

Frequency of Surgical Site Wound Infection in Elective Versus Emergency Cesarean-Section

Shaista Khan¹, Gulfareen Haider², Madiha Abbasi³, Anila Mahmood⁴, Ujala Wahid Bux Shaikh⁵, Samia Aijaz⁶

¹Postgraduate student (FCPS=II), department of Gynae and Obs Isra Hospital Hyderabad

²Professor of Gynae and OBS Isra University Hospital Hyderabad

³Associate Professor, Obs, LUMHS/ Jamshoro

⁴Associate Professor, Obs, LUMHS/ Jamshoro

⁵Postgraduate trainee (FCPS-II) (Obs & Gynae), ISRA University Hospital, Hyderabad

⁶Assistant professor OBGYN and Urogynaecology, LUMHS/ Jamshoro

Author's Contribution

^{1,5}Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, ²Final approval of the version to be published, ^{3,5}Drafting the work or revising it critically for important intellectual content, ⁶Literature review

Conflict of interest: None

Funding source: None

Article received: 19-01-26

Article accepted: 20-04-26

Correspondence

*E: Shaistaakhan1495@gmail.com

ABSTRACT

Objective: To determine the frequency of surgical site wound infection among women undergoing elective versus emergency cesarean sections (C-section).

Methodology: A descriptive cross-sectional study was done at department of Obstetrics and Gynecology, ISRA University Hospital, from August 2025 to December 2025. Women undergoing cesarean section (elective or emergency), aged between 18 to 45 years, presented with singleton pregnancy at term (≥ 37 weeks of gestation) and who received standard prophylactic antibiotics preoperatively were included. Patients were categorized in two groups; women undergoing elective cesarean section were placed in Group I, and an equal number of women undergoing emergency cesarean section were kept in Group II. The rate of SSI was assessed during follow-up visits within 30 days postoperatively. All relevant data were entered and analyzed using SPSS version 26.0.

Results: Overall 170 patients were enrolled with maternal mean age of 29.88 ± 4.12 years, mean BMI of around 28.28 ± 3.18 kg/m², and average gestational age of 38.34 ± 4.44 weeks. Surgical site infection (SSI) was noted in 13(15.3%) cases of emergency group and in 6(7.1%) patients of elective procedures, representing higher infection rate in emergency cases, ($p = 0.994$). Additionally, there was no significant association found of booking status, residential status, SES, anemia and BMI with overall SSI occurrence, p-values were quite insignificant ($p > 0.05$).

Conclusion: The surgical site wound infection rate was observed more frequent in emergency C-sectional group contrasted to elective procedures with a slight association to anemia, blood transfusion and raised BMI.

Key words: C-section, Emergency, Elective, SSI, Anemia, BMI

Introduction

Cesarean section (CS) is a potentially lifesaving surgical procedure in which the fetus, placenta, and membranes are delivered through incisions made in the abdominal wall and the uterus.¹ Although C-section can be lifesaving, it may also possess substantial risks for both mother and newborn, including severe maternal morbidity, postpartum infections, neonatal and maternal mortality. Even though it is a lifesaving procedure, it can also carry a significant risk both for the mother and the newborn including severe acute maternal morbidity, post-partum infection or death.^{1,2} Resulting in the ongoing global rise in rates of cesarean sections, the number of women affected by postpartum infection is expected to grow.³ The surgical site infection (SSI) is one among such risks that may happen to a woman after a procedure of C-section, is a significant contributor to maternal morbidity and mortality, prolonging hospital stay and increasing costs of healthcare, thereby placing additional considerable health burden on healthcare system.³ Despite this

according to the WHO, the C-section deliveries should ideally account for only 10–15% of total deliveries; whereas, several studies have reported rates exceeding 40%.⁴

