

## Fetomaternal outcomes of cesarean delivery performed in the first and second stage of labor - an analytical prospective observational study

### Authors

- 1) Pillai Arthi Karunanithi, Assistant Professor, Department of Obstetrics and Gynecology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, India.
- 2) Chithra AK, Associate Professor, Department of Obstetrics and Gynecology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, India.
- 3) Punithavathi J, Assistant Professor, Department of Obstetrics and Gynecology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, India.

Corresponding Author : Dr. Pillai Arthi Karunanithi, Assistant Professor, Department of Obstetrics and Gynecology, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil Nadu, India; Email : dr\_arthibubby@gmail.com

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### Abstract:

**Objectives:** Cesarean section at full cervical dilatation has many implications for maternal and neonatal morbidity as well as in subsequent pregnancy outcomes. The study compared neonatal and maternal outcomes of the cesarean sections performed in the first stage versus the second stage of labor. **Methods:** This is a two-year analytical prospective observational study conducted at a tertiary care research institute. A total of 339 participants were included. Patients who underwent cesarean delivery in the first stage of labor were 303 (controls). The second stage was 36 (cases) and was compared in maternal demographics, labor characteristics, maternal and neonatal outcomes. Differences were considered statistically significant if p value was <0.05. **Results:** The majority of (n=15, 41.67%) cases and controls (n=162, 53.46%) were in the age group of 21-25 years. There was no significant difference in age between cases and controls. Cesarean delivery performed in the second stage was associated with increased maternal morbidity such as difficulty in head delivery, haemorrhage, uterine angle extension, and the results were statistically significant between cases and controls (P<0.05). Apgar score <7 at five minutes was observed in very less proportion of cases (n=1, 2.78%) and controls (n=2, 0.66%). No statistically significant difference was seen in Apgar score at five minutes and fetal injury between the two study groups. **Conclusion:** Cesarean section in the second stage of labor is a technically demanding procedure with an increased risk of maternal and neonatal morbidity compared to the cesarean section in the first stage of labor.

**Keywords:** Cesarean section, obstetric labor, pregnancy complications, induced labor, pregnancy outcomes.

Worldwide nearly 10-20% of deliveries require intervention which is frequently cesarean section. It is the most commonly performed major abdominal surgery in women all over the world.<sup>1</sup> World Health Organisation has recommended an ideal cesarean section rate between 10% and 15%. Global estimates suggest a current cesarean section rate of 18.6%, ranging from 6% to 27.2% in the least and the most developed nations of the world, respectively. As the cesarean section rate is rising globally, so is the incidence of second-stage cesarean section.<sup>2</sup> As per the latest Indian data (National Family Health Survey 2015-2016, NFHS-4), the cesarean rate at the population level seems to be ranging between 17.2% -20%.<sup>3</sup> The rate of cesarean delivery continues to increase despite efforts to constrain operative abdominal deliveries. This is a cause for concern because the cesarean section is associated with a higher likelihood of adverse outcome for both mother and fetus as compared to vaginal delivery.<sup>4</sup>

The Royal College of Gynecology (RCOG) cited four usual indications, and these are mainly; fetal compromise, “failure to progress” in labor, repeat CS (cesarean section), and breech. The current most common reason given for performing the CS has changed, and now it is reported to be “maternal request.”<sup>5</sup> The escalating rates of cesarean is worrying and the risk it poses on the overall health of the women is alarming. Additionally, an emergency cesarean section in the course of labor is related to poor maternal satisfaction and bonding with her newborn.<sup>6</sup>

Several studies have compared second stage with first stage cesarean section. An observational study in Istanbul, Turkey by Asicioglu O et al<sup>7</sup> concluded that cesarean deliveries performed in the second stage of labor were associated with higher rates of maternal and neonatal complications, particularly in women who had undergone previous cesarean delivery. Another study in Pondicherry, India, by Samal DR et al<sup>8</sup> suggested that women undergoing cesarean section in the second stage of labor have increased maternal and fetal morbidity, and they require special care. Hence appropriate selection of mode of birth should be decided carefully and judiciously to decrease maternal, neonatal morbidity.

