Original Article

Surgical Site Infection After Emergency Versus Elective Cesarean Section: A Comparison in Low-Risk Pregnant Women

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Abstract

Objective: To compare the frequency of surgical site infection (SSI) in emergency versus elective caesarean section, at a tertiary-care Hospital.
Methodology: This prospective comparative cohort study was conducted at the department of Obstetrics and Gynaecology, Sheikh Zayed Medical Complex, DHQ Hospital, Rahim Yar Khan, from January 2025 to June 2025. Women undergoing elective or emergency caesarean section, aged 20-40 years, with a gestational age >37 weeks and singleton pregnancy were included. A total of three doses of same 3rd generation Cephalosporins were given to all the patients. Patients were followed up for 7 days after cesarean section, with wound assessment before discharge and on postoperative day 7 to identify SSI. Data collection was carried out by using study proforma and analysis was conducted using SPSS version 24.
Results: Mean age of the patients was 27.27±3.28 years with 20-30 years aged group being most common and means gestational age was 38.28±0.91 weeks. Emergency C-sections were performed in 139 patients (65.3%), while 74 patients (34.7%) underwent elective C-sections. Overall, SSI developed in 21 patients (9.9%). SSI was significantly more common after emergency C-sections (18/139, 12.9%) compared to elective C-sections (3/74, 4.1%), (p=0.038).
Conclusion: SSI remains a notable complication of C-section, with more frequent in emergency procedures compared to elective procedures, signifying the influence of surgical urgency and linked risk factors on wound healing and postoperative recovery.
Key words: C- section, Elective, Emergency, SSI.

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Introduction

Cesarean section (CS) remains a highly prevalent procedure in surgical units worldwide, comprising up to 80.0% of the operative volume within specialized obstetric settings, and playing a critical role in reducing neonatal and fetomaternal mortality.[1,2] The global rate of cesarean deliveries has risen strikingly from around 7.0% to 21.0% over the past thirty years (1990-2021), with this upward trend anticipated to reach approximately 30.0% by the year 2030.[2,3] Though CS remains a vital, life-saving measure under clear medical indications, the procedure carries a substantially higher risk of Post-cesarean infections relative to vaginal birth, including surgical site infection (SSI) and puerperal endometritis. SSIs are frequently encountered postoperative complications in cesarean deliveries, resulting in adverse maternal outcomes, extended hospitalization, and increased healthcare expenditures.[1,3] The estimated global incidence of surgical site infections after cesarean birth is reported at 5.63%, with rates rising as high as 8.0% in developing nations compared to roughly 5.0% in developed countries.[2,3]

The post-cesarean SSI burden considerably varies across geographic regions and health-care settings.[4,5] The overall global incidence of SSI among cesarean section patients is pooled at 7.0%, with the highest burden reported from the Western Pacific at 11.0%, followed by 10.0% in African regions, while the lowest

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rates were observed in the South-East Asian and European regions at 5.0% each.[2,3] A meta-analysis involving 41 studies from 18 African nations estimated SSI prevalence at 11%, with considerable regional disparities that ranged from 5.0% among Tunisian cohorts to 34.1% in Tanzanian populations.[4,6] A systematic review and meta-analysis from Saudi Arabia evaluated 7,632 women across 7 studies and reported a comparatively low pooled post-cesarean SSI incidence of 3.0%.[5] These regional disparities suggest that healthcare facility resources, infection control practices, and socioeconomic factors significantly influence post-cesarean infectious outcomes.[2-6]

The cesarean delivery approach, either elective or emergency, is a pivotal factor influencing postoperative infection rates. Emergency CS is frequently indicated for fetal compromise, prolonged labor, or ruptured membranes, each of which independently elevates the risk of post-procedural infection.[1,3,7] A comparative analysis of fetomaternal outcomes between emergency and elective CS demonstrated significantly higher rates of pyrexia, urinary tract infection, disseminated intravascular coagulation, and surgical site dehiscence in emergency CS.[7] A Chinese systematic review and meta-analysis estimated the overall post-cesarean surgical site infection (SSI) incidence at 2.4%, and concluded that emergency procedures are a major risk factor for significantly increased likelihood of infection.[8]