Cesarean sections are performed as emergency or elective procedures depending upon the indications. Elective operation is defined as a cesarean section that was planned at least 24 hours before the intervention and emergency operation is when it is performed where there is an immediate threat to the life of a fetus and/or woman. The reported rates of SSI following C-section deliveries vary significantly across the settings, usually ranging between 3% and 20% throughout the world.⁵ This variability appears strongly linked to the types of C-section deliveries: as according to a Norwegian hospital-based case-control study reported the SSI rates around 0.4% following elective C-sections compared to 5.4% following emergency caesarean deliveries, categorizing the

emergency delivery as a significant independent risk factor for infection development.⁶ Such pattern of obstetric complications has been replicated across diverse healthcare facilities. A SSI surveillance study from Egypt demonstrated that of all infected CS cases around 79.2% had undergone emergency rather than elective CS detected over a period of two-years, with the emergency operation and the obese women identified as the two dominant risk factors.⁷ Likewise, another large scale study of 1,682 women found that emergency CS combined with raised BMI or a history of smoking presented a three- to ten-fold increase risk in adverse infection- associated outcomes.⁸

According to the National Nosocomial Infection Survey (NNIS) definition of Centers for Disease Control (CDC) and Prevention, a SSI is detected when at least one of the following four criteria is met like purulent drainage from the wound, any positive culture obtained by swab from a wound, other local signs and symptoms (pain, tenderness, localized swelling, redness, malodor, or fever) encouraging the surgeons to thoughtfully open the wound, unless the results of culture being negative, or a diagnosis of infection made by the attending physician or the surgeon.⁹ Additionally as per following duration it may also be defined as the SSI occur at or near the site of a surgical incision within 30 days of the procedure.¹⁰

The Pakistan is one among those countries where the rate of cesarean section has surprisingly expanded, during the previous two decades. As it is a developing country with the limited resources carrying a higher maternal mortality rate due to the several preventable pregnancy related complications.¹¹ As per findings of a recent Indian study conducted at SVMC, Tirupati, investigating the SSIs in elective versus emergency cesarean deliveries, observed SSIs in 8.2% of emergency cases compared to only 1.07% among elective cases, with emergency procedures showing a stronger link with risk factors such as postoperative anemia (39.13%) and obesity (34.78%).¹² Likewise, a national study conducted at Central Park Teaching Hospital, Lahore, on 180 women undergoing emergency versus elective C-section, reported that the wound infection occurred significantly higher in emergency CS group (19.6%) compared to elective CS group (0%) ($p < 0.001$), emphasizing the emergency delivery as a major risk factor for impaired wound healing in the local population.¹²

A substantial difference in the occurrence of SSI has been consistently described between elective and emergency cesarean births, with emergency procedures repeatedly linked to the considerably high infection rate. Regardless of this well-established international evidence, proper and adequate local-level data remain almost lacking, with only few limited studies addressing

this specific comparison in local population. This study was therefore planned to explore recent and locally relevant evidence on this important source of maternal morbidity, particularly to underscore the emergency C-section as a contributing factor that should not be ignored in routine obstetric practice. Importantly, identification and special consideration of this risk is very important to prevent a prolong hospital stay and extended bed rest, along with the added financial burden on our already resource-limited healthcare facilities and mostly poor unemployed population.

Methodology

This descriptive cross-sectional study was done at department of Obstetrics and Gynecology (Unit II), ISRA University Hospital, Hyderabad. This study was done after approval of synopsis from CPSP and ethical Review Board Committee of Isra University Hyderabad. The duration of study was 4 months from August 2025 to December 2025. Sample size calculation was done by Raosoft software, by using the proportion "surgical site infection is 13% in emergency caesarean section"¹⁴ with 95% confidential level and 5% margin error, the study sample size stand to be 170. Non-probability consecutive sampling technique was used. All the women undergoing cesarean section (elective or emergency), aged between 18 to 45 years, presented with singleton pregnancy at term (≥ 37 weeks of gestation) and who received standard prophylactic antibiotics preoperatively were included. On the other hand women with pre-existing wound infection or any skin/soft tissue infection at or near the surgical site prior to the cesarean, women with diabetes mellitus or gestational diabetes, multiple pregnancies (twins pregnancy), women undergoing repeat cesarean section with a history of prior infected surgical scar and those who were not agreeing to take a part of study and failed to have follow-ups (virtual/on phone) were excluded from study. Written informed consent was obtained from each participant after explaining the objectives of the study. All the patients were categorized in two groups; women undergoing elective cesarean section were placed in Group I, and an equal number of women undergoing emergency cesarean section were placed in Group II. All participants were assured that their personal information will remain confidential. All the procedures were conducted by a senior gynecologist with a minimum of five years of clinical experience. The rate of surgical site infection (SSI) was assessed during follow-up visits or via phone contact up to 30 days postoperatively. Surgical site infection was defined by the presence of fever (temperature $> 98^{\circ}\text{F}$), redness, swelling, warmth, pain or