The cesarean section at full dilatation with or without attempt at operative vaginal delivery is technically a more challenging surgical procedure than the cesarean section in early labor.<sup>9</sup> The cesarean section being a major operation, related morbidity and complications are to be taken into consideration for safety, which depends upon many factors. One important factor is the timing of the cesarean section when it is performed, i.e., elective, a first stage, or a second stage. Although the morbidity of cesarean in the second stage of labor has been described by many studies, comparison with cesarean delivery in the first stage of labor is less well known. Given there has been no similar study conducted in India; hence, the present study was conducted to bridge this gap and provide data by comparing fetomaternal outcomes of cesarean delivery performed in the first and second stage of labor at the tertiary care center.

**Aims and objectives:** To compare fetomaternal outcomes of cesarean delivery performed in the first and second stage of labor at the tertiary care center.

### **Methodology**

**Study design:** The study design was an analytical prospective observational study.

**Study setting:** The study was conducted at the department of obstetrics and gynecology at a tertiary care center.

**Source population:** Pregnant women admitted at labor ward of the department of obstetrics and gynecology outpatient and labor unit at a tertiary care center constituted source population

**Study population:** Pregnant women undergoing intrapartum cesarean deliveries at the department of obstetrics and gynecology at a tertiary care center were considered as study population

**Study period:** The study period was from January 2016 to December 2017.

**Sample size:** Total number of women who delivered during the study period was 3272. Of these, 1244 were delivered by cesarean section. Of 1244 patients, 303 patients underwent primary cesarean section in the first stage of labor, and 36 patients underwent prior cesarean in the second stage of labor. The percentage of cesarean section was 38.02%. Percentage of first stage cesarean section was 24.357%. Percentage of second stage cesarean section was 2.894%.

**Cases:** Cesarean sections performed during second stage of labour were considered as cases (N=36).

**Controls:** Cesarean sections performed during second stage of labour were considered as controls (N=303).

**Definitions:** The onset of labor is defined by the initiation of regular, painful contractions. The first stage of labor was defined as the period when there were regular contractions associated with cervical change (dilatation of 4-10 cm). The second stage of labor was defined as the period from full cervical dilatation (10 cm) to delivery.

**Sampling technique:** A total of 339 pregnant women with >37 weeks of gestation undergoing cesarean delivery during the first or second stage of labor at the tertiary care centre were selected according to convenience or non-probability sampling method for the feasibility of the study.

**Ethical and informed consent:** Ethical clearance was obtained from the institutional review board of the concerned tertiary care hospital. Written informed consent was taken from the patients before the study, and confidentiality was maintained throughout.

**Inclusion criteria:** Age group between 18 to 40 years, singleton pregnancy irrespective of parity, period of gestation >37 weeks and pregnant women with cephalic presentation were included.

**Exclusion criteria:** Previous cesarean section, previous abdominal surgery, non-cephalic presentation, and significant fetal anomaly and pregnancy complications (such as gestational hypertension, gestational diabetes, or intrauterine growth restriction) were excluded

**Data collection:** Data were collected by pretested semi-structured questionnaire, clinical examination, and investigations. Subjects were eligible for the trial if the fetus was older than 37 weeks of estimated gestational age and if the mother was undergoing cesarean delivery during the first or second stage of labor.

Maternal characteristics, such as parity, postpartum haemorrhage, difficulty in head delivery, mode of conception, cardiotopography, and induction of labor were noted. Neonatal outcome indicators included Apgar score of the newborn at five minutes, rates of fetal injury. Estimated blood loss (EBL) (including blood loss at cesarean delivery and during the first 48 hours after delivery due to uterine atony; postpartum haemorrhage was calculated using the difference in hematocrit values taken prior to and 48 hours after cesarean delivery, according to the following formula:

$$EBL = EBV \frac{(\text{pre-op hematocrit} - \text{postop hematocrit})}{\text{pre-op hematocrit}}$$

Where, EBV is estimated blood volume (EBV) in millilitre and woman's weight in kilograms. Excessive bleeding during the procedure was defined as an estimated blood loss of 1,000 ml.