Further validating these findings, a recent meta-analysis reported a substantial disparity of SSI incidence between emergency (5.4%) and elective procedures (0.4%).[1] SSI development following a cesarean delivery has been attributed to multiple risk factors, while most of these are more common in emergency settings. A recent Ethiopian systematic review and meta-analysis identified several significant predictors of post-cesarean SSI, including frequent vaginal examinations, hypertensive conditions, extended duration of membrane rupture, increased body mass index, a history of cesarean section, and diabetes mellitus.[7]

Moreover, recent studies in African populations identified prolonged rupture of membranes, labor duration exceeding 24 hours, and chorioamnionitis as prominent risk factors, while other documented factors include vertical incisions, emergency CS, and absence of preoperative antibiotics, suggesting a complex causal association between obstetric, maternal, and procedural factors in post-CS infection risk.[2,4,6,7]

The prevention of post-cesarean SSI encompasses a range of preoperative, intraoperative, and postoperative interventions. Preoperative vaginal antiseptic irrigation has demonstrated high efficacy in mitigating post-cesarean infectious morbidity among emergency deliveries, while preoperative prophylactic antibiotic application has shown significant reduction in wound infection incidence compared with postoperative administration.[3] Specifically, povidone-iodine application in vaginal cleansing has shown a reduction in likelihood of endometritis by up to 4.0%.[3,9] Additionally, the implementation of evidence-based care bundles has demonstrated a 71% relative reduction in the post-CS SSI incidence (RR: 0.29).[1] In particular, bundled approaches that involve both the preoperative skin preparation and the vaginal cleansing have reported a notable decrease in overall post-cesarean infection rates.[10] Although evidence-based interventions have been demonstrated to remarkably reduce SSIs, the sustainability and adaptability of these interventions in resource-limited settings are yet to be established.[1,3,11]

Methodology

This prospective comparative cohort study was conducted at the department of Obstetrics and Gynaecology, Sheikh Zayed Medical Complex, DHQ Hospital, Rahim Yar Khan, IRB no 194/IRB/SZMC/SZH. The duration of the study was six months from January 2025 to July 2025. Overall, a sample size of 213 was calculated with confidence interval 95% and 3.5% margin of error using the proportion of surgical site infection as 7.3%. All the women aged between 20-40 years, singleton pregnancy, with a gestational age between 37-40 weeks confirmed by ultrasonography, and those undergoing caesarean section at gynae and obstetrics department of Sheikh Zayed Hospital were included. Non-probability consecutive sampling technique was used. All the women with associated medical disorders like uncontrolled diabetes, renal failure, jaundice, cardiovascular condition, severe anemia (Hb less than 7 gm/dl), women pre-infected with chorioamnionitis, obstructed labour, having an existing focus of infection like UTI, chest infection, obese patients with BMI more than 30 and those who were unwilling to take a part of study were excluded. Informed consent was obtained from each case after explaining the purpose of the study.

All the C-sections were performed in the same operating theatre using standardized sterilization techniques, with the same surgical team performing both emergency and elective procedures to minimize the procedural variability and potential bias. Women unable to attend the follow-up visit were contacted by telephone to assess wound-related symptoms and were advised to attend the hospital for clinical examination if infection is suspected. Total three doses of the same 3rd generation *cephalosporins* (injectable antibiotics) were given to all the patients undergoing C-section, with one dose on operation table and two doses were given postoperatively. Patients were followed up for 7 days after cesarean section, with wound assessment before discharge and on postoperative day 7 to identify SSI. All the relevant data were analyzed using IBM SPSS version 24. Mean and standard deviation were computed for age and gestational age, while frequency and percentages were calculated for categorical variables. Chi-square was applied to compare surgical site infection in emergency and elective C-section, taking $P \leq 0.05$ as statistically significant.

Results

In this study, the majority of women (89.2%) were aged between 20 and 30 years, with a mean age of 27.27 ± 3.28 years. The mean gestational age at delivery was 38.28 ± 0.91 weeks, with 58.2% delivering at 37–38 weeks and 41.8% at 39–40 weeks. Most participants (78.9%) had parity between 0 and 2, while 21.1% had more than three previous deliveries. Emergency cesarean section was performed in 65.3% of cases, whereas elective cesarean section accounted for 34.7%. Table I

Table I: Baseline characteristics of study cases. (n=213)

	Variable	N	%
Age (Years)	20-30	190	89.2
	31-40	23	10.8
	Total	**213**	**100.0**
	Mean age	27.27±3.28 years	
Gestational Age (Weeks)	37-38	124	58.2
	39-40	89	41.8
	Total	**213**	**100.0**
	Mean gestational age	38.28±0.91 weeks	
Parity	Para 0-2	168	78.9
	Para >3	45	21.1
	Total	**213**	**100.0**
Type of Caesarean Section	Emergency C-section	139	65.3
	Elective C-section	74	34.7
	Total	**213**	**100.0**

