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Fetomaternal outcome in caesarean section in second stage of labour

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Abstract

Background: Second-stage caesarean section (CS), performed after complete cervical dilatation, represents one of the most technically challenging obstetric procedures. It carries significantly higher maternal and neonatal risks compared with first-stage or elective CS. The increasing incidence of second-stage CS in tertiary care centres across India underscores the need to analyse its indications, intraoperative and postoperative complications, and perinatal outcomes to strengthen clinical management and improve patient safety.

Materials and Methods: This prospective observational study was carried out in a tertiary care teaching hospital from February 2022 to October 2022. All women undergoing caesarean section during the second stage of labour were included, comprising 69 cases out of 2,933 caesarean deliveries (2.35%). Data were collected from operative notes and patient records. Statistical analysis was performed using SPSS 22.0, Stata 17.0, and GraphPad software. Continuous variables were expressed as mean $\pm$ SD, and categorical data as frequencies and percentages. Associations were tested using Chi-square and t-tests, with $p < 0.05$ considered significant.

Results: Most women were primigravida (78.26%) with a mean age of 24.23 ± 4.03 years. The leading indication for second-stage CS was fetal distress (33%), followed by obstructed labour (26%) and non-progress of labour (19%). Intraoperative complications were reported in 91.3% of patients, most frequently the need for blood transfusion (40.58%) and atonic postpartum haemorrhage (31.88%). Postoperative complications occurred in 92.75% of cases, with wound infection (40.57%) and prolonged catheterization (34.78%) being predominant. Neonatal complications were noted in 34.79% of cases, mainly meconium aspiration (20.29%) and respiratory distress (5.79%). No maternal deaths were recorded.

Conclusion: Second-stage caesarean section is associated with considerable maternal and neonatal morbidity. Early referral, vigilant intrapartum monitoring, and advanced surgical training are crucial to minimize complications and optimize fetomaternal outcomes.

Keywords: Second-stage caesarean section, fetomaternal outcome, neonatal complications

Introduction

X The Caesarean section (CS) procedure, a pivotal surgical intervention in obstetrics, has played a crucial role in reducing maternal and neonatal mortality rates in complex childbirth cases. Global trends over the last thirty years have shown a consistent rise in CS rates, a pattern also observed in South Asia. The World Health Organization (WHO) recommended in 1985 that CS rates at a population level should ideally fall within the 10-15% range, as higher rates did not demonstrate significant improvements in maternal or neonatal health outcomes.^[1] Nevertheless, recent statistics indicate that several teaching hospitals in India are reporting rates exceeding 20%, with an institutional average around 24%. The escalation in the rate of use of CS reflects advancements in surgical safety measures and evolving obstetric methodologies but has also sparked concerns regarding unwarranted interventions, particularly in low-risk pregnancies.^[2, 3]

A specific area of apprehension revolves around second-stage CS, conducted post-complete cervical dilatation during labour. In contrast to first-stage or elective CS procedures, performing a second-stage CS is notably complex, often demanding heightened surgical expertise due to the deeply engaged fetal head and the altered pelvic anatomy. The incidence of second-stage CS has surged in recent years, rising from under 1% to as high as 2-3% of all deliveries in some centres.^[4, 5] This trend can be partly attributed to the declining rates of

instrumental vaginal deliveries (such as rotational and mid-pelvic forceps, vacuum), an increasing reliance on surgical interventions, extended second-stage durations due to regional analgesia, and growing medico-legal apprehensions.

In the multicenter study by Rahim A., Lock G., and Cotzias C., titled *"Incidence of second-stage (fully dilated) caesarean sections and how best to represent it"* (UK, 2021), a total of 28,867 deliveries were analysed across six maternity units in Greater London. Of these, 493 cases were second-stage caesarean sections. The reported incidence was 1.7% of all deliveries, 2.0% of all labouring women, and 2.5% of women reaching full dilatation.^[5] The research concentrated on determining optimal methods for representing incidence rates but lacked in-depth information regarding maternal or neonatal outcomes.

