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Research Article

Factors affecting "decision to delivery interval" in emergency caesarean sections in a tertiary care hospital: a cross sectional observational study

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ABSTRACT

Background: The objective was to assess the waiting time and factors affecting the decision to delivery interval in an emergency caesarean section and to correlate it with neonatal and maternal outcomes.
Methods: This study was conducted in the Department of Obstetrics & Gynaecology at UCMS and GTB Hospital, Delhi which is a government supported tertiary care hospital located in East Delhi. Data of 275 emergency caesarean sections was collected and analyzed for decision to delivery interval (DDI) along with the causes of delay and maternal and fetal outcomes.
Results: The mean DDI was 183.24 minutes for all 275 cases and was 122 ± 89min for category I caesarean sections (crash caesareans). The major cause of delay was non availability of operation theatres due to long list of waiting caesareans sections. When the mean DDI exceeded 75 minutes, there was a 4.6 fold increase in the risk to the life of neonate while the maternal outcome was not significantly affected.
Conclusion: DDI of 30 minutes is difficult to achieve even for urgent caesarean sections in government based set up of a developing nation, therefore a more reasonable time frame of 60-75 min may be justified for emergency caesarean sections under similar set up.

Keywords: Caesarean section, Decision to delivery interval (DDI)

INTRODUCTION

A caesarean section is a complex multidisciplinary procedure with inherent risks for mother and baby. Many tasks, some of which are quite complex, are required to be executed before performing an emergency caesarean section. The procedure needs at least seven professionals—an anaesthetist and a skilled assistant, an obstetrician and an assistant, a theatre nurse or midwife to assist with the operation, a midwife, and a paediatrician to take the baby. The staff has to be assembled before the necessary complex tasks can be undertaken.

When an urgent caesarean section is performed, the National Institute for Clinical Excellence clinical guideline on electronic fetal monitoring recommends that "in cases of suspected or confirmed acute fetal compromise, delivery should be accomplished within 30 minutes.[1] This places a great responsibility on the shoulders of clinicians faced with delivering babies in an emergency.

Achieving this standard in government set ups is a highly difficult task and as literature states, the current recommendations for the interval between decision and delivery are not being achieved in routine practice, also failure to meet the recommendations does not seem to increase neonatal morbidity.[2,3] In yet other studies, it has been suggested that rapid delivery may in itself be dangerous for the fetus.[4,5]

Some of the major factors which negatively influence this 30 minutes' target of "Decision to Delivery Interval" (DDI) are:

1) Increase in patients' load leading to a long waiting list for surgery.
2) Limited number of operation theatres.
3) Limited surgical staff including surgeons, anaesthetists, scrub nurses and theatre technical staff in emergency hours.
4) Lack of coordination among above teams.
5) Transportation delay while shifting the patient from labour rooms to operation theatre.

An insight into the above factors would help us identify those which are mainly responsible for the delay in decision to incision time and also devising reforms to improve such delays. This objective evidence would also enable us in setting realistic standards and clinical guidelines in order to provide good care to our patients. The present study was thus designed to identify factors and areas which affect the "decision to delivery interval" (DDI) and also to evaluate maternal and neonatal outcome with respect to this interval**.**

METHODS

Study setting: This study was conducted in the Department of Obstetrics & Gynaecology at the University College of Medical Sciences and Guru Teg Bahadur Hospital, which is a tertiary care hospital located in the Eastern part of the capital city of Delhi, India.

Study design: Cross sectional observational study.

Subjects: Patients undergoing emergency caesarean delivery for either maternal or fetal indications over 2 months' period (1st Dec 2012 to 31st Jan 2013) were recruited for the study. Patients qualifying for elective caesarean section but reporting in labor rooms were also included in the study whereas patients admitted in the wards for planned caesarean sections and cases where complete data was not available for analysis were excluded from the study.

The indications for LSCS were categorized as under:

- Category I: Immediate threat to life of woman or fetus.
- Category II: Maternal or fetal compromise but not immediately life threatening.
- Category III: Needing early delivery but no fetal or maternal compromise.
- Category IV: Patients who were actually cases for elective LSCS but reported in emergency hours in latent or early labor at term.