tenderness at the incision site, or purulent discharge from the wound, through direct physical examination during follow-up visits within 30 days of the postoperative period. All relevant data, including maternal demographic characteristics, SSI and perinatal outcomes, were recorded in the self-structured proforma. Furthermore, the data entry and analysis was done using SPSS version 26.0. Quantitative variables were presented as mean $\pm$ standard deviation, while categorical variables were expressed in frequency and percentage. The chi-square test was applied to determine the association between type of cesarean section and the occurrence of SSI, taking a p-value of ≤ 0.05 as statistically significant.

Results

This study involved 170 patients with an overall average maternal age of 29.88 ± 4.12 years, mean BMI of around 28.28 ± 3.18 kg/m², and average gestational age of 38.34 ± 4.44 weeks. Most of the women were booked (77.6%) and resided in urban areas (68.8%). According to the educational status, approximately half had intermediate or above education (47.1%), following by secondary (32.4%), primary (13.5%), and uneducated (7.1%). Majority of the case belonged to poor and middle socioeconomic class, whereas 30.6% were belonging to upper-income families. Over half of the women had a history of previous C-sections (55.3%), anemia was highly frequent around in 53.5% of cases and 20.6% of patients underwent blood

transfusions. Table I

The surgical site wound infection noted among 13(15.3%) of the patients of emergency C-section paralleled to 6(7.1%) of elective procedures, representing a numerically high infection rate in the emergency cases, while the difference was statistically insignificant ($p = 0.994$). Table II

Overall SSI rates were higher among patients with un-booked status, residential status, poor SES, anemia and raised BMI. While findings were statistically insignificant, p-values were quite insignificant ($p > 0.05$).

Discussion

It has been considered that the SSIs occur more frequently among patients undergoing emergency cesarean sections compared to the elective procedures, which may be associated with greater tissue contamination, prolonged operative duration, and inadequately optimized maternal clinical status and comorbidities on urgent basis. This study was conducted to observe the occurrence of surgical site wound infection among women undergoing elective versus emergency C-section, where it was found that surgical site infection occurred in 15.3% cases of emergency cesarean section group compared to the elective cesarean section cases group which was around 7.1%, demonstrating a numerically higher

Table I: Baseline and clinical variables of the patient. (n=170)

Variable	Subcategory	Mean ± SD	Proportion / Distribution	n
Continuous Variables				
Maternal Age	Mean ± SD	29.88 ± 4.12 years		170
BMI (kg/m²)	Mean ± SD	28.28 ± 3.18 kg/m²		170
Gestational Age	Mean ± SD	38.34 ± 4.44 weeks		170
Categorical Variables				
Gender	Male	71.9%	71.9%	179
	Female	28.1%	28.1%	70
Booking Status	Booked	77.6%	77.6%	132
	Un-booked	22.4%	22.4%	38
Residential Status	Urban	68.8%	68.8%	117
	Rural	31.2%	31.2%	53
Educational Status	Illiterate	7.1%	7.1%	12
	Primary	13.5%	13.5%	23
	Secondary	32.4%	32.4%	55
	Intermediate or above	47.1%	47.1%	80
Economic Status	Lower	37.6%	37.6%	64
	Middle	31.8%	31.8%	54
	Upper	30.6%	30.6%	52
Previous C-Section	Yes	55.3%	55.3%	94
	No	44.7%	44.7%	76
Anemia	Positive	53.5%	53.5%	91
	Negative	46.5%	46.5%	79
Blood Transfusion	Yes	20.6%	20.6%	35
	No	79.4%	79.4%	135

