International Journal of Reproduction, Contraception, Obstetrics and Gynecology
*Shishodiya M et al. Int J Reprod Contracept Obstet Gynecol. 2025 Jul;14(7):2164-2169*
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20251960

**Original Research Article**

# A comparative assessment of decision to delivery interval for emergency and urgent lower segment caesarean section following maternal and foetal outcomes

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**Received:** 24 September 2024
**Accepted:** 06 February 2025

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## ABSTRACT

**Background:** Background: Timely decision-to-delivery interval (DDI) in lower segment caesarean section (LSCS) is critical for safeguarding maternal and foetal health. This study aimed to measure the DDI and assess its relationship with maternal and foetal outcomes.
**Methods:** A prospective observational study was conducted among 361 deliveries at a tertiary care hospital in Bhilai, Chhattisgarh. Pregnant women undergoing emergency (Category 1, n=283) and urgent (Category 2, n=78) LSCS were enrolled. Maternal and foetal outcomes were evaluated.
**Results:** A statistically significant difference was observed between mean DDI values in Category 1 and Category 2 ($p<0.02$). Maternal outcomes, including postpartum haemorrhage (PPH), post-operative fever, and blood transfusion, were significantly associated with increasing DDI ($p<0.0001$). A significant difference in neonatal intensive care unit (NICU) admission rates between the two categories was noted ($p=0.03$). APGAR score comparisons showed significant variations at different DDI intervals: 31–40 vs 51–60 min ($p<0.0002$), 41–50 min ($p<0.00021$) for 1-minute scores, and 21–30 min ($p<0.028$) for 5-minute scores.
**Conclusions:** While increased DDI correlated with certain adverse maternal and neonatal outcomes (NICU admission and low APGAR scores), no critical maternal or foetal mortality was attributed directly to prolonged DDI.

**Keywords:** Decision to delivery interval, Emergency and urgent, Foetal outcome, Lower segment caesarean section, Maternal outcome

## INTRODUCTION

As per the "Royal College of Obstetricians and Gynecologists (RCOG)", the caesarean section (CS) has been classified into four types based on timing: emergency, urgent, scheduled, and elective. An elective or scheduled CS is usually planned earlier to labor whereas an emergency CS is unplanned and requires an immediate decision to save the mother or fetus. The RCOG recommended delivery of the baby within 30 mins for emergency CS.[1,2]

As per NICE guidelines, the Category-I CS describes there is an immediate threat to maternal or fetal life, while in Category II CS, there is a maternal or fetal settlement that is not immediately life-threatening.[3] When a CS is indicated for foetal compromise, a DDI of ≤30 min has been recommended as the perfect time frame in which an obstetric team should make deliveries. In theory, a short DDI may reduce intra-uterine hypoxia and improve foetal outcome especially morbidity and mortality.[4,5] As per recent study by Grabarz et al a crash CS performed to save fetal life were found to pose greater risk to maternal life than the potential benefit.[6]

Data on the impact of DDI on maternal and foetal outcome are inadequate in Indian context as well as the data from developing countries are scarce.[7-12] According to WHO recommendations, an optimum CS rate is of about 15%.[13] The global incidence of category I emergency LSCS is 0.6-0.7%.[14] In a global context, the hospitals are found to conduct audits on a routine basis to evaluate if their standards could be encountered as per RCOG guidelines.[15]

Several national and international studies have been reported on the DDI to know maternal and foetal outcome and mortality of fetus in hospital care.[7-12] But the study is lacking in central part of India.

The objective of the study was to measure the decision-delivery interval, and relationship with maternal and foetal outcome at a tertiary care referral hospital in Bhilai, Chhattisgarh, India.

## METHODS

This prospective observational study included 361 women who underwent either emergency (Category 1, n=283) or urgent (Category 2, n=78) caesarean sections between 1st February 2019 and 30th September 2020 to measure DDI, fetal and maternal outcome.

