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Original Research Article

RISING CESAREAN SECTION RATES: CLINICAL INDICATIONS, RISKS, AND LONG-TERM OUTCOMES

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ABSTRACT

Background: Cesarean section (CS) rates have increased substantially worldwide, raising concerns regarding maternal and neonatal complications associated with unnecessary operative deliveries. Although cesarean section remains a lifesaving obstetric procedure when medically indicated, increasing rates have contributed to postoperative morbidity and adverse long-term outcomes. **Materials and Methods:** A prospective observational study was conducted in the Department of Obstetrics and Gynecology at Kumaran Hospital, Coimbatore, from January 2024 to December 2025. A total of 200 women undergoing elective or emergency cesarean section were included. Demographic characteristics, obstetric indications, maternal complications, neonatal outcomes, and long-term maternal consequences were assessed using a structured proforma. Statistical analysis was performed using SPSS version 25.0. **Result:** Most women belonged to the age group of 21–30 years (62%). Emergency cesarean sections accounted for 63% of deliveries, while elective procedures constituted 37%. Previous cesarean section was the most common indication (29%), followed by fetal distress (21%) and cephalopelvic disproportion (14%). Maternal complications included prolonged hospital stay (13%), postpartum hemorrhage (11%), and surgical site infection (9%). Neonatal complications included NICU admission (16%), respiratory distress (9%), and low APGAR score (7%). Long-term maternal outcomes revealed repeat cesarean section in 24% of women, while chronic pelvic pain and postoperative adhesions were observed in 8% and 7% of cases, respectively. **Conclusion:** Rising cesarean section rates are associated with considerable maternal and neonatal morbidity. Appropriate evaluation of clinical indications and adherence to evidence-based obstetric practices are essential to reduce unnecessary cesarean deliveries and improve maternal and neonatal outcomes.

INTRODUCTION

Cesarean section (CS) is one of the most commonly performed obstetric surgical procedures worldwide and plays a crucial role in reducing maternal and neonatal morbidity and mortality when medically indicated.[1] Over the past few decades, the global rate of cesarean deliveries has increased substantially across both developed and developing countries, raising concerns regarding the appropriateness of its utilization and the potential consequences associated with unnecessary surgical intervention.[2] The World Health Organization (WHO) has emphasized that cesarean section rates higher than 10–15% at the population level are not associated with additional reductions in maternal or neonatal mortality, suggesting that the growing trend may reflect overuse rather than clinical necessity.[3]

India has witnessed a marked increase in cesarean section rates in recent years, particularly in urban and tertiary healthcare settings. Data from the National Family Health Survey (NFHS-5) demonstrated that institutional deliveries and improved access to obstetric care have contributed to a rise in cesarean deliveries, especially in private hospitals.[4] Several factors have been implicated in this increase, including previous cesarean section, fetal distress, labor dystocia, malpresentation, maternal request, medico-legal concerns, and changing obstetric practices.[5] While cesarean delivery can be lifesaving in selected situations, its indiscriminate use may expose both mother and neonate to avoidable short-term and long-term complications.

Maternal complications associated with cesarean section include postpartum hemorrhage, wound infection, thromboembolic events, anesthetic complications, prolonged hospitalization, and

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increased healthcare expenditure.[6] In addition, women undergoing cesarean delivery are at higher risk of complications in subsequent pregnancies, including placenta previa, placenta accreta spectrum disorders, uterine rupture, pelvic adhesions, infertility, and repeat cesarean section.[2] Neonatal complications such as respiratory distress syndrome, transient tachypnea of the newborn, altered immune development, and admission to neonatal intensive care units have also been reported more frequently following cesarean delivery when compared with vaginal birth.[7]

Despite the rising trend in cesarean section rates, there remains ongoing debate regarding the balance between medically justified procedures and avoidable surgical deliveries. Understanding the clinical indications and associated outcomes is essential for developing evidence-based obstetric strategies aimed at optimizing maternal and neonatal health. Moreover, evaluating the pattern of cesarean deliveries in tertiary care institutions may provide valuable insight into current obstetric practices and areas requiring intervention.

In this context, the present study was undertaken at Kumaran Hospital, Coimbatore, to assess the rising cesarean section rates, analyze the major clinical indications, and evaluate maternal, neonatal, and long-term outcomes associated with cesarean delivery.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Kumaran Hospital, Coimbatore, from January 2024 to December 2025. The study aimed to evaluate the clinical indications, maternal risks, neonatal outcomes, and long-term consequences associated with cesarean section deliveries. A prospective observational approach was adopted to ensure systematic and real-time assessment of maternal and neonatal outcomes while minimizing recall bias.[8]

Kumaran Hospital is a tertiary care center managing both routine and high-risk obstetric cases, thereby providing a comprehensive clinical setting for evaluating current cesarean section trends and associated outcomes in a South Indian population.