Table II: Post stratification for effect modifiers. (n=170)					
Variables		Surgical site wound infection		Total	p-value
		Yes	No		
Booking status	Booked	12	120	132	0.108
		63.2%	79.5%	77.6%	
	Un-booked	7	31	38	
		36.8%	20.5%	22.4%	
Residential status	Urban	15	102	117	0.312
		78.9%	67.5%	68.8%	
	Rural	4	49	53	
		21.1%	32.5%	31.2%	
Socio economic status	Lower	9	55	64	0.518
		5.3%	32.4%	37.6%	
	Middle	4	50	54	
		2.4%	29.4%	31.8%	
	Upper	6	46	52	
		3.5%	27.1%	30.6%	
Previous cesarean delivery	Yes	11	83	94	0.809
		57.9%	55.0%	55.3%	
	No	8	68	76	
		42.1%	45.0%	44.7%	
Anemia	Negative	8	71	79	0.686
		42.1%	47.0%	46.5%	
	Positive	11	80	91	
		57.9%	53.0%	53.5%	
BMI	Normal	2	19	21	0.900
		15.4%	12.6%	12.8%	
	Overweight	8	89	97	
		61.5%	58.9%	59.1%	
	Obese	3	43	46	
		23.1%	28.5%	28.0%	

rate of post cesarean section infection in the

emergency group, which is consistent with a substantial body of national and international literature: as a comparative Indian study was carried out by Charitha AS et al¹², to identifying the rate of SSI in elective versus emergency cesarean surgeries, consistently reported that the SSIs was around 8.2% among emergency cases versus only 1.07% in elective cases, with emergency procedures found with significant association to risk factors including anemia (39.13%) and obesity (34.78%), results that closely parallel the pattern observed in this study. The comparable observations were made by a Norwegian hospital-based case-control study by Kvalvik SA et al⁶, where reported that the incidence of SSI was only 0.4% following elective CS in contrast to around 5.4% following emergency CS, also indicating an emergency delivery as a significant independent risk factor, according to our findings. The findings of the present study are further supported by a large five-year retrospective Egyptian study of over 15,000 cesarean births noted the emergency CS as a significant contributing factor for SSI, with an adjusted odds ratio of 2.16 (95% CI 1.61–2.51).¹⁵ The present findings are broadly consistent with observations reported by a national study from Abbottabad found the unusual reversal of this pattern, with elective procedures presenting a higher rate of SSI

around (37.93%) compared emergency procedures (27.77%) along with patients from general surgical wards,¹⁶ nevertheless this study was not specific to cesarean delivery and may reflect differences in surgical case mix rather than a true deviation from the broader pattern of obstetric field. Corroborating the present findings, a study conducted by Fatema K e t al¹⁷ at Bangabandhu Sheikh Mujib Medical University, Bangladesh, observing the risk factors for post-cesarean SSI, observed that the post-discharge wound infections were more frequent following emergency CS (10.53%) when compared to elective cesarean deliveries (2.61%), further reinforcing the consistent pattern found in studies linking emergency delivery to a higher burden of surgical site wound infection. Moreover, according a study by Opøien HK et al¹⁸ reported that the rate of SSI was 7.2% in the elective group and 10% in the emergency patients group, while a difference was not reached to statistical significance (p=0.24).

Overall emergency cesarean deliveries carry a higher risk for SSI primarily because they often occur after labour has already begun or after ruptured membranes, allowing the bacterial contamination to reach the surgical site from the birth canal along with limited time available for proper preoperative skin preparation and timing of the antibiotics. The risk is

further compounded in our setting, as women requiring emergency cesarean delivery often arrive in unhygienic condition, frequently after prolonged labour at home or referral from peripheral health facilities with inadequate preparation of perineum and abdomen, further increasing their baseline risk of infection.