Second-stage CS poses significantly increased risks compared to first-stage procedures. Maternal complications may include postpartum hemorrhage, extensions of uterine incisions into the cervix or broad ligament, bladder or ureteric injuries, wound infections, febrile complications, sepsis, thromboembolism, and an escalated likelihood of adverse outcomes in subsequent pregnancies like spontaneous preterm birth. In severe scenarios, peripartum hysterectomy might be deemed necessary. Research indicates that women undergoing CS at full dilatation face over a fourfold increase in maternal morbidity compared to those undergoing delivery in the first stage.

The neonatal risks associated with second-stage CS are also substantial. Difficult extraction of a deeply engaged fetal head can lead to traumatic injuries, hypoxia, and perinatal asphyxia. Infants born via second-stage CS exhibit elevated rates of low Apgar scores, metabolic acidosis, NICU admissions, respiratory distress, sepsis, and perinatal mortality. Concerns regarding hypoxic-ischemic encephalopathy are particularly pronounced, especially when delays in delivery compound fetal compromise.

The indications prompting second-stage CS are diverse, with cephalopelvic disproportion (CPD) and persistent malpositions like occipito-posterior or deep transverse arrest being the most prevalent. Additional contributing factors include maternal exhaustion, obesity, and fetal distress during prolonged labour. These conditions not only increase the likelihood of surgical interventions but also amplify the associated risks.

In the study by Khanam A., Sri A. S., and Ahmed M., titled *"The Study of Fetomaternal Outcome in Second Stage Caesarean Section,"* total 67 second-stage caesarean sections were analysed out of 5,392 caesarean deliveries among 10,433 total deliveries at a tertiary perinatal care center. The most common indication for second-stage caesarean section was deep transverse arrest. Maternal complications included uterine atony, observed in 32.5% of cases, and postoperative complications like febrile illness in 23% patients. Neonatal outcomes revealed that 24% of newborns required NICU admission, with respiratory distress being the leading cause.^[6] The study demonstrates that caesarean section during the second stage of labour carries significant maternal and neonatal morbidity, highlighting the importance of timely decision-making, skilled obstetric intervention, and proper training to optimize fetomaternal outcomes. In the study by Jyotsna Yadav, Ramesh Shrestha, Archana Sah, and Reena Bhagat, titled *"Feto-maternal outcome of second stage caesarean section in B. P. Koirala*

Institute of Health Sciences: a retrospective study", a total of 16,131 deliveries were conducted over one year, of which 6,748 were caesarean deliveries. Among these, 65 cases (0.96%) were performed in the second stage of labour. The most common indication of second stage CS was arrest of descent and dilatation (40%), followed by meconium-stained liquor (15.3%) and occipito-posterior position (12.3%). Maternal complications included prolonged catheterization (23%), febrile illness (15%), wound infection, postpartum haemorrhage, and one case of peripartum hysterectomy. Neonatal outcomes showed that half of NICU admissions were due to respiratory distress and other half due to hypoxic-ischemic encephalopathy, with two stillbirths reported. The study concluded that second-stage caesarean section is technically challenging and carries increased risk of both maternal and neonatal morbidity.^[7]

Given these complexities, professional organizations underscore the significance of prudent judgment, prompt decision-making, and comprehensive training in instrumental vaginal delivery and challenging CS techniques. While the burden of second-stage CS is increasing in numerous South Asian tertiary healthcare facilities, the literature describing the fetomaternal outcomes in this context remains limited. This gap in the literature prompted the need for a dedicated study to delineate risk magnitudes, refine management protocols, and ensure optimal maternal and neonatal outcomes.

Consequently, this observational study was undertaken with the primary objective of determining the incidence of caesarean section performed during the second stage of labour. In addition, the study aimed to analyse the various indications leading to caesarean section in the second stage of labour. A further objective was to evaluate the intraoperative, postoperative, and neonatal complications associated with second-stage caesarean sections, thereby providing a comprehensive understanding of the fetomaternal outcomes in such cases and highlight implications for clinical practice in a tertiary care setting.

Methodology

This prospective observational study was conducted at a teaching hospital and tertiary care referral center between February 2022 and October 2022. Prior to the initiation of the study, all necessary approvals from the institutional ethical committee were obtained. Anonymized patient data were utilized, and no individual identifiers were employed.

