

## Original research article

## A prospective study to determine the relationship between the delivery interval and the perinatal outcome in emergency caesarean sections

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### Abstract

**Aim:** To determine the relationship between the delivery interval and the perinatal outcome in emergency caesarean sections.

**Materials and methods:** A prospective study was conducted in the Department of obstetrics and gynaecology, VIMS, Pawapuri, Nalanda, Bihar, India, India for 1 year. Pregnant women at term in whom decision for emergency caesarean delivery was taken and who delivered a singleton baby were included in this study. A questionnaire is designed containing information about, demographic details, pregnancy details, indication for emergency caesarean section, stage of labor, grade of obstetrician managing the case, time of decision to emergency caesarean section, time at arrival to theatre (TTT), time start of anesthesia, time delivery of the baby, type of anesthesia used, time and day of delivery, neonatal outcome (Apgar score at 1 min, 5 min birth weight, admission to NICU, condition at discharge), maternal outcome with regard to recovery from anesthesia, need for blood transfusion, condition at discharge.

**Results:** Mean age was  $26.43 \pm 3.744$  years. Majority of women were in the age group 25 to 30 years (43%). 53% of women were nulliparous women and 47% were multiparous. The mean DDI in the study participants was  $80.28 \pm 29.66$  mins. The mean DDI for interval 1, interval 2, interval 3 and interval 4 were  $40.68 \pm 23.51$ ,  $18.50 \pm 6.940$ ,  $16.66 \pm 4.976$  and  $7.48 \pm 1.601$  mins respectively. Mean DDI for category 1, 2, 3 caesarean deliveries were  $48.23 \pm 14.35$  mins,  $65.83 \pm 12.83$  mins,  $111.15 \pm 13$  mins respectively. Duration of DDI varied significantly in between the caesarean categories. In 100 cases included in the study, 75 babies were shifted to mother's side after caesarean delivery, 24 babies were shifted to NICU and 1 was still born.

**Conclusion:** Neonatal outcomes did not differ significantly in between those caesarean deliveries with  $DDI \leq 30$  mins and those with  $DDI > 30$  mins. It is difficult to achieve 30 minute goal in every emergency caesarean delivery and it is also not an indispensable measure to prevent maternal or neonatal morbidities.

**Keywords:** emergency caesarean, delivery interval, perinatal outcome

### Introduction

In present day Obstetric practice, the need to avoid the adverse neonatal effects of perinatal asphyxia has been one of the common indications for Caesarean section. Expedient delivery is dependent on decision to perform Caesarean delivery and time lines achieved.<sup>1</sup> Since the dawn of Caesarean births, operative deliveries have been performed in extreme clinical situations.<sup>2-4</sup> In modern Obstetrics, routine Caesarean deliveries are offered electively to women for variety of indications; or performed in emergency foetal or maternal complications or both.<sup>5</sup> Caesarean section has been classified based on the severity of foetal and/or maternal

situation into emergency, urgent, scheduled and elective Caesarean deliveries.<sup>6</sup> According to the classification, emergency CS is performed in situations that are extremely life-threatening for the mother or foetus or both. Some authors refer to this category as ‘crash’ Caesarean delivery.<sup>1</sup> Urgent Caesarean delivery is the one performed for maternal or fetal compromise which is not immediately life-threatening. Scheduled CS is done in situations needing early delivery but no maternal or fetal compromise while elective CS is done at a time to suit the mother and the maternity team.<sup>6</sup> The decision-to-delivery interval (DDI) is defined as the interval in minutes from the date and time of decision to carry out Caesarean section to the date and time of delivery of the baby.<sup>1,7</sup> It is not synonymous with decision-to-incision time where the goal of the birth of a baby is yet to be achieved.<sup>1</sup> A decision-to-delivery interval of 30 minutes for emergency Caesarean section has been widely recommended,<sup>8,9</sup> but there is little evidence to support it.<sup>10</sup> Inability to meet this target has been the basis for medico-legal suits.<sup>11</sup> The ‘30 minute rule’ for a DDI takes its origin from the Guidelines to perinatal care jointly developed by the American Academy of Paediatrics and the American College of Obstetricians and Gynaecologists.<sup>12</sup> Recent studies however, have cast doubts not only on the practicability of this target but also on its anticipated beneficial effect on neonatal outcome.<sup>4</sup>

### **Materials and methods**

A prospective study was conducted in the Department of obstetrics and gynaecology, VIMS, Pawapuri, Nalanda, Bihar, India, for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

### **Inclusion criteria**

Pregnant women at term in whom decision for emergency caesarean delivery was taken and who delivered a singleton baby

### **Exclusion criteria**

- Pregnant women posted for elective caesarean delivery.
- Pregnant women with medical co-morbidities which independently could result in poor maternal outcome.
- Pregnant women who delivered a baby with any congenital anomaly.
- Cases where data was not recorded properly.

