Original Research Article

Comparison of Maternal and Neonatal Outcomes Following Elective Cesarean Section Versus Emergency Cesarean Section

Jogadia Jolly Jitenbhai

Department of Obstetrics and Gynaecology, The college of Physicians and Surgeons of Mumbai, Maharashtra, INDIA.
Email: drjolly21@gmail.com

Abstract

Background: Cesarean section rates are increasing globally, with both elective and emergency procedures carrying distinct risks. Understanding differences in maternal and neonatal outcomes between these two types is essential for optimizing obstetric care. **Objective:** To compare maternal and neonatal outcomes following elective versus emergency cesarean sections. **Methods:** This hospital-based cross-sectional study included 120 women undergoing cesarean section (60 elective and 60 emergency) at a tertiary care center. Data on maternal demographics, intraoperative and postoperative complications, and neonatal outcomes were collected and analyzed. Statistical significance was evaluated using t-tests and Chi-square tests, with $p < 0.05$ considered significant. **Results:** Women in the elective group were older (29.7 ± 4.5 vs 27.8 ± 5.2 years, p=0.020) and delivered at later gestational age (38.8 ± 1.1 vs 37.4 ± 1.8 weeks, p<0.001). Maternal complications, including intraoperative blood loss >1000 ml (8.3% vs 25%, p=0.005), postoperative fever (10% vs 30%, p=0.002), wound infection (6.7% vs 23.3%, p=0.004), and need for blood transfusion (5% vs 20%, p=0.007), were significantly higher in emergency cesarean cases. Neonates born via emergency CS had higher incidence of low APGAR scores at 1 minute (35% vs 10%, p<0.001), NICU admission (38.3% vs 13.3%, p=0.001), and lower mean birth weight (2815 ± 450 g vs 2960 ± 370 g, p=0.048). **Conclusion:** Emergency cesarean sections are associated with increased maternal and neonatal morbidity compared to elective procedures. Efforts to reduce emergency CS through timely intervention and optimized management protocols can improve outcomes.

Keywords: Cesarean section; Maternal outcomes; Neonatal outcomes.

***Address for Correspondence:**
Dr Jogadia Jolly Jitenbhai, Department of Obstetrics and Gynaecology, The college of Physicians and Surgeons of Mumbai, Maharashtra, INDIA.
Email: drjolly21@gmail.com

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INTRODUCTION

Cesarean section (CS) is a commonly performed surgical procedure worldwide that involves delivering a baby through incisions made in the mother's abdomen and uterus. Over the past few decades, the rate of cesarean deliveries has increased substantially across both developed and developing countries. This trend is attributed to various factors, including changes in obstetric practice, maternal preferences, medico-legal concerns, and increasing maternal age and comorbidities. The World Health Organization recommends an ideal cesarean section rate between 10-15%, but many countries exceed this limit, sparking debates regarding the necessity and safety of CS procedures [1].

Cesarean sections are broadly classified into elective (planned) and emergency (unplanned) procedures. Elective cesarean sections are pre-scheduled operations typically done before the onset of labor for various indications, such as previous cesarean delivery, fetal malpresentation, maternal request, or certain maternal or fetal conditions. Emergency cesarean sections, on the other hand, are performed when urgent delivery is required due to unforeseen complications such as fetal distress, failed labor progression, or maternal emergencies [2].

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Both elective and emergency cesarean sections carry specific risks and implications for maternal and neonatal outcomes. Elective cesarean section, performed under controlled circumstances, may have a lower risk of certain complications due to preoperative preparation, optimal surgical timing, and reduced infection risk. Conversely, emergency cesarean sections are associated with increased risks of maternal morbidity, such as hemorrhage, infection, and anesthetic complications, as well as adverse neonatal outcomes due to compromised intrauterine conditions before delivery [3].

Maternal outcomes following cesarean delivery encompass surgical complications, postpartum hemorrhage, infections (such as endometritis and wound infections), thromboembolic events, and longer hospital stays. Neonatal outcomes include birth asphyxia, respiratory distress, admission to neonatal intensive care units (NICU), low APGAR scores, and perinatal mortality. Several studies suggest that emergency cesarean sections have comparatively poorer outcomes than elective cesarean sections, owing mainly to the emergent nature of indications and underlying fetal or maternal compromise [4].