Study design and population:

All second-stage caesarean deliveries conducted within this timeframe were included regardless of the patient's parity. During the study period, a total of 2933 caesarean sections were performed, of which 69 cases were carried out in the second stage of labour. These 69 women formed the study population.

Inclusion and Exclusion Criteria

Study included all women who underwent caesarean section during the second stage of labour at term gestation with cephalic presentation. Exclusion criteria excluded patients with multiple pregnancy, malpresentation, preterm deliveries or significant maternal comorbidities including cardiac disease

Sample size

The sample size consisted of all 69 eligible second-stage caesarean sections identified during the study period, out of a total of 2933 caesarean deliveries.

Data collection and analysis

Data were obtained exclusively from operative notes and recorded in a structured template. The dataset was organized and handled using Microsoft Excel, while graphical representations and tables were generated utilizing Microsoft Word and Excel tools.

Statistical analyses were conducted using SPSS version 22.0, Stata version 17.0, and GraphPad software.

Descriptive statistical analysis was conducted to summarize the findings. Continuous variables are reported as mean±standard deviation (SD) along with their range (minimum- maximum), whereas categorical variables are presented as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test, and effect size where relevant was expressed using Cramer's V coefficient. For comparison of continuous variables, independent sample t-test or ANOVA was applied as appropriate.

$p < 0.05$ was considered statistically significant and $p < 0.01$ was taken as strongly significant.

Observation and Results

A total of 2933 caesarean sections were performed between February 2022 and October 2022, of which 69 (2.35%) were conducted in the second stage of labour. These 69 cases formed the study group.

Maternal Characteristics

- Age distribution:** The mean age of the study population was 24.23 ± 4.03 years.
 - **≤20 years:** 13.04%
 - **21-25 years:** 62.32%
 - **26-30 years:** 14.49%
 - **30 years:** 10.14%

Parity: The majority were primigravida (78.26%), while 21.74% were multigravida.

Table 1: Distribution of cases according to maternal gravida

Gravida	Number of patients (Percentage)	Mean Age ±SD	
Primigravida	54 (78.26%)	23.44 ± 3.29 Yrs	p-value = 0.00028 (Significant at $p < 0.05$)
Multigravida	15 (21.74%)	27.07 ± 5.19 Yrs	
Total	69(100%)	24.23 ± 4.03 Yrs	

- In our study, 78.26% of cases were primigravida and 21.74% were multigravida. The mean maternal age was 24.23 ± 4.03 years, and the difference in age distribution was found to be statistically significant ($p = 0.00028$; $p < 0.05$).
- Gestational age at delivery**

- **37-39+6 weeks:** 47.83%
- **40-40+6 weeks:** 39.13%
- **41-41+6 weeks:** 7.25%
- **≥42 weeks:** 5.80%

Table 2: Distribution of cases according to maternal age

Age Group	Primigravida	Multigravida	Number of patients	Percentage
≤20yrs	8	1	9	13.04%
21-25yrs	36	7	43	62.32%
26-30yrs	8	2	10	14.49%
>30yrs	2	5	7	10.14%
Total	54 (78.26%)	15 (21.74%)	69	100%

Table 3: Distribution of cases according to period of gestation

Period of gestation	Primigravida	Multigravida	Total
37wks to 39wks+6d	27	6	33(47.83%)
40wks to 40wks+6d	21	6	27(39.13%)
41wks to 41wks+6d	4	1	5(7.25%)
≥42wks	2	2	4(5.80%)
Total	54	15	69 (100%)

In the present study, 47.83% of cases were delivered between 37 weeks to 39 weeks + 6 days, followed by 39.13% between 40 weeks to 40 weeks + 6 days, 7.25% between 41 weeks to 41 weeks + 6 days, and 5.80% at ≥42 weeks of gestation.

With regard to the onset and progress of labour, 44.93% of primigravida women experienced spontaneous onset of labour, compared to 10.15% among multigravida. Labour was induced in 17.39% of primigravida and 4.35% of multigravida, while augmentation of labour was required in 15.94% of primigravida and 7.25% of multigravida women.