### **Methodology**

A questionnaire is designed containing information about, demographic details, pregnancy details, indication for emergency caesarean section, stage of labor, grade of obstetrician managing the case, time of decision to emergency caesarean section, time at arrival to theatre (TTT), time start of anaesthesia, time delivery of the baby, type of anaesthesia used, time and day of delivery, neonatal outcome (Apgar score at 1 min, 5 min birth weight, admission to NICU, condition at discharge), maternal outcome with regard to recovery from anaesthesia, need for blood transfusion, condition at discharge.

### **Statistical analysis**

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 20 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and SD. ANOVA (Analysis of Variance) was the test of significance to identify the mean difference between more than two groups for quantitative data.

### **Results**

Amongst 500 emergency caesarean deliveries, 100 cases were selected by simple random sampling after confirming that they satisfied the inclusion and exclusion criteria.

Mean age was  $26.43 \pm 3.744$  years. Majority of women were in the age group 25 to 30 years (43%). 53% of women were nulliparous women and 47% were multiparous.

85% of women were in gestational age of 37-40 weeks and 15% of women were in gestational age in 41-42 weeks. Among 100 participants, 19(19%) belonged to category 1, 42(42%) belonged to category 2 and 39(39%) belonged to category 3.

The mean DDI in the study participants was  $80.28 \pm 29.66$  mins. The mean DDI for interval 1, interval 2, interval 3 and interval 4 were  $40.68 \pm 23.51$ ,  $18.50 \pm 6.940$ ,  $16.66 \pm 4.976$  and  $7.48 \pm 1.601$  mins respectively. Mean DDI for category 1, 2, 3 caesarean deliveries were  $48.23 \pm 14.35$  mins,  $65.83 \pm 12.83$  mins,  $111.15 \pm 13$  mins respectively. Duration of DDI varied significantly in between the caesarean categories. All 4 cases where DDI was  $< 30$  min belonged to category 1 caesarean delivery. 100 % of category 1 caesarean deliveries were performed within 75 minutes. All cases where DDI was  $> 120$  minutes belonged to category 3 caesarean deliveries. Most important factors causing delay in the study were delay in obtaining consent in 45 cases (45%) and preparation of OT table between surgeries in 39 cases (39%). Delayed referral though cannot be a cause for delay in decision to delivery interval but was considered to account for the cases where maximum damage was done before the decision for caesarean delivery was taken. In 100 cases included in the study, 75 babies were shifted to mothers side after caesarean delivery, 24 babies were shifted to NICU and 1 was still born. In the study among those with Category 1, 65% were admitted to NICU, 30% were on mother's side and 5% were still born. Among those with Category 2, 30% were admitted to NICU, 70% were on mother's side and 0% were still born. Among those with Category 3, 5% were admitted to NICU, 95% were on mother's side and 0% were still born. There was significant association between LSCS category and NICU admission and Mothers side. There was no significant association between Still born and LSCS category

Mean DDI for babies admitted to NICU was  $56.05 \pm 17.47$  min and Mean DDI for babies shifted to mother's side was  $89.47 \pm 27.92$  min.

Among 100 cases, 99 babies born alive were followed up during their hospital stay. In 72% of cases there were no complications, 24% of cases had hypoxic ischemic encephalopathy and 3% of cases had sepsis. There were 1 neonatal death among the cases included in the study.

**Table 1: Descriptive analysis for DDI and different intervals in study population (N=100)**

Parameter	Mean $\pm$ STD	Median	Min	Max	95% C.I. for EXP(B)	
					Lower	Upper
Interval 1	$40.68 \pm 23.51$	31.00	10.50	90.50	36.64	42.92
Interval 2	$18.50 \pm 6.940$	16.00	4.50	35.50	16.64	18.57
Interval 3	$16.66 \pm 4.976$	16.00	5.50	30.50	14.98	16.46
Interval 4	$7.48 \pm 1.601$	7.00	4.50	12.50	6.36	6.80
DDI	$80.28 \pm 29.66$	72.00	26.50	141.50	75.38	83.38

**Table 2: Comparison of mean DDI across different caesarian sections in study population (N=100)**

Category	DDI Mean $\pm$ SD	Mean difference	95% Confidence Interval for Mean		P value
			Lower Bound	Upper Bound	
Category 1 (Base line)	$48.23 \pm 14.35$				

Category2	65.83±12.83	17.69	12.86	22.53	<0.001
Category 3	111.1.5±13	62.9	58.11	67.84	<0.001

