

Post Emergency Cesarean Surgical Site Infections: Analyzing Risk Factors and Impact on Maternal Morbidity

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ABSTRACT

Background. Cesarean section (CS) is one of the most performed surgeries in obstetrics. Post-cesarean surgical site infections (SSI) remain a significant cause of morbidity and extended hospital stay.

Aims and Objectives: The aim of this study was to determine the incidence rate and study the clinical profile, risk factors and associated maternal morbidity associated with surgical site infections in women undergoing caesarean section.

Methodology : We conducted a retrospective cohort study involving women who underwent Cesarean from July 2024 to December 2024, in the department of Obstetrics and Gynecology, GMC Jammu. Visual inspection during ward rounds, reports from laboratory, and postprocedure follow-ups formed the basis of identifying infections in the patients. Sociodemographic features, laboratory parameters, comorbid diseases and surgical characteristics were recorded and statistical analysis done.

Results: The rate of surgical site infection requiring hospitalization was 1.7% (76/4490). 40.78% of the patients had deep surgical site infections. Mean age of the study population was 32.46 ± 2.65 . In the infection positive group, Host related risk factors included severe anemia in 55.26% (RR=6.39), previously scarred uterus which was present in 65.78% of cases (RR=5.28), gestational diabetes (65.78%, RR=11.32) and hypertension (55.26%, RR=6.08). Intra-partum factors among the infected group included prolonged leaking for more than 12 hours (47.36%) and more than five per vaginal (PV) examinations (63.15%). Intraoperative risk factors included prolonged surgery time (67.10%) and blood loss exceeding 1 liter (36.84%). Staphylococcus aureus was the most commonly identified pathogen (51.31%). Post-cesarean surgical site infections were associated with significant maternal morbidity. A prolonged hospital stay (>10 days) was observed in 73.68% of affected patients with all patients reporting a pain score >4. Fever was present in 55.26% of cases. Regarding critical care needs, 3.94% of patients required ICU admission, while 13.15% were admitted to a high-dependency unit (HDU). Additionally, 59.21% of patients experienced difficulty breastfeeding, indicating a substantial impact on postpartum recovery.

Conclusion: Post-cesarean surgical site infection (SSI) is a complex clinical challenge. This study highlights the intricate interplay between various risk factors associated. By identifying women at higher risk, healthcare providers can adopt proactive, evidence-based measures and targeted interventions to mitigate post-cesarean SSIs and thus decrease its impact on maternal morbidity and enhance patient safety.

INTRODUCTION

According to the Centers for Disease Control and Prevention (CDC); [Surgical site infection](#) (SSI) is defined as infection related to surgical procedure which occurs at or near the surgical site within 30 days after procedure. It is of three types

- Superficial incisional SSI involving skin and [subcutaneous tissue](#),
- Deep incisional SSI involving muscle and fascia
- Organ/ Space occupying SSI involving deeper tissues.¹

WHO estimates that direct obstetric infections, including maternal sepsis, are the third most common cause of maternal mortality, representing 10.7% (95% Uncertainty Intervals, UI, 5.9–18.6%) of all deaths worldwide².

The risk factors associated with SSI includes Patient related - Age, nutritional status, anaemia diabetes, smoking, obesity, altered immune status, duration of preoperative hospital stay; Procedure related—duration of surgery, preop skin preparation, antimicrobial prophylaxis, surgical drains, inadequate sterilisation of instruments, foreign materials. The independent factors associated with Surgical Site Infections are: Preterm delivery, Multiple vaginal examinations, Prolonged labor, Prolonged rupture of membrane (PROM), Chorioamnionitis, obstructed labor³.

Surgical site infections (SSIs) significantly impact patient outcomes, increasing the risk of death by 2-11 times compared to those without SSIs. Furthermore, SSIs lead to prolonged hospital stays and increased treatment costs. In developing countries, post-cesarean wound infections are a major contributor to prolonged hospitalizations and contribute to widespread aversion to cesarean deliveries. To mitigate this, hospitals with surgical services are recommended to implement SSI surveillance and provide feedback to surgeons, a strategy shown to effectively reduce SSI rates^{4,5}.