Table 4: Distribution of cases according to indication of caesarean section

Indication of C-section	Primigravida	Multigravida	Total no of cases
Obstructed labour	15	3	18 (26%)
Cephalopelvic disproportion	6	2	8 (12%)
DTA	5	2	7(10%)
NPOL	9	4	13(19%)
Fetal distress	19	4	23(33%)
Total	54	15	69(100%)

In our study, the most common indication for caesarean section was fetal distress, accounting for 33% of cases. This was followed by obstructed labour in 26%, non-progress of labour (NPOL) in 19%, cephalopelvic disproportion (CPD) in 12%, and deep transverse arrest (DTA) in 7% of cases. Notably, the majority of obstructed labour cases were delayed referrals from peripheral health centres and nearby district hospitals, highlighting the impact of late presentation on operative interventions, as supported by other studies as well. [8]

Table 5: Comparison between indication of caesarean section and intraoperative complications

Complications	Atonic PPH	Angle Hematoma	Hematuria	Blood transfusion	Extension of Uterine Incision	Others	Total
Indications	9	0	6	6	3	0	124
Obstructed (18)	2	1	1	1	1	0	6
CPD (8)	2	0	0	4	4	0	10
DTA (7)	2	1	3	8	2	2	18
FD (23)	7	0	6	9	1	2	25
Total (69)	22, 31.88%	2, 2.90%	16, 23.18%	28, 40.58%	11, 15.94%	4, 5.79%	83

In our study, 63 cases (91.30%) experienced one or more intraoperative complications, while only 6 cases (8.70%) had no complications. The most common intraoperative complication was the need for blood transfusion (40.58%), followed by atonic postpartum haemorrhage (31.88%), hematuria (23.18%), extension of the uterine incision (15.94%), and other complications (15.94%), which included uterine artery ligation, cervical laceration, and broad ligament hematoma. Angle hematoma was observed in 2.9% of cases. Importantly, no bladder or ureteric injury was reported, except for hematuria, which was likely due to bladder congestion, edema, or obstruction. There was no

maternal mortality in the present study. Among primigravida, the most frequent complication was blood transfusion (37.03%), followed by atonic PPH (29.62%), hematuria (24.07%), extension of uterine incision (14.81%), and angle hematoma (3.70%). In multigravida, blood transfusion (53.33%) was also the most common complication, followed by atonic PPH, hematuria (20%), and extension of uterine incision (14.81%). There was no statistically significant difference in intraoperative complications between primigravida and multigravida women ($p = 0.60$).

Table 6: Comparison between indication of caesarean section and post-operative complication

Complications	Febrile illness	Wound infection	Wound re-suturing	Prolonged catheterization	Abdomen distension	Prolonged hospital stays	Others	Total
	5	6	2	10	0	4	4	31
Indication	0	4	0	2	1	0	0	7
Obstructed (18)	2	2	2	2	1	1	3	13
CPD (8)	3	6	0	4	2	2	4	21
FD (23)	10	10	3	6	1	4	5	39
Total (69)	20 (28.98%)	28 (40.57%)	7 (10.14%)	24 (34.78%)	5 (7.24%)	11 (15.94%)	16 (23.18%)	101

In our study, 64 cases (92.75%) experienced one or more postoperative complications, while 5 cases (7.24%) had an uneventful postoperative course. The most common postoperative complication was wound infection (40.57%), followed by prolonged catheterization (34.78%), febrile illness (28.98%), other complications (23.18%), prolonged hospital stay (15.94%), wound re-suturing (10.14%), and abdominal distension (5.8%). Prolonged catheterization was

defined as urinary catheterization for more than 48 hours. Cases requiring postoperative blood transfusion and jaundice were included under the “others” category. Among the 69 neonates, 36 (52.17%) were male and 33 (47.83%) were female. Regarding birth weight, 14.49% of babies weighed <2.5 kg, 84.06% weighed between 2.5 kg and 3.5 kg, and 1.45% weighed >3.5 kg, with a mean birth weight of 2.78 kg

Table 7: Total no. of neonatal complications according to gravida

Gravida	Neonatal Complication	No neonatal Complication	
Primigravida (54)	18 (33.33%)	36 (66.66%)	P value = 0.63 (not significant)
Multigravida (15)	6 (40%)	9 (60%)	
Total (69)	24 (34.79%)	45 (65.22%)	

In our study, 24 neonates (34.79%) required NICU admission. Of these, 18 babies were delivered by primigravida and 6 by multigravida mothers, with the association found to be statistically non-significant ($p = 0.63$). The most common neonatal complication observed was meconium aspiration (20.29%), followed by respiratory

distress (5.79%), birth asphyxia (4.35%), and neonatal jaundice (2.89%). Other complications, including intrauterine death (IUD), accounted for 1.45% of cases. There was one neonatal mortality (1.45%) reported during the study period.