**Table 3: Comparison of DDI across different caesarian sections instudy population (N=100)**

Category	DDI					
	≤30	31-60	61-75	76-90	91-120	>120
Category 1(N=20)	2 (10%)	14 (70%)	4 (20%)	0 (0%)	0 (0%)	0 (0%)
Category2(N=40)	0 (0%)	14 (35%)	18 (45%)	6 (15%)	2 (5%)	0 (0%)
Category 3 (N=40)	0 (0%)	0 (0%)	0 (0%)	2 (5%)	28 (70%)	10 (25%)

**Table 4: Causes for delay in performing caesarean section**

Causes for delay	Yes		No	
	N	%	N	%
No delay	3	3%	97	97%
Delay in Obtaining Consent	45	45%	55	55%
Delay in Cross Matched Blood	19	19%	81	81%
Non Availability of Basic Investigations	28	28%	72	72%
Delay in Arrangement of Drugs	38	38%	62	62%
Preparation of OT Table In Between Surgeries	39	39%	61	61%
Non Availability of OT Table during Daytime	17	17%	83	83%
Procedural Delay in Inducing Anesthesia	30	30%	70	70%
Failed Spinal Converting To General Anesthesia	4	4%	96	96%
Delay in Extraction Due To Adhesions and Malpresentation	4	4%	96	96%

**Table 5: Neonatal outcome at birth among study participants (N=100)**

Neonatal outcome	Frequency	Percentage
Mother side	72	72 %
NICU	27	27%
Still born	1	1%

**Table 6: Category wise Neonatal Outcome at birth**

Neonatal Outcome		LSCS Category						P value
		1		2		3		
		N	%	N	%	N	%	
NICU	Yes	13	65%	12	30%	2	5%	<0.001*
	No	7	35%	28	70%	38	95%	
Mother's Side	Yes	6	30%	28	70%	38	95%	<0.001*
	No	14	70%	12	30%	2	5%	
StillBorn	Yes	1	5%	0	0.0%	0	0.0%	0.136
	No	19	95%	40	100%	40	100%	

**Table 7: Comparison of mean DDI between neonatal outcomes (N=100)**

Parameter	Neonatal outcome	
	Mother's side (N=75) Mean ±SD	NICU admission (N=25) Mean ±SD
DDI	89.47 ± 27.92	56.05 ± 17.47

**Table 8: Neonatal outcomes (on follow up) among study participants(N=100)**

Neonatal outcome	Frequency	Percentage
No complications	72	72%
HIE ( any grade )	24	24
SEPSIS	3	3. %
Neonatal death	1	1%

### Discussion

In general, the consensus has been that hospitals should have the capability of beginning a caesarean delivery within 30 minutes of the decision to operate.” This guideline does not establish the 30-minute interval to be a requirement but rather a capability. The distinction between these two terms is important and we believe this is often overlooked. For example, not being able to perform caesarean delivery within 30 minutes is a common reason that obstetric malpractice claims are perceived to be indefensible. The implication of such perception is that the 30- minute interval is a requirement or standard for acceptable obstetric practice. Intrinsic to this perception is the belief that delivering within 30 minutes necessarily would prevent untoward infant outcomes.

The need for the study was to see if exceeding the 30-minute interval is necessarily an index of substandard obstetric care. We aimed to estimate the ideal “decision to delivery interval” in emergency caesarean delivery for optimal perinatal outcome and the factors causing delay were also evaluated.

Mean age was  $26.43 \pm 3.744$  years. Majority of women were in the age group 25 to 30 years (43%). 53% of women were nulliparous women and 47% were multiparous.

85% of women were in gestational age of 37-40 weeks and 15% of women were in gestational age in 41-42 weeks.

Among 100 participants, 19(19%) belonged to category 1, 42(42%) belonged to category 2 and 39(39%) belonged to category 3.

They were categorized accordingly and their perinatal outcomes were analysed and evaluated with standard literature. This was compared to a study by Gita et al.<sup>13</sup> In which among 275 participants, 146(53.1%) belonged to category 1, 38 (13.82%) to category 2 and 91 (33.1%) to category (3+ 4).

The mean DDI in the study participants was  $80.28 \pm 29.66$  mins. The mean DDI for interval 1, interval 2, interval 3 and interval 4 were  $40.68 \pm 23.51$ ,  $18.50 \pm 6.940$ ,  $16.66 \pm 4.976$  and  $7.48 \pm 1.601$  mins respectively. The differences in the DDI of caesarean deliveries belonging to different categories were statistically significant. Chauleur et al.<sup>14</sup> reported the mean DDI of 46.84 min in their study. Mackenzie et al.<sup>15</sup> reported a DDI 27.4 minutes for crash caesarean deliveries (impending fetal death), 42.9 minutes for fetal distress and for cases without fetal distress it was 71.1 minutes. In another study by Sayegh et al.<sup>16</sup> showed mean DDI for emergency caesarean delivery was 39.5 minutes and for elective cases it was 55.9 minutes. Gita et al.<sup>13</sup> reported a mean DDI of 183.6 mins for all participants in the study and 122.1 min, 183.2 min, 299.8 min for category 1, 2 and 3 respectively.