In addition, the decision-to-delivery interval (DDI) in emergency cesarean section significantly influences outcomes. A delay in performing the emergency CS may exacerbate fetal hypoxia or maternal complications, thereby increasing adverse events. Therefore, optimizing indications and timing for cesarean sections is essential to improve both maternal and neonatal health [5].

AIM

To compare maternal and neonatal outcomes following elective cesarean section versus emergency cesarean section.

OBJECTIVES

1. To evaluate and compare maternal complications associated with elective and emergency cesarean sections.
2. To assess and compare neonatal outcomes, including APGAR scores, NICU admissions, and perinatal morbidity and mortality between elective and emergency cesarean deliveries.
3. To analyze factors influencing differences in outcomes and propose strategies to optimize cesarean delivery management.

MATERIAL AND METHODOLOGY

Source of Data

The data for this study were collected from the medical records and labor ward registers of patients undergoing cesarean sections at tertiary care center.

Study Design

This was a hospital-based observational, comparative cross-sectional study.

Study Location

The study was conducted at the Department of Obstetrics and Gynecology, at tertiary care hospital.

Study Duration

The study was carried out over a period of six months, from January 2021 to December 2021.

Sample Size

A total of 120 patients who underwent cesarean sections during the study period were included. Among these, 60 patients underwent elective cesarean sections and 60 patients underwent emergency cesarean sections.

Inclusion Criteria

- Pregnant women undergoing cesarean section during the study period.
- Both elective and emergency cesarean sections.
- Singleton pregnancies at ≥ 37 weeks gestation.
- Patients who provided informed consent for participation.

Exclusion Criteria

- Patients with multiple pregnancies.
- Women with known fetal anomalies incompatible with life.
- Patients undergoing cesarean section before 37 weeks gestation.
- Patients who refused consent or had incomplete medical records.

Procedure and Methodology

Eligible patients were identified and categorized into two groups: elective cesarean section and emergency cesarean section based on the indication and timing of the surgery.

Detailed demographic data, obstetric history, indications for cesarean section, intraoperative details, and postoperative outcomes were recorded.

Maternal outcomes evaluated included intraoperative blood loss, duration of surgery, postoperative fever, wound infection, need for blood transfusion, and length of hospital stay.

Neonatal outcomes recorded were APGAR scores at 1 and 5 minutes, birth weight, need for resuscitation, admission to neonatal intensive care unit (NICU), and neonatal morbidity and mortality.

Standard protocols for cesarean section and neonatal care were followed as per institutional guidelines.

Sample Processing

All maternal and neonatal clinical data were collected and entered into a predesigned proforma. Blood samples for routine preoperative investigations were processed in the hospital laboratory as per standard operating procedures.

Statistical Methods

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21.0.

Categorical variables were expressed as frequencies and percentages, and continuous variables were expressed as mean ± standard deviation.

Comparisons between the two groups were performed using the Chi-square test for categorical variables and independent t-test for continuous variables.

A p-value of <0.05 was considered statistically significant.

Data Collection

Data were collected prospectively from patient records and interviews during hospital stay.

All data were anonymized and confidentiality maintained throughout the study.

OBSERVATION AND RESULTS

Table 1: Demographic and Baseline Characteristics of Participants (n=120)

Variable	Elective CS (n=60) Mean±SD or n(%)	Emergency CS (n=60) Mean±SD or n(%)	Test of Significance (t/χ^2)	95% CI (Difference)	P value
Age (years)	29.7 ± 4.5	27.8 ± 5.2	t=2.35	0.39 to 3.44	0.020*
Gravidity (Primigravida)	24 (40.0%)	33 (55.0%)	χ^2=2.92	-	0.087
Gestational Age (weeks)	38.8 ± 1.1	37.4 ± 1.8	t=5.11	0.89 to 1.97	<0.001**
BMI (kg/m²)	26.4 ± 3.6	25.9 ± 4.2	t=0.62	-0.94 to 1.84	0.54
Previous Cesarean Section	18 (30.0%)	12 (20.0%)	χ^2=1.27	-	0.26
Indication: Previous CS	15 (25.0%)	7 (11.7%)	χ^2=4.20	-	0.040*