Table 8: Comparison between indication of caesarean section and neonatal outcome

Indication of C-section	No complications	Birth asphyxia	Meconium aspiration	Neonatal jaundice	Respiratory distress	others	Total no. of complication
Obstructed labour	9 (50%)	1	5	1	1	1	9 (50%)
CPD (8)	7 (87.5%)	1	0	0	0	0	1 (12.5%)
DTA (7)	3 (42.86%)	0	2	1	1	0	4 (57.15%)
NPOL (13)	11 (84.62%)	0	1	0	1	0	2 (15.38%)
Fetal distress (23)	15 (65.22%)	1	6	0	1	0	8 (34.78%)
Total (69)	45 (65.21%)	3 (4.35%)	14 (20.29%)	2 (2.89%)	4 (5.79%)	1 (1.45%)	24 (34.79%)

In our study, analysis of neonatal outcomes based on the indication for caesarean section revealed variable complication rates. Among caesarean sections performed for obstructed labour, 50% of neonates had complications requiring NICU admission, while the remaining 50% had no complications and were shifted to the mother's side. In cases due to cephalopelvic disproportion (CPD), 12.5% of neonates experienced complications, whereas 87.5% had an uncomplicated outcome. For deep transverse arrest (DTA), 57.14% of neonates developed complications, and 42.86% had no complications. In non-progress of labour (NPOL), complications were observed in 15.38% of neonates, while 84.62% were complication-free. Among cases with fetal distress, 34.78% of neonates had complications requiring NICU care, and 65.22% were stable and roomed-in with their mothers.

Discussion

Our study confirms that second-stage caesarean delivery carries a markedly higher maternal morbidity than first-stage caesarean. In our cohort (n=69), over 90% of women experienced one or more serious intraoperative or postoperative complications. These findings are consistent with recent Indian and Western reports. For example, Zainab *et al.* (2025) found postpartum hemorrhage in 35% of full-dilation CS cases, sepsis in 12%, and 15% required blood transfusion.⁹ Similarly, Jadav *et al.* (2021) observed hematuria (blood-stained urine) in 40.8% of second-stage CS and a transfusion rate of 18.4%.¹⁰ In contrast, routine (first-stage) caesareans have much lower rates of these complications. Western reviews likewise emphasize the added risks: a recent European analysis notes that a deeply engaged fetal head at full dilation makes delivery difficult and "is associated with increased maternal morbidity including uterine extensions [of the incision] and hemorrhage".^[11] In short, both Indian and Western data agree with our finding that second-stage CS is exceptionally hazardous for the mother.

Intra operatively, the most common problems involve uncontrolled bleeding and accidental injuries. In our series, lateral uterine incision extensions (into the angle of the uterus) were frequent, as were tears into adjacent structures. This matches published data: Vashi *et al.* (2023) reported that extension of the uterine incision was the predominant intraoperative complication and atonic hemorrhage the predominant postoperative one.^[12] We likewise observed that uterine vessel injuries (e.g. broad ligament or cervical tears) often led to massive bleeding; Vashi *et al.* also identified uterine-vessel injury with PPH as the single most common maternal injury.^[12] In Jadav's series, nearly 41% of second-stage CS cases had intraoperative hematuria (suggesting bladder contusion).^[10] Postoperatively, atonic PPH was a leading issue - over a third of cases in Zainab's series - often requiring uterotonics and further transfusion.^[9] Wound infection and sepsis also contributed to morbidity: wound breakdown or endometritis are well-known CS complications (occurring in roughly 2-7% of all CS)^[13] and were observed in our patients as well. Overall, our pattern of complications (blood loss, transfusion requirement, extensions, and infection) closely parallels other reports of second-stage caesareans.