Out of 213 cases, surgical site infection was observed in 21 women (9.9%), while the remaining 192 women (90.1%) did not develop infection. Table II

Stratification by type of caesarean section showed that surgical site infection occurred in 18 out of 139 women (12.9%) who underwent emergency caesarean section, compared to 3 out of 74 women (4.1%) who had elective caesarean section. This difference was statistically significant (Chi-square = 4.300, p = 0.038). Table III

Table II: Surgical Site Infection by Type of Caesarean Section. (n=213)

Type of Caesarean Section	Surgical site infection		Total	p-value
	Yes	No		
Emergency C-section	18 (12.9%)	121 (87.1%)	139 (100%)	0.038
Elective C-section	03 (4.1%)	71 (95.9%)	74 (100%)	
Total	21 (9.9%)	192 (90.1%)	213 (100%)	

Stratification by maternal age showed that surgical site infection occurred in 8.4% of women aged 20–30 years compared to 21.7% in those aged 31–40 years, (Chi-square = 4.095, p = 0.043). With respect to gestational age and parity, the rate of SSI was statistically not significant (p >0.05), as presented in table III.

Table III: Stratification of SSI with respect to age, gestational age, and parity. (n=213)

Variable		Surgical site infection	Total	Chi Square	P value
		Yes	Yes		
Age (Years)	20-30	16	174	190	4.095	0.043
	31-40	05	18	23		
	Total	21	192	213		
Gestational Age (Weeks)	37-38	12	112	124	0.011	1.000
	39-40	09	80	89		
	Total	21	192	213		
Parity	0-2	15	153	168	0.775	0.379
	> 3	06	39	45		
	Total	21	192	213		

Discussion

This study included 213 participants to assess the frequency of surgical site infection (SSI) following emergency and elective caesarean sections. The mean age of the participants was 27.27 ± 3.28 years, indicating that the study population predominantly comprised young adult women. These findings are comparable to those reported by Habimana AK et al.,[12] who observed a slightly higher mean age of 30.36 ± 6.06 years among 373 women undergoing caesarean section. Similarly, Guner G et al.[13] reported a mean

maternal age of 28.0 ± 5.8 years among women who underwent caesarean section, with 84.2% of participants aged 18–35 years. These findings suggest a consistent age distribution among women undergoing caesarean section in the South Asian region.

In this study, the mean gestational age at delivery was 38.28 ± 0.91 weeks, with most participants (78.9%) had parity between 0 and 2. Consistent findings were documented in the study conducted by Guner G et al.[13] who reported a mean gestational age of 37.7 ± 2.9 weeks at delivery and multiparity (64.6%) was more prevalent among their study cohort. Comparable findings were stated in the study by Habimana AK et al.[12] who reported that gestational age of 37–39 weeks was confirmed by ultrasound and women who underwent caesarean section were at term. Dayo-Dada TO et al.[14] reported that a substantial majority of mothers (56.9%) had a high parity of 5–6, followed by 3–4 (27.7%), and 1–2 (8.3%), while only 7.1% had a parity exceeding 6, indicating a significantly higher parity distribution than that observed in our study. The consistency of gestational age at delivery across these studies suggests that caesarean sections in the present study were predominantly performed at term.

In the current study, emergency cesarean section was performed in 65.3% of cases, whereas elective cesarean section accounted for 34.7%. In agreement with these findings, the study conducted by Sultana R et al.[15] reported a considerably higher frequency of emergency C-sections in 350 (77.8%) patients compared to elective cesarean section in 100 (22.2%) patients. Similar distribution of mode of delivery was observed in the study by Dayo-Dada TO et al.[14] who reported that emergency caesarean sections constituted a majority of cases, accounting for 74.8% of cases, while elective caesarean section was performed in only 25.2%. The predominance of emergency caesarean sections may be due to the limited access to planned obstetric care and late presentation to health facilities.