A mere 2 cases (10%) could be delivered within 30 minutes all of which belonged to category 1 and 14 cases (70%) by 60 minutes. This observation was totally in contrast with the western standards, where in a study by Mackenzie et al.<sup>15</sup> approximately 40% emergency caesareans could be completed within 30 minute interval and bloom et al.<sup>17</sup> observed 62% of caesarean deliveries for non-reassuring fetal heart rate and 98% of caesarean deliveries for an obstetric

accident defined as umbilical cord prolapse, placental abruption or previa, or uterine rupture met the 30-minutes-or-less guideline. Chauleur C et al.<sup>14</sup> observed that around 50% patients could be delivered within 30 minute DDI and in the study by Chauhan et al.<sup>18</sup> 52% babies with fetal distress could be delivered within 30 minute interval. However Gita et al.<sup>13</sup> reported 18% of category I & II cases delivered within 60 minutes and 63% by 120 minutes. When the preparation step at which delays occurred and the reasons behind the same were analysed, it was observed that maximum delay happened between decision for caesarean delivery & shifting the patient to the OT. Most important factors causing delay in the study were delay in obtaining consent in 45 cases (45%) and preparation of OT table between surgeries in 39 cases (39%). Delayed referral though cannot be a cause for delay in decision to delivery interval but was considered to account for the cases where maximum damage was done before the decision for caesarean delivery was taken.

Gita et al.<sup>13</sup> reported maximum delay happened between decision for caesarean delivery & shifting the patient to the OT (Interval 1). Interval 1 accounted for nearly 72% of the entire DDI and the major reason was non availability of OT in 166 cases (73.5%). In 40 cases (15%), the delay was inevitable as the patients were immediately unfit and required some resuscitative measures to withstand anaesthesia. Nearly 78% patients in this group belonged to category I & II.

Sayegh et al.<sup>16</sup> reported observed that the maximum delay occurred in shifting the patient to the operation theatre and the delay was mainly due to non-availability of operation theatres. This delay was inversely proportional to the urgency of caesarean section, the lowest was for category I caesarean deliveries (76.47 min) and the highest was for category IV (753 minutes).

The present study specifically looked at the effect of DDI on neonatal outcome using APGAR scores, no of stillborn, need for admission into NICU, duration of NICU stay development of complications like HIE, sepsis and neonatal death. In the study, 75 babies were shifted to mothers side after caesarean delivery, 24 babies were shifted to NICU and 1 was still born.

Gita et al.<sup>13</sup> reported there were no complications in 130 babies, 141 were admitted to NICU and 9 perinatal deaths (One case admitted with intrauterine death, 3 fetal deaths occurred while waiting for LSCS and 5 neonatal death). When degree of asphyxia or presence or absence of neonatal complications was correlated with the mean DDI in category I & II caesareans, it was found that when the mean DDI exceeded 75 minutes, there was a 4.6 fold increase in the risk to the life of neonate. Since, the number of cases with a mean DDI of  $\leq 30$  minutes was only 5, risk reduction in neonatal complication could not be assessed statistically, but all those babies were shifted mother side with no neonatal complications. 8 babies who expired had a DDI of  $>75$  min.

Mean DDI for babies admitted to NICU was  $56.05 \pm 17.47$  min and Mean DDI for babies shifted to mother's side was  $89.47 \pm 27.92$  min.

Similar results were seen by Bloom et al.<sup>17</sup> where decision-to-incision intervals of 30 minutes or less were significantly associated with higher rates of fetal acidemia and need for intubation in the delivery room. Of 538 infants with indications for emergency caesarean delivery who delivered more than 30 minutes after the decision to operate, 95% did not experience any adverse outcomes. This paradoxical result could be explained based on the fact that obstetricians prioritized the cases where fetus was more at danger to be delivered within 30 mins and hence the incidence of complications was more in these cases.

I Z. MacKenzie et al.<sup>15</sup> reported an important finding of a trend of improving cord arterial pH values with more prolonged time from decision-to-delivery which was observed for deliveries with and without fetal distress, although the values were less acidotic among the latter babies. It is hard to explain the lower values found in the non-distressed babies born with short time from decision-to-delivery.

### Conclusion

The neonatal outcomes did not vary substantially between caesarean deliveries with a DDI of less than or equal to 30 minutes and those with a DDI of more than 30 minutes. It is difficult to meet the 30-minute target in any emergency caesarean delivery, and it is not an absolute requirement for preventing maternal and neonatal morbidity.

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