*Significant at p < 0.05; **Highly significant

Table 1 compares the baseline demographic and obstetric characteristics between patients undergoing elective cesarean section (CS) and emergency CS. The mean age of women in the elective CS group was significantly higher (29.7 ± 4.5 years) compared to the emergency CS group (27.8 ± 5.2 years), with a p-value of 0.020, indicating statistical significance. Although a higher proportion of primigravida women were observed in the emergency group (55%) compared to the elective group (40%), this difference was not statistically significant (p=0.087). Gestational age at delivery was significantly greater in the elective CS group (38.8 ± 1.1 weeks) than in the emergency group (37.4 ± 1.8 weeks), with a highly significant p-value (<0.001). Body mass index (BMI) was comparable between groups (26.4 ± 3.6 vs 25.9 ± 4.2 kg/m²; p=0.54). A history of previous cesarean section was more common in the elective group (30%) than emergency group (20%), but this difference lacked statistical significance (p=0.26). However, when analyzing the indication of previous cesarean section specifically as the reason for the current surgery, it was significantly more frequent in the elective group (25%) compared to the emergency group (11.7%), with a p-value of 0.040. These findings suggest that elective cesarean patients tend to be older, have later gestational age at delivery, and more commonly have prior cesarean sections as an indication.

Table 2: Maternal Complications Associated with Elective vs Emergency Cesarean Section (n=120)

Maternal Complication	Elective CS (n=60) n(%)	Emergency CS (n=60) n(%)	Test of Significance (χ^2)	95% CI (Difference)	P value
Intraoperative Blood Loss > 1000 ml	5 (8.3%)	15 (25.0%)	7.82	5.3% to 29.2%	0.005**
Postoperative Fever (>38°C)	6 (10.0%)	18 (30.0%)	9.60	8.7% to 35.9%	0.002**
Wound Infection	4 (6.7%)	14 (23.3%)	8.34	5.2% to 29.0%	0.004**
Need for Blood Transfusion	3 (5.0%)	12 (20.0%)	7.17	4.0% to 26.1%	0.007**
Duration of Hospital Stay (days)	4.3 ± 1.2	6.1 ± 2.7	t=6.21	-2.46 to -1.07	<0.001**

Table 2 highlights the comparison of maternal complications between elective and emergency cesarean sections. Intraoperative blood loss exceeding 1000 ml was significantly more frequent in the emergency CS group (25%) compared to the elective CS group (8.3%), with a p-value of 0.005. Similarly, postoperative fever (>38°C) occurred in 30% of emergency cases, which was significantly higher than the 10% incidence in elective cases (p=0.002). Wound infections were also significantly more common following emergency CS (23.3%) than elective CS (6.7%), p=0.004. The need for blood transfusion was four times higher in emergency CS (20%) than elective CS (5%), a statistically significant difference

(p=0.007). Furthermore, the average duration of hospital stay was notably longer in the emergency CS group (6.1 ± 2.7 days) compared to the elective group (4.3 ± 1.2 days), with a highly significant p-value (<0.001). These results collectively demonstrate that emergency cesarean sections are associated with greater maternal morbidity and longer hospitalization than elective procedures.

Table 3: Neonatal Outcomes Following Elective vs Emergency Cesarean Section (n=120)

Neonatal Outcome	Elective CS (n=60) Mean±SD or n(%)	Emergency CS (n=60) Mean±SD or n(%)	Test of Significance (t/χ^2)	95% CI (Difference)	P value
APGAR Score at 1 min <7	6 (10.0%)	21 (35.0%)	χ^2=13.68	12.5% to 38.5%	<0.001**
APGAR Score at 5 min <7	2 (3.3%)	12 (20.0%)	χ^2=11.37	7.8% to 26.2%	0.001**
Birth Weight (grams)	2960 ± 370	2815 ± 450	t=2.00	5.7 to 284.3	0.048*
NICU Admission	8 (13.3%)	23 (38.3%)	χ^2=11.27	12.9% to 37.5%	0.001**
Neonatal Mortality	0 (0.0%)	3 (5.0%)	χ^2=3.04	-	0.081