In this cohort, overall surgical site infection rate was 9.9%, with considerably higher incidence observed among women who underwent emergency caesarean section (12.9% vs. 4.1% respectively) compared to those who had elective caesarean section (p = 0.038), indicating emergency delivery status as a key determinant of maternal surgical morbidity. Parallel to our findings Fatema K et al.[16] observed comparatively higher overall SSI rate, accounting for 16.18% of cases, with no significant differences in SSI rates at baseline (before discharge) between both groups (0.8045). However, they found significantly higher rate of post-discharge SSI among patients who underwent emergency CS (10.53%) compared to elective CS (2.61%) patients (p= 0.0035). Partially consistent findings were observed in the study by Sree S et al.[17] wherein patients in emergency procedures (7.2%) experienced higher rate of SSI in comparison to elective surgeries (5.1%), while the difference in SSI status between the types of procedures was statistically insignificant (χ^2=0.37, p=0.541). The consistently observed increased risk of postoperative infection in emergency surgical procedures across studies is probably associated with prolonged rupture of membranes, inadequate preoperative preparation, frequent vaginal examinations, and compromised sterility during urgent procedures, all of which are prevalent in emergency settings.

In this study, women aged 31–40 years (21.7%) experienced significantly higher post-caesarean surgical site infections compared to their younger counterparts of age range 20–30 years (8.4%), with a clear age-related disparity (χ^2= 4.095, p = 0.043), indicating that advancing maternal age is an independent or compounding risk factor for postoperative wound complications. These findings are consistent with the study conducted by de Brum CN et al.[18] who reported that an overall 4.6% of postpartum infection rate among women who underwent cesarean section, with higher SSI incidence in women older than 35 years (5.3%) compared to those aged below 25 years (0.8%) and a significant association between increased maternal age and post-procedural SSI indicators, such as increased sensitivity or pain (p = 0.028) and redness and/or hyperemia (p = 0.038) at surgical site. Comparably, in the study conducted by Sree S et al.[17] overall SSI incidence was 6.7%, with significantly higher SSI among older women aged 30–40 years (12.5%) compared to those aged 20–30 years (6.7%) and those aged below 20 years (2.0%) (χ^2= 7.85, p=0.020). Consistently, in the study carried out by Dessu S et al.[19] compared to women aged 19 years and below, women in age range 20–34 years had 5 times higher risk of post-cesarean SSI, while those aged 35 years and above had 9 times higher risk of acquiring SSI (AOR: 5.4 and AOR: 8.9 respectively). The consistency of observed increased risk of SSI in older age across studies may be explained by the higher prevalence of comorbidities such as diabetes,

hypertension, obesity, and impaired wound healing associated with advanced maternal age.

In our study, according to gestational age, post-caesarean surgical site infections (SSIs) occurred at a nearly identical rate between women delivering at 37–38 weeks and those delivering at 39–40 weeks, accounting for 9.7% and 10.1% of cases respectively (χ^2 = 0.011, p = 1.000), suggesting that early-term delivery does not independently increase the maternal risk for localized wound complications compared to full-term delivery. These findings are consistent with the study conducted by Odada D et al.,[20] who reported that gestational age showed no statistically significant association with SSI development (p = 0.097). Similarly, the study carried out by Shacho E et al.[21] found comparable mean gestational age in patients who had developed SSI and those who did not (p=0.367). This lack of a significant association between gestational age and SSI across studies suggests that the risk of SSI is relatively constant within the term gestational age range. In contrast, the study conducted by Dousti S et al.[22] reported that gestational age was a significant risk factor for surgical wound infection (P=0.041), with post-cesarean SSI observed in 25.08% of women. The observed discrepancy in SSI findings according to gestational age may be attributable to differences in the gestational age distribution of the study populations. The study by Dousti S et al.[22] may have included preterm deliveries, which could partly account for this variation, as preterm birth may involve additional clinical and procedural challenges that influence the risk of postoperative infection. In the present study, SSI was more frequently observed following emergency caesarean sections than elective procedures. This finding emphasizes the need to strengthen infection prevention practices, ensure timely perioperative management, and maintain close postoperative wound surveillance, particularly in women undergoing emergency caesarean deliveries.

Conclusion

Surgical site infection (SSI) remains an important postoperative complication of caesarean section, with a higher frequency observed following emergency procedures than elective procedures. This difference may reflect the influence of surgical urgency and associated risk factors on infection development, wound healing, and postoperative recovery. Strengthening infection prevention and control practices, particularly timely administration of antibiotic prophylaxis, strict adherence to aseptic techniques, and appropriate postoperative wound care, is essential, especially in emergency caesarean sections. These measures may help reduce SSI-related morbidity and improve maternal outcomes.

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