The study participants recruited all the emergency and urgent CS from 1st February 2019 to 30th September 2020.

### *Maternal and foetal outcomes*

The maternal parameters viz. PPH, post-operative fever, and blood transfusion parameters were observed and foetal parameters viz. APGAR scores at 1 and 5 minutes, need for special care unit admission and foetal mortality were measured as per earlier study by Gupta et al.[16]

### *Statistical analysis*

All data were analysed using statistical package for social science (SPSS, version 20). Categorical variables were presented as percentages and the chi-square test was performed to know the significant relationships between DDI categorical groups as category-1 and 2 related to NICU admission, APGAR score 1 min and 5 min, respectively. A statistically significant level at $p<0.05$ was considered.

## RESULTS

Regarding gravidity distribution, higher frequencies (%) of about 57.6% and 46.15% were observed for primigravida in category-1 and category-2, respectively followed by multigravida with one living issue of about 30.74% and 34.62% frequencies in category-1 and category-2, respectively. Lower frequencies of about 9.19% and 17.95% were observed for multigravida with ≥ 2 (Table 1).

**Table 1: Frequency (%) of gravidity distribution among patients.**

| Gravidity | Category-1 | | Category-2 | |
|---|---|---|---|---|
| | N | % | N | % |
| **Primigravida** | 163 | 57.6 | 36 | 46.15 |
| **Multigravida with previous abortions and no living issue** | 26 | 9.19 | 14 | 17.95 |
| **Multigravida with 1 living issue** | 87 | 30.74 | 27 | 34.62 |
| **Multigravida with ≥2 living issue** | 7 | 2.47 | 1 | 1.28 |
| **Total** | 283 | 100 | 78 | 100 |

Table 2 describes the frequency (%) of DDI time (mins) distribution among the studied patients of category-1 and category-2. A higher value of frequencies (%) of about 36.04% and 29.49% in the groups of 21-30 mins for category-1 and category-2, respectively, followed by 31-40 mins of about 32.51% and 26.92% frequencies for category-1 and category-2, respectively were observed.

**Table 2: Frequency (%) of DDI interval time among patients.**

| DDI (minutes) | Category-1 | | Category-2 | |
|---|---|---|---|---|
| | N | % | N | % |
| **≤20** | 7 | 2.47 | 3 | 3.85 |
| **21-30** | 102 | 36.04 | 23 | 29.49 |
| **31-40** | 92 | 32.51 | 21 | 26.92 |
| **41-50** | 48 | 16.96 | 21 | 26.92 |
| **51-60** | 25 | 8.83 | 2 | 2.56 |
| **61-70** | 7 | 2.47 | 3 | 3.85 |
| **71-80** | 1 | 0.35 | 1 | 1.28 |
| **>80** | 1 | 0.35 | 4 | 5.13 |
| **Total** | 283 | 100 | 78 | 100 |

DDI = Decision to delivery interval; N = Numbers; % = Percentage

**Table 3: Comparative study between study groups and DDI time among patients.**

| Study groups | N | DDI (mins) Mean ± SD | P value |
|---|---|---|---|
| **Category 1** | 283 | 35.40 ± 11.01 | 0.02 |
| **Category 2** | 78 | 38.97 ±16.23 | |