Study Population: The study population comprised pregnant women undergoing cesarean section during the study period at Kumaran Hospital, Coimbatore. Both elective and emergency cesarean section cases were included to obtain a broad understanding of the indications and complications associated with the procedure.

Women admitted through outpatient services, emergency obstetric services, and referral cases from peripheral healthcare centers were considered for enrollment in the study.

Sample Size: A total of 200 women undergoing cesarean section were included in the study using consecutive sampling during the study period. The sample size was considered feasible and appropriate for a single-center prospective observational study assessing maternal and neonatal outcomes.

The selected sample size also allowed adequate representation of common obstetric indications and postoperative complications encountered in routine clinical practice.

Inclusion Criteria

- Pregnant women aged 18 years and above
- Women undergoing elective or emergency cesarean section
- Singleton and multiple pregnancies
- Patients willing to provide informed consent

These criteria were selected to ensure inclusion of a diverse obstetric population representative of routine hospital practice.

Exclusion Criteria

- Patients unwilling to participate in the study
- Women with incomplete medical records
- Patients lost to follow-up during the study period
- Women with major pre-existing systemic illnesses unrelated to pregnancy

Exclusion criteria were applied to maintain the accuracy and reliability of collected clinical data and follow-up outcomes.

Data Collection Procedure: Data were collected using a structured and pre-validated proforma designed specifically for the study. Demographic details, obstetric history, antenatal complications, indications for cesarean section, intraoperative findings, postoperative complications, and neonatal outcomes were recorded.

Clinical indications for cesarean section were categorized into maternal, fetal, and obstetric causes according to standard obstetric guidelines (9). Information regarding antenatal care, gestational age at delivery, labor progression, and fetal monitoring findings were also documented wherever applicable.

All patients were followed from admission until discharge to assess perioperative maternal and neonatal outcomes.

Maternal Outcome Assessment

Maternal complications evaluated in the study included:

- Postpartum hemorrhage
- Surgical site infection
- Blood transfusion requirement
- Postoperative fever
- Intensive care unit admission
- Prolonged hospital stay
- Other perioperative complications

Long-term maternal outcomes assessed during follow-up included:

- Chronic pelvic pain
- Postoperative adhesions
- Repeat cesarean section
- Placenta previa
- Placenta accreta spectrum disorders
- Complications in future pregnancies.[10]

Maternal morbidity was assessed during the immediate postoperative period as well as during

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follow-up visits whenever available. Duration of hospital stay and requirement for additional interventions were also documented.

Neonatal Outcome Assessment

Neonatal outcomes assessed included:

- Birth weight
- APGAR score at 1 and 5 minutes
- Respiratory distress
- NICU admission
- Neonatal sepsis
- Early neonatal morbidity

Neonates were evaluated immediately after birth by pediatricians or trained neonatal care personnel. Cases requiring respiratory support, prolonged NICU admission, or specialized neonatal care were documented and analyzed.

Operative and Postoperative Management: All cesarean sections were performed by qualified obstetricians following standard institutional protocols. Antibiotic prophylaxis, anesthesia administration, operative procedures, and postoperative care were provided according to evidence-based obstetric guidelines and hospital policies.[11]

Patients were monitored postoperatively for vital stability, wound complications, postoperative pain, bleeding, and recovery status. Early ambulation and routine postoperative care were encouraged to minimize postoperative morbidity.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were represented as frequencies and percentages. Associations between variables were analyzed using the Chi-square test or Fisher's exact test wherever appropriate. A p-value <0.05 was considered statistically significant.[12]

Descriptive statistical methods were primarily used to summarize demographic characteristics, obstetric variables, maternal complications, and neonatal outcomes observed during the study period.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Ethics Committee of Kumaran Hospital, Coimbatore. Written informed consent was obtained from all participants prior to enrollment in the study. Confidentiality and privacy of patient information were strictly maintained throughout the study period. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for biomedical research involving human participants.

RESULTS

A total of 200 women undergoing cesarean section during the study period were included in the present study. The demographic, obstetric, maternal, and neonatal characteristics of the study population were analyzed.

Demographic Characteristics: The majority of women included in the study belonged to the age group of 21–30 years, accounting for 62% of the study population, followed by women aged 31–40 years (26%). Only a small proportion of patients were below 20 years or above 40 years of age. Multigravida women constituted a slightly higher proportion (52%) compared to primigravida women (48%). Urban residents represented the majority of the study population (69%) [Table 1].