**Study variables:** Maternal outcomes measured in terms of postpartum haemorrhage and neonatal outcomes measured in terms of Apgar score and fetal injuries during delivery were considered as primary outcome variables. Demographic and clinical parameters were considered as primary explanatory variable.

**Statistical analysis:** All quantitative data like age and height were represented as mean and standard deviation. All qualitative variables like parity, postpartum haemorrhage, difficulty in head delivery, mode of conception, cardiotopography, induction of labor, Apgar score of the newborn at five minutes, rates of fetal injury were presented as frequencies and percentages. The chi-square test of significance was applied to test the association between fetomaternal outcomes of cases and controls. Differences were considered statistically significant if p value was less than 0.05. coGuide was used for statistical analysis.<sup>10</sup>

## Results

A total of 339 participants were included in the final analysis, with 36 participants in the case group and 303 participants in the control group.

The majority of (n=15, 41.67%) participants among cases were aged between 21 to 25 years, and (n=14, 38.39%) participants were aged between 26 to 30 years. Similarly, in the controls, the majority of (n=162, 53.46%) participants were aged between 21 to 25 years, and (n=99, 32.67%) participants were aged between 26 to 30 years. There was no significant difference in age between cases and controls. Most of the participants, i.e. (n=14, 38.89%)

had height between 141 cm to 145 cm in the cases group, while the majority of (n=173, 57.09%) participants had height between 146 cm to 150 cm in the controls group. A statistically significant difference was there between cases and controls in height (P value < 0.05) (table 1).

Parameters	Study Group		P value
	Cases (N=36)	Controls (N=303)	
<b>Age (in years)</b>			
<20	2 (5.55%)	16 (5.28%)	0.529
21-25	15 (41.67%)	162 (53.46%)	
26-30	14 (38.89%)	99 (32.67%)	
>30	5 (13.89%)	26 (8.58%)	
<b>Height (in cm)</b>			
<140	5 (13.89%)	5 (1.65%)	<0.001
141-145	14 (38.89%)	42 (13.87%)	
146-150	11 (30.56%)	173 (57.09%)	
151-155	4 (11.11%)	70 (23.10%)	
156-160	2 (5.55%)	12 (3.96%)	
>160	0 (0.00%)	1 (0.33%)	

Parameter	Study Group		P value
	Cases (N=36)	Controls (N=303)	
<b>Parity</b>			
Primi	24 (66.67%)	243 (80.19%)	0.061
Multi	12 (33.33%)	60 (19.81%)	
<b>Mode of conception</b>			
Spontaneous	35 (97.22%)	296 (97.69%)	0.861
Ovulation induction	1 (2.78%)	7 (2.31%)	
<b>Indication of labor</b>			
Present	34 (94.44%)	270 (89.11%)	0.320
Absent	2 (5.56%)	33 (10.89%)	
<b>Difficulty in head delivery</b>			
Present	16 (44.44%)	5 (16.50%)	<0.001
Absent	20 (55.56%)	298 (98.35%)	
<b>Angle extension</b>			
Present	4 (11.11%)	2 (0.66%)	<0.001
Absent	32 (88.89%)	301 (99.34%)	
<b>Cardiotocography</b>			
Present	36 (100%)	303 (100%)	*
Absent	0 (0.00%)	0 (0.00%)	
<b>Postpartum haemorrhage</b>			
Present	6 (16.67%)	4 (1.32%)	<0.001
Absent	30 (83.33%)	299 (98.68%)	

\*No statistical test was applied due to 0 value in one of the cells.