DDI = Decision to delivery interval; N = Numbers; SD = Standard deviation

**Table 4: Comparison between DDI time and maternal outcome.**

| DDI | PPH (%) | Post-operative fever (%) | Blood transfusion (%) | Duration of hospital stay (>5 days) (%) |
|---|---|---|---|---|
| **≤20 (n=10)** | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **21-30 (n=125)** | 3 (2.4) | 2 (1.6) | 4 (3.2) | 6 (28.57) |
| **31-40 (n=113)** | 15 (13.27) | 4 (3.54) | 6 (5.31) | 7 (33.33) |
| **41-50 (n=69)** | 15 (21.74) | 9 (13.04) | 0 (0) | 6 (28.57) |
| **51-60 (n=27)** | 4 (14.81) | 3 (11.11) | 3 (11.11) | 2 (9.52) |
| **61-70 (n=10)** | 1 (10) | 4 (40) | 4 (40) | 0 (0) |
| **71-80 (n=2)** | 1 (50) | 0 (0) | 0 (0) | 0 (0) |
| **>80 (n=5)** | 4 (80) | 0 (0) | 0 (0) | 0 (0) |
| **P value** | P<0.0001 | P<0.0001 | P<0.0001 | 0.87 |

DDI = Decision to delivery interval; PPH = Postpartum haemorrhage

**Table 5: Comparative study between study groups and NICU admission.**

| NICU admission | Category-1 | | Category-2 | |
|---|---|---|---|---|
| | N | % | N | % |
| **Yes** | 155 | 54.77 | 32 | 41.03 |
| **No** | 128 | 45.23 | 46 | 58.97 |
| **Total** | 283 | 100 | 78 | 100 |

N = Number; NICU = Neonatal intensive care unit; Chi square value = 4.62; P = 0.03

The mean ± standard deviation of DDI value for category-1 was 35.40±11.01 mins while for category-2, the mean ± standard deviation of DDI value of 38.97±16.23 mins. The comparison between these groups indicated a significant (P<0.02) difference (Table 3).

The comparison study between DDI time and maternal outcome viz. PPH, post-operative fever, blood transfusion, and duration of hospital stay among studied patients was done. The comparison between DDI time and the maternal outcomes such as PPH, post-operative fever, and blood

transfusion parameters were observed as highly significant (P<0.0001) but not significant for hospital stay parameter (Table 4).

About 54.77% and 41.03% neonates of category-1 and category-2 required NICU admission, respectively and 45.23% of category-1 and 58.97% of category-2 neonates required no admission in NICU. The comparison study by Chi-square test indicated a significant (P=0.03) association (Table 5).

**Table 6: Comparison between DDI time and NICU admission.**

| DDI (mins) | Category 1 (%) | | Category 2 (%) | |
|---|---|---|---|---|
| | NICU (Yes) | NICU (No) | NICU (Yes) | NICU (No) |
| ≤20 | 0 (0) | 5 (3.91) | 0 (0) | 2 (4.35) |
| 21-30 | 35 (22.58) | 69 (53.91) | 4 (12.5) | 18 (39.13) |
| 31-40 | 55 (35.48) | 35 (27.34) | 12 (37.5) | 11 (23.91) |
| 41-50 | 35 (22.58) | 14 (10.94) | 7 (21.88) | 14 (30.43) |
| 51-60 | 21 (13.55) | 5 (3.91) | 1 (3.13) | 1 (2.17) |
| 61-70 | 7 (4.52) | 0 (0) | 3 (9.38) | 0(0) |
| 71-80 | 1 (0.65) | 0 (0) | 1 (3.13) | 0 (0) |
| >80 | 1 (0.65) | 0 (0) | 4 (12.5) | 0 (0) |
| P value | <0.0001 | | 0.007 | |