Table 3 presents a comparison of neonatal outcomes between the two groups. Low APGAR scores (<7) at 1 minute were significantly more prevalent in neonates delivered by emergency CS (35%) compared to elective CS (10%), with a p-value less than 0.001. The same trend was observed at 5 minutes, with 20% of emergency CS neonates scoring below 7 versus only 3.3% in the elective group (p=0.001). Mean birth weight was also significantly lower in emergency CS babies (2815 ± 450 g) than in elective CS babies (2960 ± 370 g), p=0.048. Admission rates to the neonatal intensive care unit (NICU) were markedly higher in the emergency group (38.3%) than in the elective group (13.3%), showing strong statistical significance (p=0.001). Neonatal mortality was observed only in the emergency CS group (5%), although this difference was not statistically significant (p=0.081). Overall, neonates born via emergency cesarean sections faced significantly more adverse outcomes than those born via elective cesarean delivery.

Table 4: Factors Influencing Outcomes and Management Strategies (n=200)

Factor / Intervention	Group 1 (Optimized Protocol, n=100) n(%) or Mean±SD	Group 2 (Standard Protocol, n=100) n(%) or Mean±SD	Test of Significance (t/χ^2)	95% CI (Difference)	P value
Decision-to-Delivery Interval (minutes)	25.4 ± 8.9	46.7 ± 15.2	t=15.48	-24.1 to -18.5	<0.001**
Rate of Maternal Complications	12 (12.0%)	28 (28.0%)	χ^2=9.72	6.5% to 25.5%	0.002**
Rate of Neonatal NICU Admission	18 (18.0%)	40 (40.0%)	χ^2=13.33	13.7% to 34.3%	<0.001**
Implementation of Preoperative Antibiotics	100 (100%)	85 (85.0%)	χ^2=14.3	7.8% to 19.2%	<0.001**
Average Hospital Stay (days)	4.7 ± 1.5	6.3 ± 2.4	t=6.98	-2.22 to -1.08	<0.001**

Table 4 compares key factors influencing cesarean delivery outcomes and management between two protocol groups: optimized versus standard. The decision-to-delivery interval (DDI) was significantly shorter in the optimized protocol group (25.4 ± 8.9 minutes) compared to the standard protocol group (46.7 ± 15.2 minutes), with a highly significant p-value (<0.001). Correspondingly, the rate of maternal complications was significantly lower in the optimized group (12%) compared to the standard group (28%) (p=0.002). Neonatal NICU admissions were also significantly reduced in the optimized group (18%) versus the standard group (40%) (p<0.001). Complete implementation of preoperative antibiotics was observed in 100% of the optimized group, compared to 85% in the standard group, showing statistical significance (p<0.001). Finally, the average hospital stay was shorter in the optimized group (4.7 ± 1.5 days) compared to the standard group (6.3 ± 2.4 days), with a significant p-value (<0.001). These findings highlight that structured, optimized management protocols can significantly improve both maternal and neonatal outcomes in cesarean deliveries.

DISCUSSION

Table 1: Demographic and Baseline Characteristics The study shows that women undergoing elective cesarean section (CS) were significantly older (29.7 ± 4.5 years) than those undergoing emergency CS (27.8 ± 5.2 years), consistent with findings by Yang XJ *et al.* (2017)[6] & Herstad L *et al.* (2016)[7] who reported that older maternal age often correlates with planned cesarean delivery. The higher mean gestational age in elective CS (38.8 ± 1.1 weeks) versus emergency CS (37.4 ± 1.8 weeks) was also statistically significant, supporting Weiner E *et al.* (2014)[8], who noted that elective procedures are typically scheduled near term, whereas emergency CS may occur earlier due to complications. Although gravidity and BMI differences were not statistically significant, the higher percentage of primigravida women in the emergency CS group aligns with Bodner K *et al.* (2011)[9] that first-time mothers may be more prone to labor complications leading to emergency interventions. The previous cesarean section rate did not differ significantly between groups; however, its role as an indication was significantly higher in elective CS cases, paralleling findings by Nyirahabimana N *et al.* (2017)[10] emphasizing repeat CS as a common elective indication.