Once the decision for caesarean delivery was taken, patient was inducted into the study and all relevant details of history noted from the case sheet. In addition the following data were recorded:

1. Calculation of DDI

Total decision to delivery interval (DDI) was calculated as the sum of the following intervals:

a. Interval between decision of caesarean section and shifting the patient from the labour room to the pre-operative area of the OT (Interval-1).
b. Interval between receiving the patient by OT team and shifting the patient to the operation table (Interval-2).
c. Time taken for induction of anaesthesia (Interval-3).
d. Interval between induction of anaesthesia and delivery of the baby (Interval-4).

Although the optimal decision to delivery interval is 30 min especially for category I cases, an interval of more than 15 minutes at any of the above steps was considered as delay and cause of delay was noted.

2. Cause of Delay

Factors resulting in prolonged interval at each step were noted separately for interval 1-3. These factors were grouped and coded "0-5", "0" was assigned if no delay was noted.

1) Non availability of OT whether due to another ongoing surgery or the OT not yet ready after a previous surgery.
2) Delay while arranging or transfusing blood or controlling BP when patient was considered unfit for anaesthesia.
3) Delay due to lack of manpower including surgeons, anaesthetists, staff nurses, nursing orderlies & sweepers.
4) Delay due to non availability of relatives to give consent
5) Delay due to malfunctioning apparatus, non availability of instruments, sutures, drugs, technical problems etc.

As the prolongation of interval 4 i.e. time from induction of anaesthesia to delivery of fetus would be generally due to procedural delay related to surgery, like previous surgical adhesions, difficulty in extraction of baby etc these causes were not individually categorized and coded.

1) APGAR score was noted at 1 and 5 minutes after birth, details of neonatal complications if any and whether the baby was transferred to NICU or mother side was noted.
2) Any maternal complication due to delay in surgery was also documented.

Statistical Analysis

Qualitative and quantitative data were analysed by Chi square and Student 't' test respectively and logistic

regression test were used to assess the most important variable affecting maternal &/or neonatal outcome.

RESULTS

During this period of 2 months, there were 1850 deliveries of which 390 were by LSCS giving a rate of 21.08% for this period. 12 LSCS were elective cases and hence excluded. Thus 378 LSCS qualified to be enrolled in the study.

Amongst 378 caesarean deliveries, 275 cases for whom complete data were available, finally formed the study group (72.75% of all LSCS).

The age of the study subjects ranged from 19-35 years with 174 (63.3%), being <25 years. Primigravida and Para1 women constituted nearly 85.2% of the cases. Majority of cases (60.4%) were at term gestation i.e. 37-40 weeks.

The decision to delivery interval (DDI) varied very widely between the categories and even within each category. The mean DDI for all the categories pooled together was 183.24 minutes. An increasing trend in mean DDI was observed from Category 1 to Category 4 cases. The mean DDI for category I caesarean section was the lowest 122 ± 89min and the highest DDI was for category IV caesarean sections. The mean DDI of categories I&II taken together was 134.8 min and that for Categories III &IV was 281.1 min and the difference was statistically significant (Table 1).

The mean interval at all steps was much longer than the stipulated cut off for the present study. The longest delay was observed at interval 1 in all the categories with a mean of 132.4±198.6 min when all cases considered However, while intervals 2, 3, 4 were comparable across all categories (Table 1).

A decision to delivery interval of 30 minutes or less could be achieved only in 5 out of 275 cases (1.8%) and all these 5 cases were category 1 sections. DDI of 31-60min, 61-75min and 76-90 min were achieved in 32 cases (12%), 36 cases (13.45%) and 35 cases (12.72%) respectively (Table 2).

Table 1: Category wise distribution DDI and other intervals.

Cesarean section category	DDI (min)	Interval-1 (min)	Interval-2 (min)	Interval-3 (min)	Interval-4 (min)
I (n=146)	122.1±89.2	76.47±90.7	21.0±14.3	17.4±10.2	12.3±8.3
II (n=38)	183.2±201.8	152.94±172.76	20.1±12.5	27.4±35.4	14.8±11.7
III (n=83)	299.8±200.7	181.5±201.5	22.8±13.6	16.0±9.3	14.8±9.3
IV (n=8)	812.6±467.0	753.7±491.0	23.4±39.0	19.4±13.7	12.6±5.7
All categories	183.6±204.1	132.4±198.6	21. 0±14.3	18.5±16.5	13.4±9.0
I+II	**134.8±123.7**	**82.2±103.5**	**20.1±12.5**	**19.5±16.4**	**12.9±9.3**
III+IV	**281.1±285.1***	**229.2±288.0$^{\#}$**	**22.8±17.2$^{\Psi}$**	**16.3±9.5$^{\Psi}$**	**14.5±8.8$^{\Psi}$**

*p<0.05, $^{\#}$p<0.001, $^{\Psi}$p>0.05

Table 2: DDI of all categories.

