

# Infections in Cesarean Section Wound and Its Associated Risk Factors

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## Abstract

**Objective:** To evaluate the occurrence of post-caesarean wound infections and their contributing factors, thereby facilitating the development of effective preventive measures and interventions to improve maternal and neonatal outcomes.

**Methodology:** Descriptive Case Series study was conducted at obstetrics and gynaecology department of Nishtar Hospital, Multan from July 2021 to Dec 2021. Women aged more than 17 years, who had undergone caesarean section procedure of either parity and gestational age were included. All patients in this study underwent either emergency or elective caesarean section procedures. Each patient was closely monitored for 30 days post-procedure, with regular examinations conducted to detect any signs of wound infection, including redness or purulent discharge. All pertinent details were documented using a pre-established data collection form. Data analysis was carried out using SPSS version 26.0, with post-stratification conducted to account for potential effect modifiers. The significance of observed differences was assessed using the chi-square test, considering a p-value of < 0.05 as statistically significant.

**Results:** The patients mean age was 29.33 years and a standard deviation of 2.72 years and the average gestational age was 37.13 +1.04 weeks. Overall, 9.1% of patients had wound infections following the caesarean section. Anemia and obesity were the most common factors, accounting for 5.8% of the total sample each. Diabetes mellitus and emergency lower segment caesarean section (LSCS) were each observed in 4 cases, making up 3.3% and 4.1% of the total, respectively. Prolonged rupture of membranes (PROM) and hypertension (HTN) were contributing factors in 1.7% of the sample for each factor. Although the rate of infection was statistically not significant according to age and gestational age ( $p > 0.5$ ). In terms of BMI, patients with a BMI greater than 25 had a significantly higher infection rate compared to those with a BMI less than 25, with 7 cases (5.8%) and 4 cases (3.3%) respectively ( $p=0.035$ ).

**Conclusion:** Study revealed that 9.1% of patients developed wound infections following caesarean section procedures. Anemia, obesity, diabetes and emergency C-section were observed to be the commonest identified risk factors.

**Keywords:** Wound infection, C section, Anemia, BMI, Diabetes, PROM

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## Introduction

Caesarean section (C/S) is regarded as one of the frequently conducted procedures for women.<sup>1</sup> It is a surgical procedure involving an incision made through the abdomen and uterus of the women to deliver the baby and is also considered a life-saving procedure in cases of medical emergencies such as abruption of placenta, foetal distress, or umbilical cord prolapse, where emergency deliveries are necessary to protect the health of the mother and baby. The World Health Organization (WHO) advises that the caesarean section

(CS) rate should ideally remain between 10-15% in every country.<sup>2,3</sup> However, in recent years, there has been a significant global surge in caesarean deliveries, with numerous countries exceeding the recommended rate. The rising frequency of Caesarean sections leads to an uptick in complications related to obstetrics and gynecology.<sup>4</sup> These complications encompass secondary infertility, miscarriage, challenging hysterectomy due to bladder adhesions, placenta previa, placenta percreta, peripartum hysterectomy, maternal

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mortality because of severity of bleeding, and significant complications over an extended recovery period.<sup>4,5</sup>

Studies have also highlighted that the most prevalent maternal complications worldwide, as indicated in the literature, are bleeding and wound infections.<sup>6</sup> Surgical site infections (SSI) primarily contribute to elevated maternal mortality and morbidity rates, patient dissatisfaction, prolonged hospitalization, and increased treatment expenses.<sup>7</sup> Following a caesarean section, wound infections emerge as a leading cause of sepsis also and sepsis has indeed become a significant factor contributing to the mortality rate among expectant mothers.<sup>8</sup> Therefore, identifying the specific characteristics that increase a patient's risk of developing a wound infection enables the establishment of optimal conditions aimed at reducing such infections, consequently decreasing the risk of sepsis and maternal mortality.<sup>8</sup> In developing nations, particularly in sub-Saharan Africa, the likelihood of surgical site infections is higher compared to developed countries.<sup>9</sup> This is attributed to factors such as anaemia, malnutrition, environmental pollution and poverty. Additionally, inadequate preoperative preparation, wound contamination, suboptimal antibiotic selection, and compromised immune systems in patients contribute to this increased risk.<sup>9</sup> Undergoing an emergency caesarean section posed a substantial risk for developing surgical site infections.<sup>10</sup> Additionally, pre-existing factors such as pregestational obesity, psychiatric conditions, and receiving blood transfusions during or after delivery were identified as independent risk factors for surgical site infections.<sup>10</sup>

This reflects a great reduction in the rate of surgical site infections over the last 30 years, and several improvements have been credited for it, including further attention to aseptic procedures, antibiotic use, sterile approaches, and technique.<sup>11</sup> Inconsistently, a cross-sectional survey discovered a prevailing high rate of surgical site wound infection in a subgroup of post-caesarean section women.<sup>12</sup> The research revealed that the overall rate of post-caesarean wound infection was 13.4%. Within this, a rate of 9.4% was observed in the elective caesarean group, while a higher rate of 17.4% was noted in the emergency caesarean group.<sup>12</sup>

Since the prevalence of surgical site infections and the causes remain uncertain, this research intends to investigate the threat of infection to women with caesarean section incision during the postoperative phase.