By contrast, neonatal complications in our study were comparatively modest and generally secondary to the difficult labour course. A number of infants required NICU

care for transient issues (meconium aspiration or asphyxia), but there were few direct surgical injuries. This is in line with literature: Jadav *et al.* found that 34.7% of neonates from second-stage CS required intensive care^[10], whereas Zainab *et al.* reported about 10% NICU admissions (mostly for respiratory distress).^[9] The variation likely reflects differences in NICU admission criteria but none of these studies reported unique long-term neonatal harm beyond what is expected in an emergency caesarean.

The exceptional maternal risk is largely attributable to the technical challenges of operating in the second stage. In a full-dilation caesarean, the fetal head is deeply impacted in the pelvis and the lower uterine segment is very thin. Van der Krogt *et al.* emphasize that at full dilatation "the fetal head is lower and can be wedged within the maternal pelvis," making delivery difficult and predisposing to tears and hemorrhage.^[11] In practice, dislodging the head often requires advanced maneuvers. Such methods demand significant skill: inexperienced hands can easily prolong the surgery and worsen bleeding. The thinned-out lower uterine segment in this situation tends to avulse blood vessels when extended, and the bladder may be adherent or under tension. All these factors explain why patients had such high rates of uterine extensions and hemorrhage.

Several systemic factors contribute to the necessity of second-stage CS and its attendant risks. Most second-stage caesareans follow labour arrest or failed instrumentation. In line with this, our cases (and others) were often indicated by obstructed labour. Zainab *et al.* reported that two-thirds (66%) of their full-dilation CS were done for deep transverse arrest.⁹ Prolonged or obstructed labour not only thins the uterine segment but also means the mother is already fatigued and coagulopathic by the time surgery occurs. Contributing causes in our setting likely include delayed referral or labour augmentation. Late decision-making - for example, pushing beyond 2-3 hours of ineffective second-stage labour - can turn a potentially manageable delivery into an emergency caesarean. Declining operative vaginal skills may play a role as well. As van der Krogt *et al.* note, changes in training and practice have reduced proficiency with forceps/vacuum, so clinicians may be quicker to go to caesarean in a tough second stage.¹¹ Cultural and systemic issues (patient preference for caesarean, fear of litigation, lack of on-site blood) may also delay timely intervention. In short, the high morbidity is probably compounded by labour management factors that push deliveries to the full-dilation caesarean scenario, exactly as other authors have suggested.

Limitations and Implications

Our findings must be interpreted in light of certain limitations. This was a single-center observational study with a relatively small sample and no first-stage CS control group; thus, incidence rates may not be generalizable to all settings. We also did not capture long-term maternal outcomes beyond discharge. Nonetheless, the markedly elevated complication rates we documented agree with external data and highlight a real clinical concern. In practice, our results reinforce the need for improved protocols and training to manage second-stage CS safely. Obstetric training programs should explicitly teach techniques for impacted head deliveries and advanced caesarean maneuvers. Simulation drills or guidelines (as

recommended by professional bodies) could help teams prepare for these emergencies.

Careful use of assisted vaginal delivery in appropriate cases (with ready back-up caesarean) might also reduce second-stage caesarean rates. Finally, obstetric units in resource-constrained settings must ensure availability of blood products, skilled anesthesia, and experienced operators around the clock. As van der Krogt *et al.* conclude, "Obstetric and midwifery training should embed the skills to manage impacted fetal head [at caesarean]" into standard curricula.⁸

Conclusion

Second-stage caesarean section, though often unavoidable in advanced labour, remains a technically challenging procedure associated with significantly increased maternal morbidity. In this study, the incidence of second-stage caesarean section was 2.35%, with high rates of intraoperative and postoperative complications such as hemorrhage, uterine incision extension, and wound infection. These findings underscore that delayed referrals, prolonged second-stage labour, and limited surgical experience contribute substantially to adverse outcomes. Strengthening intrapartum monitoring, ensuring timely decision-making, and improving surgical training and supervision are essential to minimize risks. With enhanced institutional protocols and multidisciplinary preparedness, maternal safety and overall fetomaternal outcomes in second-stage caesarean sections can be markedly improved.

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