AIMS AND OBJECTIVES

To determine the

- Incidence rate and
- Sociodemographic profile and risk factors,
- Maternal morbidity associated with surgical site infections in women undergoing emergency cesarean section.

METHODOLOGY

A retrospective cohort study was conducted at SMGS Hospital, GMC Jammu, from July 2024 to December 2024, aiming to assess the incidence and risk factors associated with surgical site infections (SSIs) following emergency cesarean sections. The study included 76 patients who underwent emergency CS at the hospital and attended the outpatient department for follow-up within 30 days post-surgery. Patients were excluded

- If they developed wound infections after 30 days, were operated on outside the hospital,
- Underwent elective CS,
- Required obstetric hysterectomy or had other surgical complications, or
- Immunocompromised/on steroids.

Data was collected retrospectively from hospital records and follow-up visits, and analysis was done to identify SSI occurrences and associated factors in the study population.

Patients with surgical site infections (SSIs) were identified based on specific criteria, including infection occurring within the first post-operative week during hospital stay or within 30 days of surgery after discharge. The diagnosis of SSI was made if at least one sign of inflammation was present at the surgical site, such as induration, erythema, or local rise in temperature. Additionally, SSI was confirmed if there was discharge from the surgical site or if the wound gaped or was deliberately opened by the surgeon for drainage due to suspicion of infection.

RESULTS

The study found that out of 4490 cesarean section cases, 76 developed surgical site infections (SSIs), resulting in an incidence rate of 1.7%. The mean age of the study population was 32.46 ± 2.65 years. The majority of the infections were superficial in nature, as illustrated in Figure 1, which shows the distribution of SSI type.

In table 1, the majority of individuals (57.89%) had a BMI greater than 30. A significant proportion (39.47%) had a BMI between 25-30, categorizing them as overweight. Only a small percentage (2.63%) had a BMI between 18-25, which is considered normal weight. It suggested that a large proportion of individuals with SSI tend to have higher BMIs, with obesity being a predominant factor.

The distribution of hemoglobin levels reveals a concerning trend as depicted in table 2, with 55.26% of cases having hemoglobin levels below 7 g/dl, indicating severe anemia. Additionally, 31.57% of cases had hemoglobin levels between 7-10 g/dl, suggesting mild to moderate anemia. Only 13.15% of cases had hemoglobin levels above 10 g/dl, indicating relatively normal levels. These findings highlight a significant prevalence of anemia among the study population, with a substantial proportion having severe anemia, which may have implications for their overall health and management.

Table 3, highlights two significant intrapartum risk factors. Notably, 63.15% of cases involved more than 5 vaginal examinations during labor, while 55.26% of cases had prolonged rupture of membranes exceeding 18 hours. These findings suggest that prolonged labor and excessive vaginal examinations may contribute to increased risk, emphasizing the need for judicious labor management to mitigate potential complications.

The intraoperative risk factors reveal that 67.10% of cases had an operating time exceeding 1 hour, while 32.89% had a shorter duration. Additionally, 36.84% of cases experienced significant intraoperative blood loss, exceeding 1 liter (Table 4). These findings suggest that prolonged surgical duration and substantial blood loss are common intraoperative risk factors, potentially contributing to increased morbidity and complications. Effective strategies to minimize operating time and blood loss may be essential to optimize patient outcomes.