DDI	Total	Category I	Category II	Category III	Category IV
<30 min	5	5	0	0	0
31-60 min	32	27	1	4	0
61-75 min	36	22	8	6	0
76-90 min	35	19	9	7	0
91-120 min	38	21	4	13	0
>120 min	129	52	16	53	8
Total	***275***	***146***	***38***	***83***	***8***

Only 37 (14%) patients had a DDI ≤60 minutes. Considering category I & II cases it was observed that by 60 minutes of decision of LSCS only 18% cases had delivered and even up to 120 minutes, delivery could be accomplished in only 63% cases.

The stipulated 15min interval at each step was exceeded at every step being highest (82%) for interval 1 and the lowest for interval 4 (24%).

"Interval-1" which was the interval from decision of LSCS to shifting the patient to OT formed a major portion of the total DDI for all categories and was 2 - 3 times longer than intervals 2 and 3 grouped together. The mean interval 1 for category II was double the value of that for category I and this was statistically significant (Table 3).

Table 4 represents various factors which were responsible for delay in "Interval-1". While there was no delay in 49 cases (18%), of the remaining 226 cases, non availability of OT was the reason in 166 cases (73.5%). 95 cases amongst these (57%) were of category I & II.

In 40 cases (15%), the delay was inevitable as the patients were immediately unfit (fever, hypotension, severe hypertension, DIC etc.) and required some resuscitative measures to withstand anaesthesia. Nearly 78% patients in this group belonged to category I & II.

Table 3: Mean values of various intervals expressed as percentage of mean DDI.

Category	DDI	Interval 1	%of DDI	Interval 2 +3	%of DDI
I	122	76	62%	38	31%
II	183	153*	84%	47	26%
All	183	132	72%	40	22%
I+II	135	82	61%	40	30%

*p<0.05 DDI and Intervals expressed as mean
All values rounded off to the nearest whole number.

Table 4: Cause of delay for interval-1.

Cause (Code)	Total	Category I	Category II	Category III	Category IV
No delay (0)	49	37	6	6	0
OT busy (1)	166	75	20	65	6
Arranging/transfusing blood/fluids (2)	40	24	7	7	2
Manpower shortage (3)	6	2	3	1	0
Relatives not available (4)	8	5	1	2	0
Logistic issues / technical problems (5)	6	3	1	2	0

There was no delay in "Interval -2" (time taken to shift the patient from the pre-op room to the OT table) in 144 cases (52.3%). The main causes of delay in the remaining 131 cases were non availability of relatives (64/131 – 49%) to either give consent or arrange for blood or drugs out of stock in the hospital or shortage of manpower within the OT (38/131 - 29%).

Once on the OT table, there was no delay in induction of anaesthesia (Interval -3) in 163 cases (59%). But the remaining 112 cases (41%) faced delay, of which in 90/112 cases (80%), the reason was at the level of OT technical staff not being ready with anaesthetic equipments/drugs/tray or due to technical problems in inducing anaesthesia, 67% in this group belonged to category I & II.

Among category I caesarean sections, there were 54 cases (37%) who faced delay at all the levels while 96 cases (66%) faced delay only while waiting for the operation theatre to get free.

There were no complications in 130 babies who were shifted out of the OT with the mother while 141 were transferred to NICU either for observation or because of some neonatal complication.

There were 9 perinatal deaths in the present study. One case was admitted with intrauterine death, while 3 fetal deaths occurred while waiting for LSCS. There were 5 neonatal deaths in NICU. When degree of asphyxia or the neonatal complications were correlated with DDI there was no significant difference. However, when only cases with severe asphyxia were compared, the difference in DDI was significant (Table 5).