The age distribution of women undergoing cesarean section demonstrated a predominance of reproductive age group pregnancies, with the highest frequency observed among women aged 21–30 years [Figure 1].

Distribution of Cesarean Sections: Among the 200 cesarean deliveries analyzed, emergency cesarean sections were more common than elective procedures. Emergency cesarean sections accounted for 63% of cases, whereas elective cesarean sections represented 37% of total procedures [Table 2].

The predominance of emergency cesarean deliveries highlights the significant burden of acute obstetric indications encountered in tertiary care practice [Figure 2].

Clinical Indications for Cesarean Section: Previous cesarean section was identified as the most common indication for cesarean delivery, accounting for 29% of cases. Fetal distress was the second most frequent indication (21%), followed by cephalopelvic disproportion (14%) and failed induction of labor (11%). Other indications included malpresentation, hypertensive disorders complicating pregnancy, oligohydramnios, and miscellaneous obstetric conditions [Table 3].

The distribution of indications demonstrated that repeat cesarean section and intrapartum fetal compromise remain the major contributors to rising cesarean section rates in the studied population [Figure 3]. Maternal Complications Following Cesarean Section

Maternal complications were observed in a considerable proportion of women undergoing cesarean delivery. Prolonged hospital stay was the most common postoperative complication, occurring in 13% of patients, followed by postpartum hemorrhage in 11% and surgical site infection in 9% of cases. Blood transfusion was required in 7% of women, while ICU admission was necessary in 4% of cases. However, more than half of the patients (56%) did not develop significant postoperative complications [Table 4].

The observed maternal morbidity reflects the surgical and postoperative burden associated with cesarean section, particularly in emergency procedures and high-risk obstetric conditions [Figure 4].

Neonatal Outcomes Following Cesarean Section: Among neonatal outcomes assessed, NICU admission was observed in 16% of newborns, making it the most frequent neonatal complication.

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Respiratory distress was present in 9% of neonates, while low APGAR scores and neonatal sepsis were observed in 7% and 3% of cases, respectively. The majority of neonates (65%) had no significant complications during the immediate neonatal period [Table 5].

Analysis of neonatal outcomes revealed that respiratory complications and NICU admissions were more frequently associated with emergency cesarean deliveries and fetal distress indications [Figure 5].

Long-Term Maternal Outcomes: Long-term maternal complications following cesarean section were also evaluated during follow-up. Repeat cesarean section was identified as the most common long-term outcome, occurring in 24% of women. Chronic pelvic pain and postoperative adhesions were reported in 8% and 7% of cases, respectively. Placenta previa or placenta accreta spectrum disorders in subsequent pregnancies were observed in a smaller proportion of women (3%). More than half of the women did not report major long-term complications during follow-up [Table 6].

These findings indicate that cesarean delivery may contribute to future obstetric and gynecological morbidity, particularly with increasing numbers of repeat surgical deliveries.

Table 1: Demographic Characteristics of Study Participants (n = 200)

Variable	Frequency (n)	Percentage (%)
Age Group		
<20 years	18	9.0
21–30 years	124	62.0
31–40 years	52	26.0
>40 years	6	3.0
Gravida Status		
Primigravida	96	48.0
Multigravida	104	52.0
Residence		
Urban	138	69.0
Rural	62	31.0

Table 2: Distribution of Elective and Emergency Cesarean Sections

Type of Cesarean Section	Frequency (n)	Percentage (%)
Elective Cesarean Section	74	37.0
Emergency Cesarean Section	126	63.0

Table 3: Clinical Indications for Cesarean Section

Indication	Frequency (n)	Percentage (%)
Previous Cesarean Section	58	29.0
Fetal Distress	42	21.0
Cephalopelvic Disproportion	28	14.0
Failed Induction of Labor	22	11.0
Malpresentation	18	9.0
Hypertensive Disorders	16	8.0
Oligohydramnios	10	5.0
Others	6	3.0

Table 4: Maternal Complications Following Cesarean Section

Maternal Complication	Frequency (n)	Percentage (%)
Postpartum Hemorrhage	22	11.0
Surgical Site Infection	18	9.0
Blood Transfusion Requirement	14	7.0
ICU Admission	8	4.0
Prolonged Hospital Stay	26	13.0
No Significant Complications	112	56.0

Table 5: Neonatal Outcomes Following Cesarean Section

Neonatal Outcome	Frequency (n)	Percentage (%)
NICU Admission	32	16.0
Respiratory Distress	18	9.0
Low APGAR Score	14	7.0
Neonatal Sepsis	6	3.0
No Significant Complications	130	65.0