Demographically present study found an overall mean maternal age around 29.88 years, mean BMI of 28.28 kg/m², and mean gestational age of 38.34 weeks, all broadly comparable to figures reported in the relevant national and international literature, along with variables like un-booked status, advance maternal age, residential status, raised BMI, poor vaginal cleanliness, anemia, PROM, diabetes mellitus, raised NNIS risk index, trial of labour, prolonged operative duration, and greater intraoperative blood loss, as significant key contributor of post-cesarean SSI.¹⁹⁻²²

To prevent the SSI in emergency cesarean deliveries, it requires without delay antibiotic prophylaxis, thorough preoperative preparation, immediate treatment of anemia where possible, reduced operative time, and strict aseptic techniques despite the time limitations. Decreasing delays in reaching tertiary care health facilities, appropriate postoperative hygiene, patient awareness, and strengthening antenatal booking status

are very important to decrease the rate of infection specifically among emergency cesarean deliveries.

Conclusion

Overall surgical site wound infection rate was observed to be 11.2%, particularly in the emergency C-section group, which showed a statistically higher infection rate contrasted to that of elective procedures with a slight association with anemia, blood transfusion and raised BMI. According to insignificant findings the type of C-section alone is not a significant predictor of surgical site wound infection. The overall higher infection rate highlights the importance of optimizing maternal factors, particularly addressing anemia and raised BMI, in reducing the risk of postoperative wound complications. However, multidisciplinary approaches incorporating strict aseptic techniques, optimization of nutritional status, and close postoperative surveillance are very important in reducing surgical site infections and improving maternal outcomes following C-section.

References

1. Alemye T, Oljira L, Fekadu G, Mengesha MM. Post cesarean section surgical site infection and associated factors among women who delivered in public hospitals in Harar city, Eastern Ethiopia: a hospital-based analytic cross-sectional study. *PLoS One*. 2021;16(6):e0253194. <https://doi.org/10.1371/journal.pone.0253194>
2. Korb D, Goffinet F, Seco A, Chevret S, Deneux-Tharaux C. Risk of severe maternal morbidity associated with cesarean delivery and the role of maternal age: a population-based propensity score analysis. *CMAJ*. 2019;191(13):E352-E360. <https://doi.org/10.1503/cmaj.181067>
3. Mhaske G, Vadehra P, Junnare K, Kalra K. Study of surgical site infection (SSI) in patients undergoing caesarean section (CS): a retrospective study. *Int J Gynecol Sci*. 2020;4(1):4-9. <https://doi.org/10.33545/gynae.2020.v4.i1f.483>
4. Odada D, Shah J, Mbithi A, Shah R. Surgical site infections post cesarean section and associated risk factors: a retrospective case-control study at a tertiary hospital in Kenya. *Infect Prev Pract*. 2024;6(1):100333. <https://doi.org/10.1016/j.infpip.2023.100333>
5. Shacho E, Yilma D, Goshu AT, Ambelu A. Incidence and risk factors of surgical site infection following cesarean section: a prospective cohort study at Jimma University Medical Center. *BMC Infect Dis*. 2025;25:457. <https://doi.org/10.1186/s12879-025-10857-y>
6. Kvalvik SA, Rasmussen S, Thornhill HF, Baghestan E. Risk factors for surgical site infection following cesarean delivery: a hospital-based case-control study. *Acta Obstet Gynecol Scand*. 2021;100(12):2167-75. <https://doi.org/10.1111/aogs.14235>
7. Alishaq MA, AlAjmi JA, Al-Ali B, Saleh F, El-Sheik M, Malkawi M, George A, Garcia L, Locus B. Risk factors of surgical site infection post cesarean section. *BMC Proc*. 2011;5(Suppl 6):P189. <https://doi.org/10.1186/1753-6561-5-S6-P189>
8. Erritty M, Hale J, Thomas J, Thompson A, Wright R, Low A, Carr M, George R, Williams L, Dumitrescu A, et al. Evaluation of independent risk factors associated with surgical site infections from caesarean section. *Arch Gynecol Obstet*. 2023;308(6):1775-83. <https://doi.org/10.1007/s00404-022-06885-7>
9. Krukerink M, Kievit J, Marang-van de Mheen PJ. Evaluation of routinely reported surgical site infections against microbiological culture results: a tool to identify patient groups where diagnosis and treatment may be improved. *BMC Infect Dis*. 2009;9:176. <https://doi.org/10.1186/1471-2334-9-176>
10. Lee KK, Lim JS, Bakar SA, Rashid NW, Razak NF, Siam KA, Kamal NA, Said SN, Aguilar JA, Park H,