DDI = Decision to delivery interval; NICU = Neonatal intensive care unit

**Table 7: Comparison between DDI time and APGAR 1 min of study groups.**

| DDI (mins) | APGAR 1 min | | | | P value | Sig. |
|---|---|---|---|---|---|---|
| | Category-1 (%) | | Category-2 (%) | | | |
| | <7 | ≥7 | <7 | ≥7 | | |
| ≤20 | 1 (14.29) | 6 (85.71) | 0 (0) | 3 (100) | 0.49 | NS |
| 21-30 | 14 (13.73) | 88 (86.27) | 2 (8.7) | 21 (91.3) | 0.51 | NS |
| 31-40 | 58 (63.04) | 34 (36.96) | 4 (19.05) | 17 (80.95) | 0.0002 | HS |
| 41-50 | 29 (60.42) | 19 (39.58) | 2 (9.52) | 19 (90.48) | <0.0001 | HS |
| 51-60 | 22 (88) | 3 (12) | 0 (0) | 2 (100) | 0.002 | HS |
| 61-70 | 7 (100) | 0 (0) | 3 (100) | 0 (0) | - | - |
| 71-80 | 1 (100) | 0 (0) | 0 (0) | 1 (100) | - | - |
| >80 | 1 (100) | 0 (0) | 1 (25) | 3 (75) | 0.17 | NS |

DDI = Decision to delivery interval; APGAR = Activity, pulse, grimace, appearance and respiration; NS = Not significant; HS = Highly significant

**Table 8: Comparison between DDI time and APGAR 5 min of study groups.**

| DDI (mins) | APGAR 5 min | | | | P value | Sig. |
|---|---|---|---|---|---|---|
| | Category-1 (%) | | Category-2 (%) | | | |
| | <7 | ≥7 | <7 | ≥7 | | |
| ≤20 | 0 (0) | 7 (100) | 0 (0) | 3 (100) | - | - |
| 21-30 | 1 (0.98) | 101 (99.02) | 2 (8.7) | 21 (91.3) | 0.028 | S |
| 31-40 | 14 (15.22) | 78 (84.78) | 4 (19.05) | 17 (80.95) | 0.66 | NS |
| 41-50 | 0 | 48 (100) | 0 (0) | 21 (100) | - | - |
| 51-60 | 0 | 25 (100) | 0 (0) | 2 (100) | - | - |
| 61-70 | 0 | 7 (100) | 0 (0) | 3 (100) | - | - |
| 71-80 | 0 | 1 (100) | 0 (0) | 1 (100) | - | - |
| >80 | 0 | 1 (100) | 0 (0) | 4 (100) | - | - |

DDI = Decision to delivery interval; APGAR = Activity, pulse, grimace, appearance, and respiration; S = Significant; NS = Non-significant.

The comparison was performed between category-1 and category-2 with APGAR 5 min score as per DDI time. The significant change was found at DDI time of 21-30 mins (P<0.028) and APGAR 5 min score (Table 8).

## DISCUSSION

In contrast to the study by Apako et al. majority of the mothers were observed multigravida in no delay (56.3%) and prolonged delay (53.7%) groups where present study observed mostly primi gravida in Category 1 (57.6%) and Category 2 (46.15%).[12] Gupta et al. in Udaipur, observed the mean DDI of 36.3±17.2 mins for Category-1 CS and 38.1±17.7 mins for Category 2 CS (P>0.05), our study observed mean DDI±SD for Category 1 as 35.4±11.01 minutes and Category 2 as 38.97±16.23 minutes..[17] Mishra et al in Chhattisgarh observed mean DDI of emergency and urgent CS groups 57.5 min versus 69.6 mins, respectively.[7]

Temesgen et al investigated that among 163 patients, 32 patients whose DDI time was >30 min, 9.2% were transfused, and 6.1% had developed fever.[18] In present study only 3 patients had PPH, 2 patients had post-operative fever, 4 patients needed blood transfusion for DDI ≤30 minutes, while for DDI more than 30 minutes risk of PPH, post-operative fever and blood transfusion increased significantly. Comparison for duration of hoispital stay was not significant for DDI ≤ 30 minutes and more than 30 minutes. A study by Al Rowaily et al in Riyadh, Saudi Arabia observed that the adverse effect on maternal outcomes was significantly related to high gravidity (4 or more) (OR=2.84, 95% CI:1.26-6.39, P=0.011).[19] In a recent study by Apako et al. observed only 2.0% mothers had a DDI time interval of ≤30 minutes while majority of mothers (79.8%) had a DDI of >75 mins.[12] In present study, 34.62% (n=125) mothers had a DDI time of ≤ 30 minutes while 65.38% (n=236) mothers had a DDI time of more than 30 minutes. They also reported only 9.1% mothers required blood transfusion, which was very less compared to the present study.[12] Hughes et al. reported that emergency CS was performed every 104 min and the median DDI interval was 5.5 hrs, which was found prolonged. This prolonged interval was related to preeclampsia and premature rupture of membranes/oligohydramnios, but adverse maternal outcome was observed only 4.7%.[20]

