developed structured proforma was used for data collection. The demographic characteristics, surgical and obstetric risk factors, signs and symptoms of SSI, and the time of onset of SSI were recorded. Data were collected by researcher through face-to-face interview with the patients in postnatal ward, or readmitted after discharge from hospital. Data entries were checked for accuracy and completeness. The data were coded and entered into the SPSS version 20. Descriptive statistics, frequency percentage were used to describe the findings.

Result

Out of a total of 1,021 patients who underwent caesarean section, 32(3.13%) developed SSI, while 989(96.87%) did not experience any signs of infection, Figure 1.

The mean age of patients was 28.44±4.40, 40.62% of the patients had completed secondary education, and majority were homemakers (84.37%), Table 1.

Among the total SSIs, majority, 24(75%), had emergency caesarean sections, indicating a higher prevalence of SSIs in emergency procedures, compared to 8(25%) elective caesarean sections, and majority (59.37%) had >1 hour surgery duration. With regard to blood transfusion, 5(15.62%) received transfusions during or after surgery. All (100%) underwent hair removal prior to surgery. None had a history of smoking during pregnancy. In terms of dietary habits, the majority of patients 27(84.37%) were non-vegetarian. When assessing hygiene practices, 22(68.75%) reported taking a bath before the caesarean section. Nearly all patients 31(96.87%) received prophylactic antibiotics within one hour before surgery, Table 3.

Majority were multiparous 22(68.75%), most deliveries occurred at term 23(71.87%), 1(3.12%) experienced premature rupture of membranes (PROM), whereas 8(25%) underwent artificial rupture of membranes (AROM) to aid labour progression. A significant proportion 21(65.62%) had a history of more than one previous lower segment caesarean section (LSCS). Regarding comorbidities, 4(12.5%) had a history of hypertension, and 1(3.12%) with pregnancy-induced hypertension (PIH). Additionally, 4(12.5%) of patients had a history of gestational diabetes mellitus (GDM), and 2(6.25%) reported preeclampsia, Table 4.

Most SSI, 29(90.62%) were superficial SSIs, and majority, 25(78.12%) after hospital discharge. Wound swabs for culture and sensitivity collected from all 32 SSIs, only 1(3.12%) swabs was positive. Most common presentation of SSIs was purulent discharge from wound site reported by 15(46.90%), followed by pain 10(31.25%) of patients, Table 5.

The most common indication for caesarean section was a previous caesarean, 11(34.37%). Other significant indications included meconium-stained liquor 6(18.75%), and non-reactive cardiotocography (CTG), failed induction of labour, and pregnancy-induced hypertension, each comprising 3(9.37%) of the cases. Less frequent indications included oligohydramnios 2(6.25%), Table 6.

A total of 13(40.62%) of SSIs were identified during 1st week (day 3 to 7), and 18(56.25%) during 2nd week (day 8 to 14); only 1(3.13%) after 2nd week (day 34th), Figure 2.