- Choon WY. Surgical site infection following caesarean section: incidence and healthcare resource utilisation in a tertiary mother and children hospital in Malaysia. *Infect Dis Health*. 2026;31(3):100423. <https://doi.org/10.1016/j.idh.2026.100423>
11. Mehboob R, Gilani SA, Khalid S, Hassan A, Alwazzan A. Maternal mortality ratio in low-income developing countries. *Glob Womens Health*. 2021;1:1-7. <https://doi.org/10.5772/intechopen.95258>
 12. Charitha AS, Rentapalli JD, Bhavani K. A comparative study of surgical site infections in elective and emergency caesarean surgeries. *Int J Pharm Qual Assur*. 2025;16(8):18-25. <https://doi.org/10.25258/ijpqa.16.8.4>
 13. Sultana N, Zia U, Riaz A, Gul S, Aashiq S. Frequency of wound breakdown in patients undergoing elective versus emergency cesarean section. *Pak J Med Health Sci*. 2022;16(7):53-9.
 14. Sangrasi AK. Surgical site infection rate and associated risk factors in elective general surgery at a public sector medical university in Pakistan. *Int Wound J*. 2008;5(1):74-8. <https://doi.org/10.1111/j.1742-481X.2007.00365.x>
 15. Gomaa K, Abdelraheim AR, El Gelany S, Khalifa EM, Yousef AM, Hassan H. Incidence, risk factors and management of post cesarean section surgical site infection (SSI) in a tertiary hospital in Egypt: a five-year retrospective study. *BMC Pregnancy Childbirth*. 2021;21:634. <https://doi.org/10.1186/s12884-021-04054-3>
 16. Sattar F, Sattar Z, Zaman M, Akbar S. Frequency of post-operative surgical site infections in a tertiary care hospital in Abbottabad, Pakistan. *Cureus*. 2019;11(3):e4243. <https://doi.org/10.7759/cureus.4243>
 17. Fatema K, Zaman MA, Kuragama KDPT, Daher ME, Das TR, Pervin HH. Risk factors associated with post cesarean surgical site wound infection in Bangabandhu Sheikh Mujib Medical University, Bangladesh. *Int J Reprod Contracept Obstet Gynecol*. 2023;12(10):2928-34. <https://doi.org/10.18203/2320-1770.ijrcog20232928>
 18. Opøien HK, Valbø A, Grinde-Andersen AN, Walberg M. Post-cesarean surgical site infections according to CDC standards: rates and risk factors. A prospective cohort study. *Acta Obstet Gynecol Scand*. 2007;86(9):1097-102. <https://doi.org/10.1080/00016340701515225>
 19. Guo L, Huang S, Sui H, Li W. Incidence and influencing factors for surgical site infections after cesarean section in China: a systematic review and meta-analysis. *J Obstet Gynaecol Res*. 2025;51(1):e16172. <https://doi.org/10.1111/jog.16172>
 20. Rakhshani Moghaddam F, Razavi M, Delaramifar Z. Prevalence and risk factors of surgical site infection following cesarean section. *J Kermanshah Univ Med Sci*. 2025;29(1):e148572. <https://doi.org/10.5812/jkums-148572>
 21. Ketema DB, Wagnew F, Assemie MA, Ferede A, Alamneh AA, Leshargie CT, Kibret GD, Petrucka P, Telayneh AT, Alebel A. Incidence and predictors of surgical site infection following cesarean section in North-west Ethiopia: a prospective cohort study. *BMC Infect Dis*. 2020;20(1):902. <https://doi.org/10.1186/s12879-020-05640-0>
 22. Fatima N. Surgical site infection and factors responsible for it after emergency cesarean section. *J Surg Pak*. 2020;25(1):27-30.