The parity for most of the participants was primi in both cases and controls. The mode of conception was spontaneous for the majority of (n=35, 97.22%) participants in cases and 296 (97.69%) participants in the control group. Indication of labor was present for (n=34, 94.44%) participants in cases and (n=270, 89.11%) 270 (89.11%) participants in control group. Difficulty in head delivery was observed majority in cases as (n=16, 44.44%) it was there in (n=5, 16.50%) participants in controls. The presence of angle extension was observed for (n=4, 11.11%)

participants in cases and for only (n=2, 0.66%) participants in controls. Cardiotocography was present for all the (n=36, 100%) participants and (n=303, 100%) participants in cases and controls respectively. Postpartum haemorrhage was reported in (n=6, 16.67%) participants in cases it was present only for (n=4, 1.32%) participants in controls. No statistically significant difference was observed in the proportion of parity, mode of conception, and IOL between cases and controls (P value>0.05). Statistically, a significant difference was observed in the proportion of difficulty in head delivery, angle extension, and postpartum haemorrhage between cases and controls (P value<0.05) (table 2).

<b>Table 3: Comparison of neonatal outcomes between study group (N=339)</b>			
<b>Parameter</b>	<b>Study Group</b>		<b>P value</b>
	<b>Cases (N=36)</b>	<b>Controls (N=303)</b>	
<b>Apgar score at 5 min &lt;7</b>			
Present	1 (2.78%)	2 (0.66%)	0.200
Absent	35 (97.22%)	301 (99.34%)	
<b>Fetal injury</b>			
Present	0 (0.00%)	0 (0.00%)	*
Absent	36 (100%)	303 (100%)	
<i>*No statistical test was applied due to 0 value in one of the cells.</i>			

Apgar score of less than seven at five minutes was observed in significantly less proportion as (n=1, 2.78%) in cases and (n=2, 0.66%) in controls. No statistically significant difference was seen in Apgar score at five minutes between the study group (P value > 0.05). No fetal injury was reported in both the cases and control (table 3).

## Discussion

The present study compared fetomaternal outcomes of cesarean delivery performed in the first and second stage of labor at tertiary care center/institute in India. The majority of (n=15, 41.67%) cases and (n=162, 53.46%) controls were in the age group of 21-25 years. There was no significant difference in age between cases and controls. Cesarean delivery performed in the second stage was associated with increased maternal morbidity such as difficulty in head delivery, haemorrhage, uterine angle extension, and the results were statistically significant between cases and controls (P<0.05). Apgar score of less than seven at five minutes was observed in a very less proportion of cases (n=1, 2.78%) and controls (n=2, 0.66%). No statistically significant difference was seen in Apgar score at five minutes and fetal injury between the two study groups.

The maternal demographics and labor characteristics of the present study are comparable to the observations reported by Gupta N et al <sup>11</sup> in their retrospective study conducted at ESI PGISR New Delhi, India. In the present study, the majority of (n=15, 41.67%) cases and (n=162, 53.46%) controls were in the age group of 21-25 years. According to our study, there was no statistically significant difference between the ages of the two groups (p > 0.05). This finding was in contrast to a prospective observational study by Mehdi SN et al <sup>12</sup> in Iraq where patients were older (33.3% were >30 years versus 23%) when cesarean section performed in the second stage and were less likely to be teenagers (3.8% vs. 12.5% in the first stage) (p=0.034). The finding was in comparison to a prospective cross-sectional study by Qadir M et al <sup>13</sup> in Pakistan, where the common age group for the second stage CS was 21-30 years. A higher rate of second-stage cesarean section in young primigravida women was probably due to rigid perineum, fetopelvic disproportion, and uterine inertia.