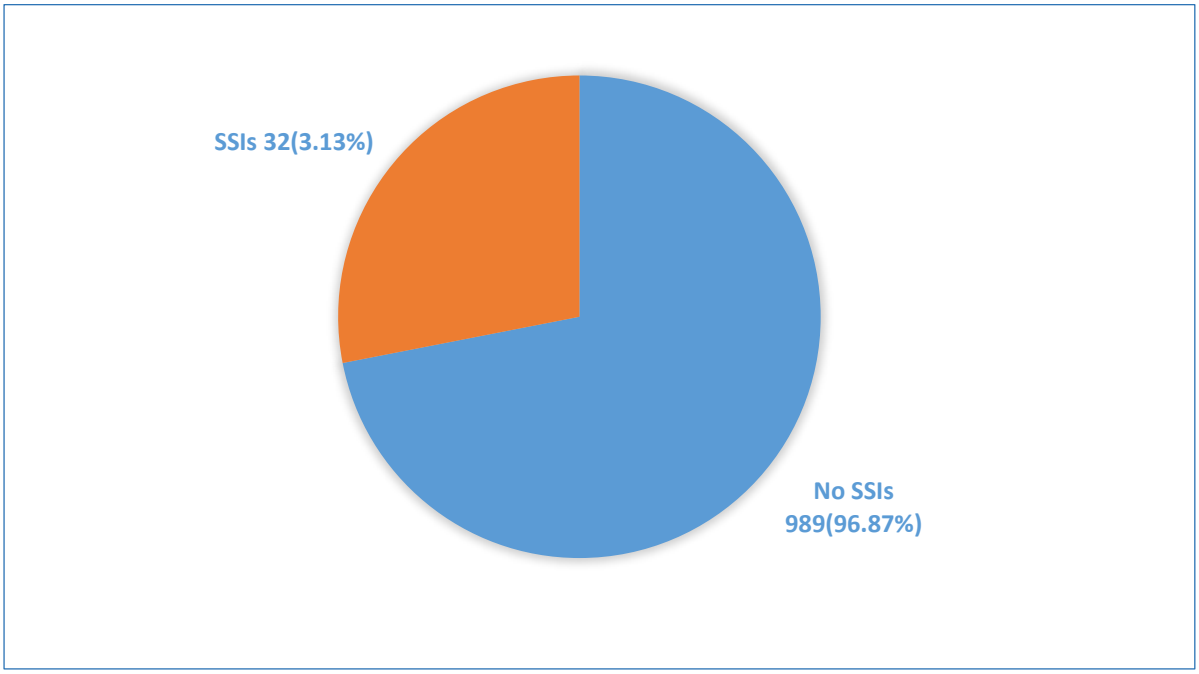

Figure 1. Incidence of SSI among post caesarean section patients, n=1021

Table 2. Demographic Characteristics of patients among post caesarean section, n=32

Variable	n(%)
Age in years, mean±sd 28.44±4.40	
20- 29	16(50.00)
30-39	16(50.00)
Education	
Basic	11(34.37)
Secondary	13(40.62)
Bachelor and above	8(25.00)
Occupation	
House maker	27(84.37)
Business	2(6.25)
Service	2(6.25)

Table 3. Surgical risk factors associated with SSI among post caesarean section patients, n=32

Variable	n(%)
Type of surgery	
Elective	8(25.00)
Emergency	24(75.00)
Duration of surgery	
1hr	13(40.62)
>1hr	19(59.37)
Preoperative haemoglobin	
< 10mg/dl	2(6.25)
>10-12mg/dl	30(93.75)
Blood transfusion	
No	27(84.37)
Yes	5(15.62)
Hair removal	
No	0
Yes	32(100.00)
Smoking	
No	32(100.00)
Yes	0
Dietary habits	
Veg	5(15.62)
Non veg	27(84.37)
Bath before surgery	
Yes	10(31.35)
No	22(68.75)
Antibiotic prophylaxis	
Yes	31(96.87)
No	1(3.12)

Table 4. Obstetric risk factors for SSIs among post caesarean section patients, n=32

Variable	n(%)
Parity	
1	10(31.25)
>2	22(68.75)
Weeks of gestation	
Preterm	7(21.87)
Term	23(71.87)
Post term	2(6.25)
Premature rupture of membrane	
Yes	1(3.12)
No	31(96.87)
Artificial rupture of membrane	
Yes	8(25.00)
No	249(75.00)
No of prior caesarean	
0	11(34.37)
>1	21(65.62)
History of hypertension	
Yes	4(12.50)
PIH	1(3.12)
No	27(84.37)
History of gestational diabetes mellitus	
Yes	4(12.50)
No	28(87.50)
History of preeclampsia	
Yes	2(6.25)
No	30(93.75)

Table 5. SSI related variable among post caesarean section patients, n=32

Variables	n(%)
Types of SSI	
Superficial	29(96.62)
Incisional	1(3.12)
Deep	2(6.25)
Identification of SSI	
After discharge	25(78.12)
During hospital stay	7(21.87)
Swab sent	
Yes	32(100.00)
No	0
Organism identified	
Yes	1(3.12)
No	31(96.87)
Sign and symptoms of SSI	
Pain & tenderness	4(12.50)
Pain & fever	10(31.25)
Purulent discharge from wound	15(46.90)
Soakage from wound	3(9.40)

Table 6. Indication for caesarean section among post caesarean section, n=32

Indications of caesarean section	n(%)
Previous caesarean section	11(34.37)
Non-reactive cardiotocography	3(9.37)
Meconium stained liquor	6(18.75)
Failed induction of labour	3(9.37)
Pregnancy-induced hypertension	3(9.37)
Oligohydramnios	2(6.25)
Bad obstetric history	3(9.37)
Cord around the neck	1(3.12)