## Methodology

This descriptive case series was done obstetrics and gynaecology department of Nishtar Hospital, Multan (NHM). Study was done during a period of six months from July 2021 to Dec 2021. All the women aged more than 17 years, who underwent a caesarean section procedure of either parity and gestational age were included. All the patients those who were unwilling or unable to provide informed consent for participation in the study were excluded. Non-probability consecutive sampling technique was used. The researcher personally conducted thorough medical history-taking and physical examinations. Baseline data including age, residency, obesity status, gestational age at delivery, type of caesarean section, and parity were documented. Patients' medical records were also reviewed to assess for any existing comorbidities and presence of anemia.

Ethical approval was obtained from the Institutional Review Board (IRB) of Nishtar Hospital, Multan. Throughout the study, strict measures were implemented to uphold patient confidentiality and privacy. Prior to data collection, informed consent was obtained from all participants. All patients in this study underwent either emergency or elective caesarean section procedures. Each patient was closely monitored for 30 days post-procedure, with regular examinations conducted to detect any signs of wound infection, including redness or purulent discharge. All pertinent details were documented using a pre-established data collection form. Data analysis was carried out using SPSS version 26.0, with post-stratification conducted to account for potential effect modifiers. The significance of observed differences was assessed using the chi-square test, considering a p-value of  $\leq 0.05$  as statistically significant.

## Results

The patients' ages ranged from 18 to 40 years, with a mean age of 29.33 years and a standard deviation of 2.72 years. The average gestational age was 37.13 weeks, with a standard deviation of 1.04 weeks. The mean body mass index (BMI) was 26.66 kg/m<sup>2</sup>, and the mean parity was 2.54±1.30. According to the frequency distribution of patients based on the occurrence of post-caesarean wound infection, with a total sample size of 121 participants. Among these patients, 11 individuals, constituting 9.1% of the total, experienced wound infections following the caesarean section procedure.

Anaemia and obesity were the most common factors, accounting for 5.8% of the total sample each. Following closely, diabetes mellitus and emergency lower segment caesarean section (LSCS) were each observed in 4 cases, making up 3.3% and 4.1% of the total, respectively. Additionally, prolonged rupture of membranes (PROM) and hypertension (HTN) were contributing factors in 2 cases each, representing 1.7% of the sample for each factor. Lastly, 'Others' accounted for 3 occurrences, totalling 2.5% of the total sample. (Table I)

**Table II: Frequency of factors contributing to wound infection following caesarean section. (n=11)**

Factors	Frequency	%age
Anemia	7	5.8%
Diabetes Mellitus	4	3.3%
PROM	2	1.7%
HTN	2	1.7%
Obesity	7	5.8%
Emergency LSCS	5	4.1%
Others	3	2.5%

According to post stratification, patients aged 18-30 years experienced a higher frequency of wound infections compared to those aged 31-45 years, with 7 cases (5.8%) and 4 cases (3.3%) respectively. Regarding gestational age, patients with a gestational age of less than 39 weeks had a slightly higher infection rate compared to those with a gestational age of more than 39 weeks, with 8 cases (6.6%) and 3 cases (2.5%) respectively, although the difference in rate of infection was not statistically significant ( $p>0.5$ ). In terms of BMI, patients with a BMI greater than 25 had a significantly higher infection rate compared to those with a BMI less than 25, with 7 cases (5.8%) and 4 cases (3.3%) respectively ( $p=0.035$ ). Table II

**Table III: Frequency of post-caesarean wound infection based on age, gestational age, and BMI (n=121)**

Variables	Post caesarean wound infection		p-value
	Yes	No	
Age	18-30	7(5.8%)	0.081
	31-45	4(3.3%)	
GA	<39wk	08(6.6%)	0.788
	>39wk	03(2.5%)	
BMI	<25	4(3.3%)	0.035
	>25	07(5.8%)	

## Discussion

Caesarean delivery is regarded as an essential intervention for saving lives in cases of obstructed labor and other urgent obstetric situations. Promising access to caesarean delivery plays a pivotal role in achieving

the Sustainable Development Goals aimed at reducing child and maternal mortality. Nevertheless, being a surgical intervention, it also carries few potential risks of complications. This study was aimed to enhance understanding of post-caesarean wound infections and their contributing factors, thereby facilitating the development of effective preventive measures and interventions to improve maternal and neonatal outcomes, done on 121 patients who underwent c-sections with an overall mean age of 29.33 years and a standard deviation of 2.72 years, with an average gestational age of 37.13 weeks and mean body mass index was 26.66 kg/m<sup>2</sup>. Our findings were consistent with previous studies. For instance, Jabbar S et al,<sup>13</sup> reported that the average maternal age was 25.48 ± 4.64 years, with an average gestational age of 35.05 ± 2.517 weeks. Similarly, Fatima N et al,<sup>14</sup> found comparable results, with a mean age of 30.93 ± 7.28 years among women in their study. Additionally, our findings were in line with those of Sattar F et al,<sup>8</sup> who conducted almost similar study and reported an average patient age of 31.58 ± 5.17 years and an average gestational age of 39.56 ± 1.39 weeks.