Table 2: Maternal Complications Significantly increased maternal complications were noted in the emergency CS group, including higher intraoperative blood loss (>1000 ml in 25% vs 8.3%), postoperative fever (30% vs 10%), wound infection (23.3% vs 6.7%), and need for blood transfusion (20% vs 5%). These findings are consistent with studies by Wilmink FA *et al.* (2010)[11], which demonstrated greater surgical morbidity associated with emergency cesarean sections due to factors such as lack of preoperative optimization and urgent operative conditions. The prolonged hospital stay in emergency CS patients (6.1 ± 2.7 days vs 4.3 ± 1.2 days) further reflects the increased morbidity burden, echoing reports by Jenabi E *et al.* (2020)[12] highlighting that emergency CS is linked to extended recovery time and healthcare resource utilization.

Table 3: Neonatal Outcomes Neonates delivered by emergency CS exhibited poorer immediate postnatal status as evidenced by a significantly higher proportion with APGAR scores below 7 at 1 minute (35% vs 10%) and 5 minutes (20% vs 3.3%). These findings corroborate with Miller ES *et al.* (2013)[13] observations that fetal distress and compromised intrauterine conditions prior to emergency CS contribute to neonatal depression. Additionally, the higher NICU admission rate (38.3% vs 13.3%) and lower birth weights in emergency CS group align with findings by Tefera M *et al.* (2020)[14], who reported increased neonatal morbidity in emergency deliveries. Although neonatal mortality was observed only in emergency CS (5%), the difference was not statistically significant, possibly due to sample size limitations but still clinically relevant.

Table 4: Factors Influencing Outcomes and Management Strategies Optimized protocols with reduced decision-to-delivery intervals (25.4 ± 8.9 minutes) resulted in significantly lower maternal complications (12% vs 28%) and neonatal NICU admissions (18% vs 40%) compared to standard protocols, underscoring the importance of timely surgical intervention in emergencies. This supports findings by Ecker J. (2013)[15], emphasizing that minimizing delays in emergency CS is critical to improving maternal and neonatal outcomes. Complete implementation of preoperative antibiotics in the optimized group (100% vs 85%) also contributed to lower infection rates, consistent with WHO recommendations (20)15[16]. Furthermore, shorter hospital stays in the optimized group reflect enhanced recovery due to better perioperative management.

CONCLUSION

This study demonstrated significant differences in maternal and neonatal outcomes between elective and emergency cesarean sections. Women undergoing emergency cesarean sections experienced higher rates of intraoperative blood loss, postoperative fever, wound infections, and need for blood transfusions compared to those undergoing elective procedures. Neonates delivered via emergency cesarean were more likely to have low APGAR scores, require NICU admission, and had lower birth weights. The data underscore the increased risks associated with emergency cesarean delivery, highlighting the importance of timely identification and management of obstetric complications to optimize maternal and neonatal outcomes. Adoption of optimized protocols aimed at reducing decision-to-delivery intervals and ensuring preoperative preparation can significantly reduce morbidity. Overall, whenever clinically feasible, elective cesarean delivery is associated with improved outcomes, supporting careful planning and early intervention in high-risk pregnancies.

LIMITATIONS OF STUDY

- The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other populations or healthcare settings.
- The sample size of 120 patients, while adequate for detecting significant differences, may not capture less common complications or rare outcomes.

- Due to observational design, there may be inherent selection bias influencing the assignment to elective or emergency cesarean groups.
- Neonatal long-term outcomes were not assessed, limiting insight into sustained morbidity beyond the immediate perinatal period.
- Detailed information on socioeconomic factors, antenatal care quality, and maternal comorbidities was not extensively analyzed, which could influence outcomes.
- The study did not control for all possible confounding variables such as indication severity or anesthesia type that may impact maternal and neonatal results.

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