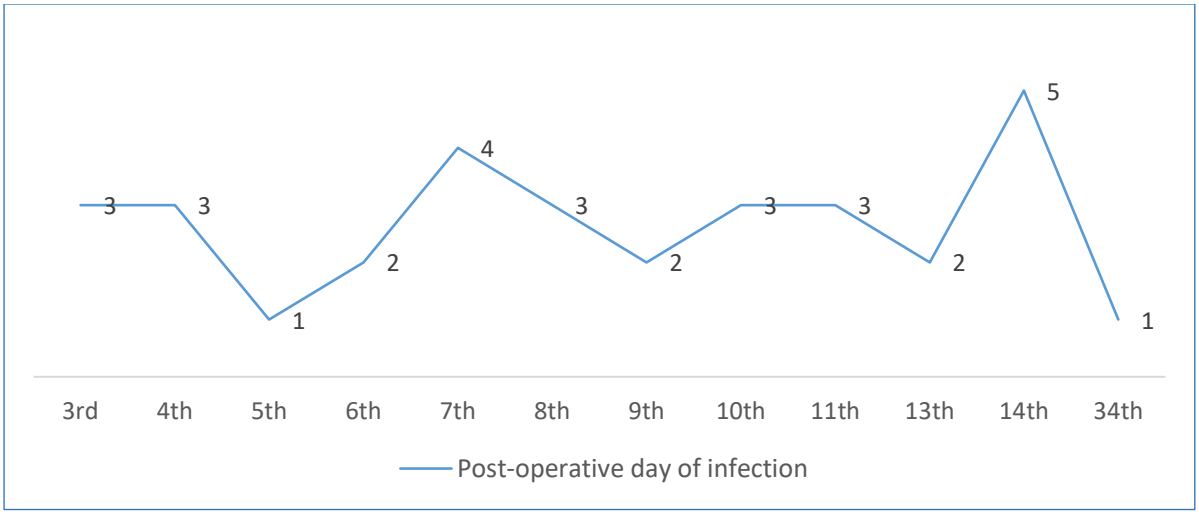

Figure 2. Post-operative day of SSI identified among Post caesarean section patients, n=32

Discussion

In this study, the incidence of SSI following caesarean section was 3.13%, compared to previous studies from the same hospital that reported rates of 6.99% and 2.9%.[8,14] According to the Centres for Disease Control and Prevention (CDC) classification, this rate falls within the low range of SSI incidence for clean-contaminated surgeries such as caesarean sections. Compared to other hospitals in Nepal, the SSI rate in our study was lower than 12.6%[6] at Dhulikhel Hospital, and similar to rate 2.86%[7] reported from Tribhuvan University Teaching Hospital. Globally, SSI rates vary widely, 7.8%[9] in Ethiopia, 5.63%[10] in India, 9.6%[11] in Pakistan, and 6.3%[12] Japan. These differences can be due to variations in study design, patient populations, infection control practices, and postoperative follow-up systems. Another possible reason for lower rate as this study included only admitted cases, post-operative infection cases treated in the outpatient department may not have captured all cases due to difficulties in maintaining systematic documentation.

In the present study, 75% of SSIs occurred among women who underwent emergency caesarean sections. This finding aligns with several other studies in similar settings 90.2%[6], 92%[14], and 82.97%[15] from Nepal. Moreover,

research from southwest Ethiopia revealed that the risk of SSI was twice as high in emergency caesarean sections compared to elective surgeries.[16]

In our study, longer surgery duration was found to be associated with higher rate of SSI. A majority of SSI cases (59.37%, n=19) occurred in caesarean sections that lasted more than one hour. This finding is consistent with previous studies reporting a significant association between longer operative time and increased risk of SSI.[17-19]

In the present study, none of the SSI cases had a history of smoking. In contrast, a study conducted in the UK reported that 10.6% of women with SSI were smokers, highlighting smoking may be an important risk factor for postoperative infections following caesarean section.[5]

In our study 31(96.9%) cases had preoperative antibiotic prophylaxis, which is higher than the 68% reported in a similar study.[5] The higher coverage of prophylactic antibiotics in our study may have contributed to the relatively lower incidence of SSI compared to other settings.

Findings from the present study reveal that patients who developed SSIs were multiparous (68.75%), and the majority had term deliveries (71.87%). These findings are consistent with a study from another tertiary hospital, 71.05% of SSI cases were multiparous and 65.78% were term deliveries.[7]

In the present study, common indication for caesarean was previous surgery (34.4%) which is consistent with 13.5%,[7] 16.6%,[8] and 17%[15] in other studies. Other indications included meconium-stained liquor (18.75%), and failed induction (9.37%) which is consistent with another study finding 21.51% and 5.38% respectively.[8]

In this study 29(90.62%) were superficial infection, while 3(6.3%) were deep SSI. A similar pattern has been reported in other studies.[5,19] This indicates that superficial SSI is the most common type following caesarean section.