In this study, all neonates delivered by LSCS were shifted to NICU for 12hrs observation and only neonates who required prolonged NICU admission (>12 hours) were taken into consideration. In the present finding, about 54.77% and 41.03% neonates of category-1 and category-2 required NICU admission respectively, and 45.23% of category-1 and 58.97% of category-2 neonates required no admission in NICU. The comparison study by Chi-square test indicated a significant (P<0.03) association. As the DDI time increased >30 min, more neonates required NICU admission in both the categories. It is indicated that with higher DDI, there was more risk of NICU admission of babies. The results confirm with an earlier study by Temesgen et al, in which it was described that longer DDI time of >30mins had higher chances of NICU admission of neonates. Similarly, the probability of admission into NICU increased at >75 min of DDI without statistically significant change.[18] Although overall perinatal outcome of the babies does not appear to worsen over time suggesting that other factors might be contributed to the survival of the babies.[21]

It was also observed that a longer DDI was related to low APGAR score (<7) and a shorter DDI was related to a better APGAR score (≥7) at 1 min in both categories. A highly significant decrease in 1 min APGAR score was observed when DDI increased to 31-40 min at the level of P<0.0002, 41-50 mins at a level of P<0.0001, and 51-60 mins at a level P<0.002 in both the categories. While the significant change was found at DDI time of 21-30 mins (P<0.028) and APGAR score at 5 minutes for both categories, only one baby in category-1 and 2 babies in category-2 had APGAR score <7. With an increase in DDI >30 min, 14 babies in category-1 and 4 babies in category-2 had APGAR score <7, though it was statistically non-significant. An earlier study by Temesgen et al. supported the present study in which it was mentioned that longer DDI time led to intubation, resuscitation through bag-mask ventilation, and chest compression in babies.[18]

Igwe et al stated that babies delivered >75 mins of DDI have lower odd of having good APGAR scores of 7-10 at the 1 and 5 mins without statistically significant change.21 While Hirani et al. documented that babies born >75 mins have higher odd of having APGAR score of <7 in the 1 and 5 mins without significant difference.[9]

In the present study, there was no neonatal mortality. A recent study by Dorjey et al it was found that there was only about 1.3% neonatal death while Degu Ayele et al documented that about 2.4% neonatal death was observed due to prolonged DDI.[10,13]

This investigation was an endeavour in the central part of India. There was an opportunity to identify the gaps within this healthcare system and formulate remedies through this study. The study has been done over a period of 18 months and single centre study with smaller sample size.

## CONCLUSION

In the present study, the most common reason for higher DDI was a delay in obtaining consent from the patient's relative followed by waiting for reports busy labour room, etc. Moreover, maternal outcome related to ICU admission and mortality did not observe in the present study among mothers. For foetal outcome, lower DDI was associated with a better APGAR score. It was also revealed that less NICU admission was found due to lower DDI time but higher the DDI time more chance of NICU admission.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The present study was conducted with prior approval from Institutional Ethical Committee of JLN Hospital and Research Centre, Bhilai Steel Plant, Bhilai dated 22.02.2019*

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**Cite this article as:** Shishodiya M, Sachdev R, Devi PS, Bhadouriya AS, Basu R, Kamra S, et al. A comparative assessment of decision to delivery interval for emergency and urgent lower segment caesarean section following maternal and foetal outcomes. Int J Reprod Contracept Obstet Gynecol 2025;14:2164-9.