Table 6: Long-Term Maternal Outcomes Following Cesarean Section

Long-Term Outcome	Frequency (n)	Percentage (%)
Repeat Cesarean Section	48	24.0
Chronic Pelvic Pain	16	8.0
Postoperative Adhesions	14	7.0

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Placenta Previa/Placenta Accreta Spectrum Disorders	6	3.0
No Long-Term Complications	116	58.0

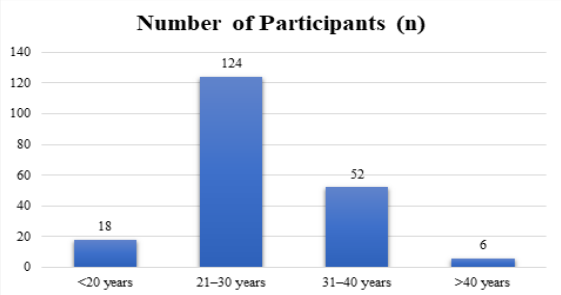

Figure 1: Age Distribution of Study Participants

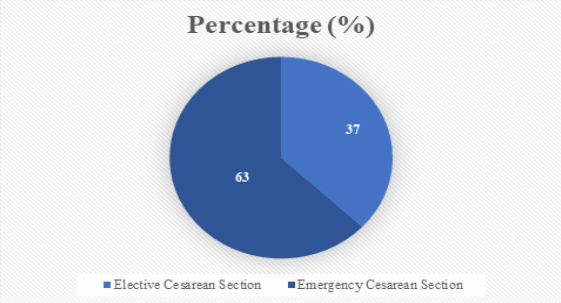

Figure 2: Distribution of Elective and Emergency Cesarean Sections

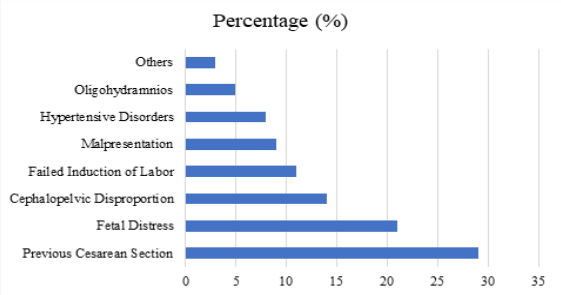

Figure 3: Clinical Indications for Cesarean Section

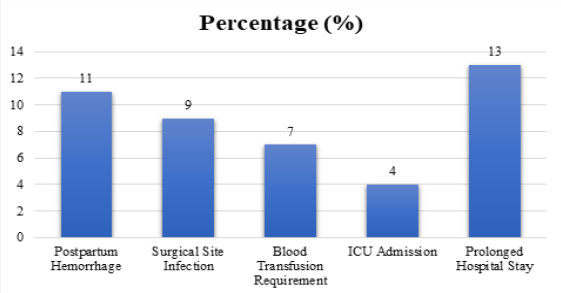

Figure 4: Maternal Complications Following Cesarean Section

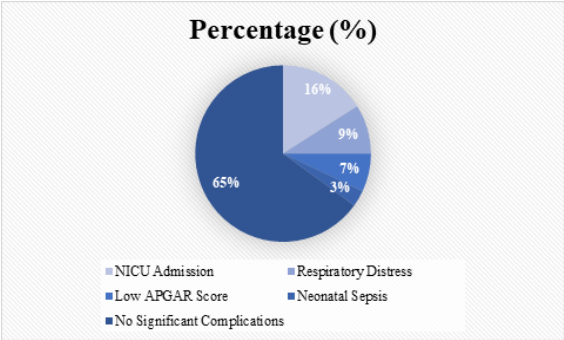

Figure 5: Neonatal Outcomes Following Cesarean Section

DISCUSSION

The present prospective observational study evaluated the clinical indications, maternal risks, neonatal outcomes, and long-term consequences associated with cesarean section among women delivering at a tertiary care hospital in Coimbatore. The findings of the study demonstrated a predominance of emergency cesarean sections, with previous cesarean section and fetal distress emerging as the leading indications for operative delivery. In addition, significant maternal and neonatal morbidities were observed following cesarean section, emphasizing the growing clinical concern regarding increasing cesarean section rates.

In the present study, the majority of women undergoing cesarean section belonged to the age group of 21–30 years. Similar findings have been reported in previous studies, reflecting the higher reproductive activity and obstetric admissions among women in this age group.[13] The predominance of multigravida women observed in the present study may be attributable to the increasing incidence of repeat cesarean sections in women with a prior uterine scar. Rising repeat cesarean delivery rates continue to represent a major contributor to the overall increase in cesarean section prevalence worldwide.