In this study, majority of SSIs (78.12%) occurred after hospital discharge. Similarly, a study in Rwanda found that 62.5% of SSIs were diagnosed after patients left the hospital.[21] Out of 32 SSI cases, 13(40.62%) were identified during 1st week (day 3 to 7), and almost all, 31 by the end of 2nd week. In comparison, other studies reported that the majority of SSIs were identified within the first 10 postoperative days.[11,19] Thus, surveillance for 2 weeks seems necessary.

In this study, the common findings of SSI were purulent wound discharge (46.9%), followed by pain and fever (18.8%). In contrast, another study reported that the most frequent presenting symptom was spontaneous superficial wound dehiscence (35.7%), followed by purulent discharge (26.7%), pain (21.5%), and fever (5.4%).[18] These findings indicate that purulent discharge is a consistent early sign of SSI, although the pattern of other symptoms may vary across settings. In our study, microbial growth from SSI cases was very low, only 1 (3.12%) out of 32 showed a positive culture. This is lower than findings from other studies, such as 12%[14] in a similar setting and 87.5%[21] in Rwanda. Besides routine antibiotics use, other factors in culture needs to be investigated in our setup.

The findings of this study have several important implications. The high proportion of SSIs occurring after discharge highlights the need for structured post-discharge follow-up to ensure early detection and management. Higher SSI rates in emergency caesarean sections, length of surgeries, and patients with prior LSCS suggest that infection prevention efforts should be targeted. Finally, the study findings are contextually relevant locally for infection prevention policies.

Post-discharge follow-up was limited, which may have led to underestimation of the true SSI incidence. The SSI cases treated in OPD basis were not systematically recorded. Small sample

size limits the generalizability of the findings. Additionally, microbiological assessment was limited, with only one positive culture, which restricts conclusions about the bacterial profile of SSIs. Finally, the study was conducted in a single tertiary hospital, which may limit the generalizability of findings with different patient populations or surgical practices.

Conclusion

In this study common risk factors for developing SSI include emergency procedures, prolonged duration of surgery, and multiparity. In most cases, SSIs were diagnosed after hospital discharge, during follow-up visits. Therefore, continuous surveillance, identification of common risk factors, and implementation of infection prevention measures are essential to reduce the incidence of SSIs.

Author contribution

Concept design: TK RP, PA; Literature search: TK, PA; Data collection: TK, PA; Data analysis: RP, SU; Draft manuscript: TK, RP, PA; Final manuscript and accountability: All

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Conflict of Interest

None

Funding

None

Supplementary material

The data and supplementary material that support the findings of this study are available from the corresponding author upon reasonable request.

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Tools/Questionnaire

Proforma

SSI Surveillance among Post Caesarean Section Patients in a Tertiary Hospital, Nepal.

A.	Demographic Details
1	Sl.no: Height:
2	Month: weight:
3	Age:
4	Education: Occupation:
5	Date of Admission:
6	Pre-operative hospitalization days:
7	Total Length of Hospital Stay:
8	Preoperative haemoglobin post-operative haemoglobin:
9.	Blood transfusion
10.	History of Smoking
11.	Type of surgery: a. Elective b. Emergency

12.	Hair Removal
13	Whole body bath given before surgery
14	Prophylactic antibiotic time before incision:
15	Blood glucose level before surgery
16	Duration Total time of surgery:
17	Parity: POG:
18	Rupture of membrane:
19	Hypertension: GDM:
20	Preeclampsia:
21	No. of prior LSCS:
22	Type of SSI a. Superficial b. deep c. Organ/space
23	Identification of SSI
	a. Readmission
	b. Post-discharge follow-up
	c. During Hospital Stay
24	Post op Day of SSI detected:
25	Drains: Yes/No Type of Drain:
26	implants: Yes/No Type of implant:
27	Swab culture: Yes/No Organism Identified:

B	**Clinical characteristics identified among SSI patients**	**Yes/No**
1	Pain & tenderness	
2	Abscess	
3	Incision opened	
4	Purulent & serum discharge	
5	Swelling	
6	Erythema/ redness	
7	Hyperthermia	
8	Hypothermia	
9	Fever	
10	Bradycardia/apnoea	
11	Nausea/vomiting	
	Others if yes please specify	
12	Diagnosis at the event:	

C	**Antibiotic Profile:**
D	**Preoperative condition**
	a)Pregnancy induced hypertension b)Gestational diabetes mellitus c)pre-eclampsia