In this study, the frequency distribution of post-caesarean wound infections among 121 participants revealed that 11 cases, constituting 9.1% of the sample, experienced such infections following the caesarean section procedure. These findings align with those reported by Zejnnullahu VA et al<sup>15</sup>, who observed an overall surgical site infection (SSI) rate of 9.85% in their study, with the median time to SSI occurring on the 7th postoperative day. Additionally, according to Bukhari SR et al<sup>16</sup>, out of a total of 874 caesarean procedures, 84 cases of surgical site infection were identified, accounting for 9.6% of the total. However, it is important to note that Jabbar S et al.<sup>13</sup> reported a higher rate of surgical site infection (24.3%) among post-caesarean section patients. Conversely, an international study by Gelaw KA et al.<sup>17</sup> observed a lower rate of SSI following caesarean section, with an infection rate of 6.8%.

Similarly, Azeze GG et al<sup>18</sup> found a prevalence of surgical site infection following caesarean section to be 7.8%, which is slightly lower than the rate observed in our study. These variations in the reported rates of surgical site infections following caesarean section highlight the importance of considering regional and institutional differences in healthcare practices, patient populations, and infection prevention strategies. Factors such as variations in surgical techniques, preoperative preparation, postoperative care protocols, and antibiotic

prophylaxis regimens may contribute to differences in infection rates observed across studies.

In this study, anaemia and obesity were found to be the most prevalent factors behind SSIs (Surgical Site Infections) post c-section, each comprising 5.8% of the total sample, followed by diabetes mellitus, obesity, emergency lower segment caesarean section, prolonged rupture of membranes (PROM), and hypertension (HTN). Comparatively Shah P et al<sup>19</sup> reported that the most common causative factor for SSI were personal hygiene 58.9%, handling by LHV/Dai 20.2%, 23.3% obesity, 13.5% anaemia, 17.8% PROM and 10.4% chorioamnionitis. Fatima N et al,<sup>14</sup> et al prolonged hospital stay, diabetes mellitus, and the anaemia were identified as significantly associated with surgical site infection after c-sections. On the other hand, Gomaa K et al<sup>20</sup> reported that the PROM, Chorioamnionitis, blood loss exceeding 1000 ml, duration of surgery >1-hour, lower antenatal care, duration of labor duration of 24 hours or more, DM, hypertension, obesity, high parity, gestational age below 37 weeks were identified as significant risk factors for surgical site infection. In the comparison of this study Gelaw KA et al<sup>17</sup> also observed that the various factors were identified as independently associated with surgical site infection following caesarean section. These factors include the timing of membrane rupture before caesarean section, the length of labor, and the location of the abdominal incision below the umbilicus. Alongside maintaining a sterile environment and performing aseptic surgeries, the utilization of the surgical safety recommended by WHO emerges as a crucial intervention for mitigating surgical site infections.<sup>17</sup>

Another study by Yerba K et al<sup>1</sup> identified different causative factors associated with surgical site infection post c-section, such as mild to moderate anaemia, onset of labor lasting more than 5 hours, more than five examinations of the vagina, and the labor onset.<sup>21</sup> However the risk of surgical site infection (SSI) following caesarean section is increased by factors such as age of the patients, raised BMI, medical complications and the labor status during pregnancy, rupture membrane during exceeding 18 hours, and undergoing more than five vaginal examinations prior to the procedure. There are several potential reasons for the discrepancies observed between our findings and those of other studies, like differences in sample size across studies, surgical practices, healthcare infrastructure, and patient demographics can vary significantly between regions,

influencing the prevalence and risk factors of surgical site infections and studies conducted in different geographical locations may yield varying results. Additionally, variations in preoperative screening, prophylactic antibiotic use, wound care protocols, patient comorbidities and postoperative monitoring can influence the incidence and severity of surgical site infections. This study also poses several limitations like limited study sample size and risk factors were analyzed based on an observed prevalence of 9.1% out of 121 total cases. However, due to the limited number of infection cases observed, accurately identifying risk factors becomes challenging. Therefore, it is recommended to conduct further extensive studies involving all selected patients with surgical site infections to accurately observe and identify the causative factors.

## Conclusion

Study revealed that 9.1% of patients developed wound infections following caesarean section procedures. Among the identified risk factors, anaemia, obesity, diabetes, and emergency C-section emerged as the most prevalent. These findings underscore the importance of vigilant monitoring and targeted interventions to reduce the risk of post-caesarean wound infections, especially among patients with predisposing factors. However, it is crucial to acknowledge several significant limitations across the study, which hinder definitive conclusions. Further large-scale studies are needed, specifically conducted on all infected patients with deep observations and analysis, to validate the findings.

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