In the present study, the maternal demographics and labor characteristics were definitely larger in cases than controls (p-value <0.05). The parity for most of the participants was primigravida in both cases, 24 (66.67%) and controls 243 (80.19%) and although the difference was not significant (p value 0.061). This finding was in contrast to a study by Isha et al <sup>14</sup>, who suggested that nulliparity was more often encountered in the second stage. The presence of angle extension was observed for four (11.11%) participants in cases and for only two (0.66%) participants in controls. This finding was almost inconsistent with the retrospective study by Gurung P et al <sup>15</sup> at Patan Hospital, where uterine incision extension was seen in 12.58%, which is slightly higher compared to our study. Difficulty in head delivery, was observed majorly in cases (n=16, 44.44%) and in only (n=5, 16.50%) controls in the present study. The finding was contradicting a study by Khaniya B et al <sup>16</sup> in Nepal, where the most common indication of the second stage cesarean section was non-descent of the head (93%). The mechanism of

difficult delivery of the fetal head during cesarean section is not entirely clear and remains a challenge to obstetricians. The technique selected for the procedure for disengagement depends on skills and expertise of the operating surgeon.

Postpartum haemorrhage was reported in (n=6, 16.67%) cases and only (n=4, 1.32%) controls in the present study. This finding is in contrast to Babre V M et al<sup>17</sup>, where atonic postpartum haemorrhage was slightly less (11.5%) in the second stage compared to the present study. There were no incidences of maternal deaths in our study. Neonatal morbidity was not much significant in the present study. Apgar score of less than seven at five minutes was observed in a very less proportion of cases (n=1, 2.78%) and controls (n=2, 0.66%). This finding was in contrast to a prospective observational study of 25 cases of cesarean sections done in the second stage of labor at Sri-Lanka by Thirukumar M<sup>18</sup> where all the babies had Apgar score of more than seven at five minutes. The study also measured neonatal admission, meconium stained amniotic fluid, and birth weight, which was not observed in the present study. The findings were contradictory to a hospital based observational study conducted with 70 patients at Pune, India, by Hemant D et al<sup>19</sup> where the mean Apgar Score at one minute was seven in group one and six in group two, respectively, while the mean Apgar Score at five minutes was nine in group one and seven in group two.

Performing cesarean delivery during the second stage of labor is associated with an increased risk of complications, particularly in women who have undergone cesarean delivery before. A prior attempt at instrumental delivery has to be documented if the patient has ended up in a second stage cesarean in order to plan future prospects of labor and delivery. The Royal College of Obstetrician and Gynaecologists in the UK suggest that a consultant be present at all second stage LSCS for taking an informed decision in lowering the chances of complications encountered during the procedure. In developing countries like India, to reduce maternal and neonatal complications, experienced and trained surgeons should help in assisting decision making by perform instrumental deliveries and second stage CS.

**Strength:** The findings of the present study are an addition to evidence based literature. The study comprehensively explained significant factors for increased maternal and neonatal morbidities in second stage cesarean section when compared to the first stage.

**Limitations:** The study is not without limitations. This study had very few subjects in the second stage of labor. The follow-up period, assessing instrumental deliveries which could be used to prevent the second stage cesarean sections and the effect of second stage cesarean sections on subsequent pregnancies were the major limitations of our study. This study was also performed in only one tertiary care center, which could limit the generalizability of the findings. Hence we recommend further large multi-center study with a longer follow-up period, incorporating other methods of assessing maternal and neonatal outcomes like hematuria, febrile illness, prolong catheterization, prolong hospitalization, NICU admission of the newborn, fresh stillbirth, baby weight, etc. We also recommend qualitative studies to understand the factors driving resident (junior) doctor's decision making in second stage events and how these can be tackled effectively.

## Conclusion

Difficulty in head delivery, angle extension, PPH, was more among those undergoing cesarean section in the second stage of labor compared with those undergoing cesarean section in the first stage of labor. Improvement of antenatal care, pelvic assessment in early labor, use of partogram, and in-time intervention can be implemented to avoid complications during pregnancy. Women undergoing cesarean section in the second stage of labor require special care and should be handled and operated on by experienced obstetricians, especially in developing and underdeveloped countries.

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