The study identified various risk factors associated with post-cesarean surgical site infections. Host-related factors included severe anemia (55.26%, RR=6.39), previously scarred uterus (65.78%, RR=5.28), gestational diabetes (65.78%, RR=11.32), and hypertension (55.26%, RR=6.08) as illustrated in fig. 2. Staphylococcus aureus was the most common pathogen isolated (51.31%). These infections led to significant maternal morbidity, including prolonged hospital stays (73.68% exceeding 10 days), high pain scores, and fever (55.26%). Some patients required critical care, with 3.94% admitted to ICU and 13.15% to HDU. Furthermore, 59.21% of patients experienced difficulty breastfeeding, underscoring the impact on postpartum recovery. (Table 5)

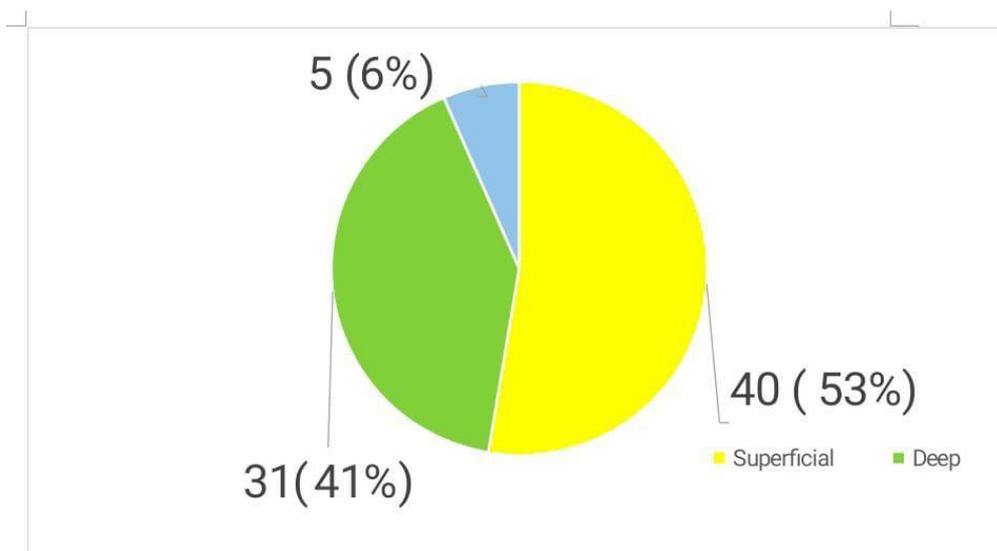


Figure 1: Distribution of data according to type of SSI

BMI	Number	Percentage (%)
18-25	2	2.63
25-30	30	39.47
>30	44	57.89

Table 1: Distribution of data according to BMI

Haemoglobin (g/dl)	Number	Percentage (%)
<7	42	55.26
7-10	24	31.57
>10	10	13.15

Table 2: Distribution of data according to Haemoglobin levels

RISK FACTOR	Number	Percentage (%)
>18 Hours of Leaking	36	55.26
>5 Vaginal examinations during labour	48	63.15

Table 3: Intrapartum Risk Factors

RISK FACTOR	Number	Percentage (%)
OPERATING TIME <1 HOUR	25	32.89
>1 HOUR	51	67.10
INTRAOP BLOOD LOSS > 1 L	28	36.84