Table 5: Category wise neonatal outcome.

Cesarean section category	Baby status at birth			Neonatal complications						
	Mother side	NICU	Stillborn	Nil	Mild asphyxia	Moderate asphyxia	Severe asphyxia	Hypoxic ischemic encephalopathy	Sepsis	Neonatal death
I (n=146)	48	95	4	87	42*	10*	3*	4*	6*	3*
II (n=38)	22	15	0	29	7	1	1	0	1	1
III (n=83)	53	30	0	73	4	4	1	0	0	1
IV (n=8)	7	1	0	8	1	0	0	0	0	0
Total	**130**	**141**	**4**	**197**	**54**	**15**	**5**	**4**	**7**	**5**
DDI (Min)				**174.3**	**197**	**217**	**350**			**128.4**

*All Complications in category 1 Significant p <0.05

When 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 ≤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.

There was no significant increase in the maternal complication rate with increase in the mean DDI. Among 275 cases, 10 mothers (3.6%) faced complications, 5 mothers had scar complications in the form of either thinned out scar or scar dehiscence, 3 had atonic and one patient required post operative ventilation due to anaesthetic complications. There was no maternal death.

DISCUSSION

The aim of this study was to assess the decision to delivery interval (DDI) and evaluate the causes of delay in emergency caesarean sections in University College of Medical Sciences & Guru Teg Bahadur Hospital, Delhi, a tertiary care centre.

Mackenzie et al,[6] reported a DDI 27.4 minutes for crash caesareans (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,[7] mean DDI for emergency sections was 39.5 minutes and for elective cases was 55.9 minutes.

A mere 18% of category I & II case could be delivered within 60 minutes and by 120 minutes it was 63%. This observation was totally in contrast with the western standards, where in a study by Mackenzie et al,[6] approximately 40% emergency caesareans could be completed within 30 minute interval, Chauleur C et al[8] observed that around 50% patients could be delivered within 30 minute DDI and in the study by Chauhan et al,[9] 52% babies with fetal distress could be delivered within 30 minute interval

The mean DDI for cases with fetal distress (FHR <120 min) was around 100 minutes. Among 3 babies with cord prolapse 2 were delivered within 30 minute interval, thus one can conclude that achieving a DDI of 30 minutes is difficult but not an impossible task and it highly depends on the prioritization of the emergency by the treating clinician and rest of the team involved.

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 LSCS & 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 (severe anemia, fever, hypotension, severe hypertension, DIC etc.) and required some resuscitative measures to withstand anaesthesia. Nearly 78% patients in this group belonged to category I & II.

Delay due to non availability of operation theatres, has also been reported by Sayegh et al[7] who also observed that the maximum delay occurred in shifting the patient to the operation theatre. This delay was inversely proportional to the urgency of caesarean section, the lowest was for category I sections (76.47 min) and the highest was for category IV (753 minutes).

Besides non availability of OT, other important causes of delay in shifting the patient to OT were time taken in arranging blood for the patient, absence of relatives, unavailability of nursing orderly to shift the patient. These findings indicate that the number of OT tables along with medical and paramedical staff was not in proportion to the patient load in this hospital.

While waiting for LSCS intrauterine fetal demise (IUFD) occurred in 3 cases. There were 140 neonates initially shifted to NICU of which 74 babies had varying degrees of asphyxia. The complications were significantly more when DDI was >75 minutes. This is in concordance with the findings of Thomas J et al,[10] who concluded that 30 minute DDI is not an absolute threshold in influencing baby outcome, but a decision to delivery interval of more than 75 minutes is associated with a poorer neonatal outcome.

From the present study, it is obvious that it is difficult to achieve 30 minute goal in every emergency caesarean section and it is also not an indispensible measure to prevent maternal or neonatal morbidities. Also all the fetal distress cases included under category I may not be truly of this category as apart from FHR monitoring, there is no facility to document fetal acidosis or imminent threat to fetal life. Most cases would in fact be of category II and hence most outcome measures have been calculated for the two categories pooled together.

A recommendation of a more practical time frame of 60-75 minutes may be justified for majority of cases under similar set up. At the same time, it is necessary for each emergency obstetric unit, to effectively triage emergency caesarean deliveries and develop the capability of commencing such cases as fast as possible.

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