Emergency cesarean sections accounted for the majority of operative deliveries in the present study. This observation is comparable to findings reported in several tertiary care studies where emergency obstetric referrals and intrapartum complications significantly contributed to higher emergency cesarean section rates.[14] The high proportion of emergency procedures may reflect delayed referrals, inadequate antenatal surveillance, and the increasing prevalence of high-risk pregnancies managed in tertiary healthcare centers. Emergency cesarean delivery is often associated with greater maternal and neonatal morbidity when compared with elective procedures due to limited preparation time and the urgency of intervention.

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Previous cesarean section was identified as the most common indication for cesarean delivery in the present study, followed by fetal distress and cephalopelvic disproportion. Similar patterns have been documented in both Indian and international studies evaluating trends in cesarean section indications.[15] The growing number of primary cesarean sections has resulted in an increasing population of women undergoing repeat cesarean deliveries in subsequent pregnancies. Fear of uterine rupture, reluctance toward vaginal birth after cesarean section (VBAC), medico-legal concerns, and institutional obstetric practices may further contribute to this trend.

Maternal complications observed in the study included postpartum hemorrhage, surgical site infection, blood transfusion, prolonged hospitalization, and ICU admission. Although the majority of women recovered without significant morbidity, the occurrence of postoperative complications highlights the inherent surgical risks associated with cesarean delivery. Previous literature has similarly demonstrated increased maternal morbidity following cesarean section when compared with vaginal delivery, particularly in emergency operative procedures and women with associated obstetric risk factors.[16] Prolonged hospitalization observed in the present study may be related to postoperative pain, wound care requirements, and management of perioperative complications.

Neonatal outcomes in the current study revealed that NICU admission and respiratory distress were among the most frequent neonatal complications following cesarean section. These findings are consistent with previous reports demonstrating higher rates of transient tachypnea, respiratory morbidity, and neonatal intensive care requirements among neonates delivered by cesarean section, particularly in emergency settings and pre-labor operative deliveries.[17] Fetal distress and obstetric emergencies contributing to cesarean delivery may also independently influence neonatal outcomes.

The present study additionally evaluated long-term maternal outcomes associated with cesarean section. Repeat cesarean section emerged as the most common long-term consequence, while chronic pelvic pain, postoperative adhesions, and placental abnormalities in future pregnancies were also observed. These findings support existing evidence that repeated cesarean deliveries increase the risk of future obstetric complications, including placenta previa, placenta accreta spectrum disorders, and surgical adhesions.[16] The long-term burden of cesarean delivery extends beyond the immediate postoperative period and has important implications for reproductive health and future pregnancy outcomes.

Overall, the findings of the present study emphasize the need for careful evaluation of indications for cesarean section and the implementation of evidence-based obstetric practices aimed at reducing unnecessary operative deliveries. Promotion of appropriate labor monitoring, safe trial of labor after cesarean section in selected women, improved antenatal care, and adherence to standardized obstetric guidelines may help optimize maternal and neonatal outcomes while limiting avoidable cesarean deliveries.

CONCLUSION

The present study demonstrated that cesarean section rates continue to rise substantially in tertiary obstetric practice, with emergency cesarean deliveries accounting for the majority of operative interventions. Previous cesarean section, fetal distress, and cephalopelvic disproportion were identified as the predominant clinical indications contributing to operative delivery. Although cesarean section remains an essential and lifesaving obstetric procedure when medically indicated, the study findings emphasize that increasing operative delivery rates are associated with considerable maternal and neonatal morbidity.

Maternal complications such as postpartum hemorrhage, surgical site infection, prolonged hospitalization, and blood transfusion requirement were observed in a significant proportion of women following cesarean delivery. Similarly, neonatal complications including respiratory distress and NICU admission highlighted the potential impact of operative delivery on early neonatal outcomes. In addition, long-term consequences such as repeat cesarean section, pelvic adhesions, and placental abnormalities in subsequent pregnancies underscore the importance of careful evaluation before performing primary cesarean section.

The findings of the present study reinforce the need for evidence-based obstetric decision-making and rational utilization of cesarean section. Appropriate antenatal monitoring, timely identification of high-risk pregnancies, standardized labor management protocols, and promotion of vaginal birth after cesarean section in selected patients may contribute to reducing unnecessary operative deliveries. Strengthening institutional obstetric practices and improving awareness regarding the long-term implications of cesarean section are essential for optimizing maternal and neonatal health outcomes.

Further multicenter studies with larger sample sizes and longer follow-up periods are recommended to better understand the evolving trends and long-term consequences associated with rising cesarean section rates in contemporary obstetric practice.

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