Table 4: Intra operative Risk Factors

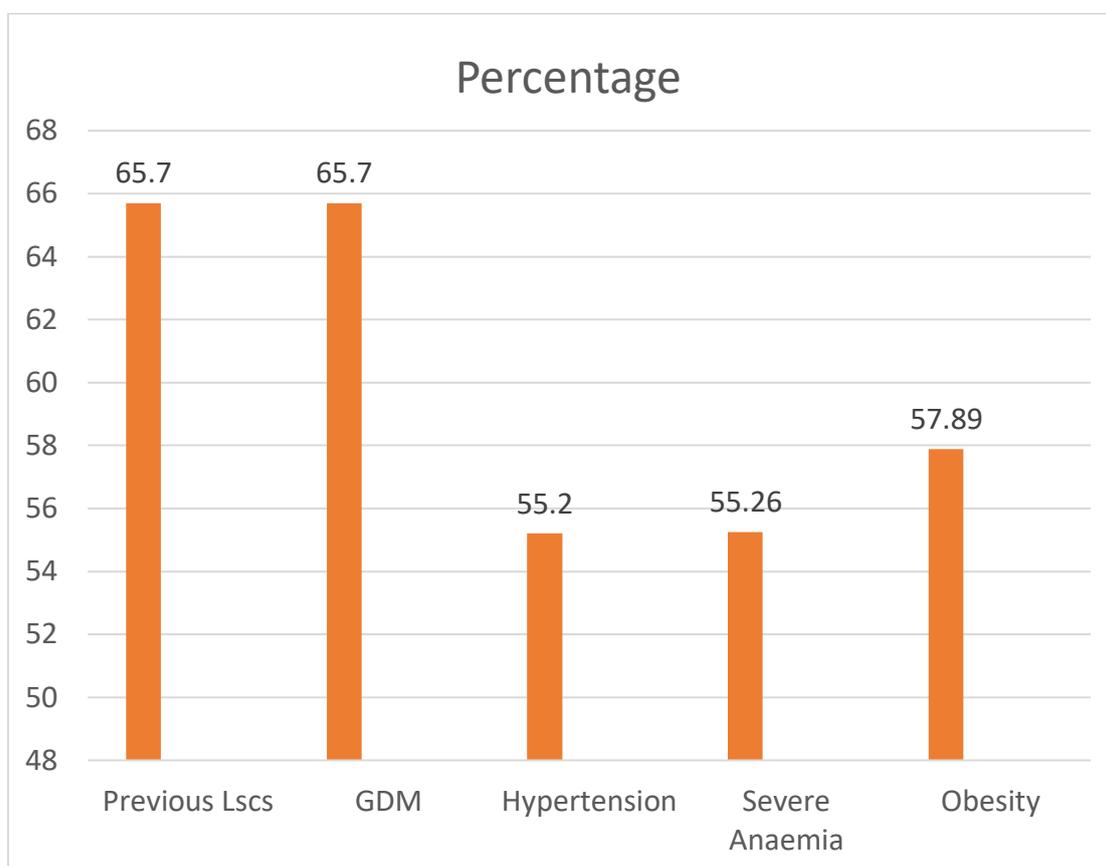


Figure 2: Association of various Risk Factors with SSI

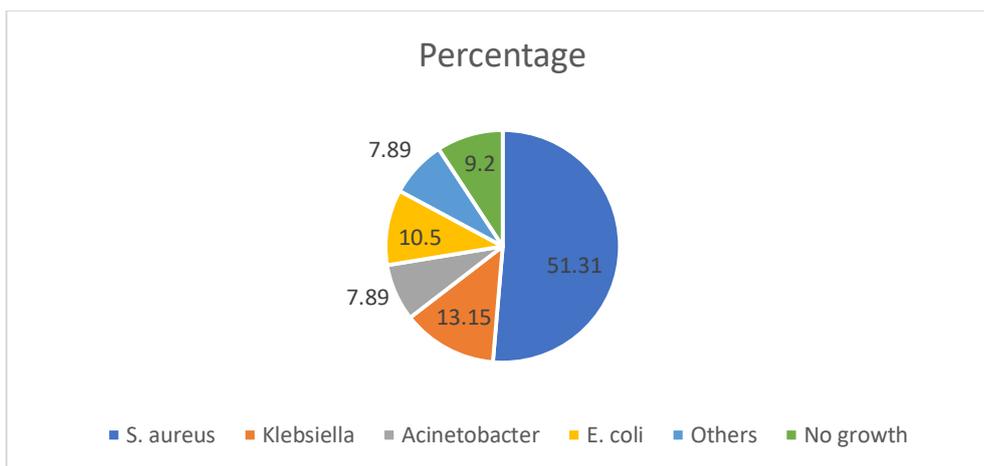


Figure 3: Distribution of microbes obtained on pus culture

		Number	Percentage
Number of days of hospital admission	5-9	20	26.31
	9-14	35	46.05
	15-19	21	27.63
Wong Bakers Faces Pain Rating Scale	2	0	0
	4	25	32.89
	6	31	40.78
	8	15	19.73
	10	5	6.57
ICU Admission		3	3.94
HDU Admission		10	13.15
Breast feeding issues		45	59.21

Table 5: Impact on maternal morbidity

DISCUSSION

In our study the incidence of SSI post cesarean was 1.7%. This was comparable to study conducted by Odada et al i.e, 2.1%⁶ and much lesser than study conducted by Gomaa K et al⁷. This difference might be attributed to the difference in the quality of both surgical care provisions and service among different hospitals.

The presence of severe anemia in 55.26% of infection-positive patients highlights the importance of addressing preoperative anemia to potentially reduce the risk of infection. Gestational diabetes is a well-established risk factor for poor wound healing and susceptibility to infections, further supporting the importance of optimizing maternal health during pregnancy. In our study GDM had the highest relative risk of SSI (11.32). Hypertension is a risk factor for SSIs due to several interconnected reasons: impaired blood flow and tissue oxygenation, chronic inflammation which can suppress the immune system and microvascular dysfunction. In our study the incidence was 55.26% (RR 6.08).

While in our study Diabetes had the maximum incidence, Gashaw A et al found the leading comorbidity being hypertension (n = 58, 13.4%) followed by anemia (n = 23, 5.3%)⁸.

Obesity was also found as a risk factor in our study with an incidence of 57.89% similar to study conducted by Kawakita T et al¹⁰. A raised BMI, particularly in the obese range increase the likelihood of wound infection as there is impaired blood flow and because it can provide a warm, moist environment where bacteria may thrive. When there is significant subcutaneous fat (greater than 2 cm) around Cesarean site, one potential consideration in managing the risk of infections, is the use of a drain. Previous cesarean scar can increase the risk of SSI owing to scar tissue, weakened abdominal muscles and presence of adhesions which prolong the surgery time.

All the patients in our study received pre operative antibiotic. Intrapartum factors also played a significant role, with prolonged rupture of membranes for more than 18 hours (47.36%) and multiple per vaginal (PV) examinations (63.15%) contributing to the increased risk of infection. These findings are in line with other studies^{8,9}, which suggests that these can introduce bacteria into the uterine cavity, increasing the likelihood of infection.

Prolonged surgery time may be indicative of complications during the procedure, while blood loss exceeding 1 liter may compromise tissue perfusion and immune function, both of which are critical in preventing infection. This has also been seen in studies conducted by Gomaa Ket al⁷ and Gashaw A et al⁸.

The most common pathogen identified in our study was *Staphylococcus aureus* (51.31%), which is consistent with previous studies^{11,12}. This pathogen's prevalence emphasizes the importance of preoperative prophylactic antibiotics, particularly those targeting gram-positive organisms.

The maternal morbidity associated with SSIs in our study was substantial. The prolonged hospital stay of over 10 days in 73.68% of affected patients underscores the significant burden of these infections on healthcare resources and patient well-being.

Pain scores greater than 4 in all infected patients highlight the severity of the infection and its impact on recovery. Fever, present in 55.26% of cases, is another indicator of systemic infection and requires careful monitoring. The need for intensive care in 3.94% of patients and high-dependency care in 13.15% further illustrates the serious nature of these infections. In addition to physical health complications, 59.21% of patients experienced difficulty breastfeeding. Difficulty breastfeeding may be related to both the pain and prolonged hospital stay, which can exacerbate emotional and psychological distress during the postpartum period.

CONCLUSION

This study highlights the complex nature of surgical site infections after cesarean sections, which significantly impact maternal health. By identifying and addressing various risk factors, healthcare providers can pinpoint high-risk patients who may benefit from tailored prevention strategies. Early detection and prompt treatment of these infections can reduce associated maternal morbidity. The study's findings add to the existing evidence on post-cesarean infections, providing valuable insights into clinical and surgical management to improve maternal outcomes.

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