ORIGINAL ARTICLE

Decision to Delivery Interval of Emergency Caesarean Sections: Evaluating Adherence to Timeframe and its Impact on Feto-Maternal Outcomes

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ABSTRACT

Objective: To evaluate the decision to delivery interval (DDI) of category-1 and category-2 emergency caesarean section (ECS) and its effect on neonatal and maternal outcomes.

Study Design: Cross-sectional study.

Place and Duration of Study: The study was carried out at Combine Military Hospital (CMH), Kharian, Pakistan from February 2022 to February 2023.

Methods: Data from 332 patients who underwent emergency caesarean section (ECS) at a tertiary care hospital were collected on a structured proforma and analyzed. Feto-maternal outcomes were dependent, and time to decision to delivery interval were independent variables.

Results: Out of 332 ECS, 126 were Category 1, and 206 were category 2. The percentages of emergency caesarean section (ECS) done within the recommended DDI were 39.5% for category 1 and 20.5% for category 2. The median (IQR) of DDI was 45 (37–54) min and 90 (75–98) min for category 1 and category 2. Eclampsia, fetal distress and failed progress of labor were the most typical indications. In both types, there was no statistically significant poor neonatal outcome related to APGAR at 1 min and 5 min. Delays were associated with more cases of post-operative fever 74 (36) and 22 (13.3) in category 2 than in category 1 ECS.

Conclusion: Our study found delays in the decision-to-delivery interval (DDI) for both category 1 and category 2 emergency Caesarean sections. However, no statistically significant association was found between neonatal and maternal outcomes.

Keywords: *Decision Making, Fetal Hypoxia, Outcome Assessment.*

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Introduction

Benjamin Franklin's famous saying, "Time is money," highlights the importance of time. In obstetrics, the time it takes to deliver care is a key quality indicator, as delays can have a negative impact on the health of newborns and mothers.[1] Caesarean section, the most common surgery, can be planned or unplanned. Planned are scheduled in advance, while unplanned are performed during a medical emergency. National confidential enquiry into patient outcome and death (NCEPOD)[2] classifies caesarean section into four categories. In category-1 caesarean section, there is an immediate risk to the mother or fetus, and delivery is expedited within 30 minutes of decision; in Category 2, there is a fetal or mother risk which is not severe and immediate and delivery is planned within 75 minutes of decision; in Category 3, there is no risk to the mother and fetus but require delivery within 24-hours of decision; in Category 4, there is no feto-maternal risk and planned delivery as convenient.

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Time-bound caesarean sections include category 1 (emergent) and category 2 (urgent), delays at various levels from decision, preparation, and delivery can have maternal or fetal consequences.

Observing and identifying the time to perform an emergency Caesarean section is a critical quality improvement measure. It can help to ensure that international policies are being applied, that the time to delivery is being reduced, and that obstetric care is being improved overall.[3,4]

Therefore, this observational study is conducted to provide valuable insight into the DDI and its impact on maternal and neonatal outcomes.

Methods

The Cross-sectional study was carried out at Emergency Caesarean sections category 1 and category 2 of Combine Military Hospital (CMH), Kharian, Pakistan, from February 2022 to February 2023 after obtaining an ethical certificate from the ethical review committee, reference no: (ERC/01/06/23) held on June 01, 2023. As it is an observational study patient's informed consent was not taken. The data were gathered from hospital documents kept at the maternity ward and operation theatre from February 2022 to February 2023 and studied jointly.

Inclusion criteria: The study included 332 patients with a singleton pregnancy of more than 24 weeks and underwent an emergency Caesarean section, either Category 1 or 2.

Exclusion criteria: Patients who have undergone Category 3, and 4 cesarean sections or diagnosed with fetal anomaly, multiple pregnancies, or incomplete documentation were excluded.

Data were collected on a structured form, including the patient's age, gravidity, parity, duration of pregnancy, indications for Category 1 and 2 emergency Caesarean section, mode of anaesthesia (spinal or general), maternal outcomes (eventful or uneventful), and hospital stay. Perinatal outcomes by APGAR scores at 1 and 5 minutes, with scores less than 7 considered unfavorable and scores of 7 or higher considered favourable. Decision Delivery Interval (DDI) was calculated as the total time from the decision to perform an emergency Caesarean section by the attending obstetrician and gynecologist to the delivery of the baby, as recorded by the operating theatre nurse.

The operational definition used for categories of emergency cesarean section are:

Category 1: An immediate threat to the life of the woman or fetus, which requires the delivery of the fetus within 30 minutes of the decision.

Category 2: Maternal or fetal compromise that is not immediately life-threatening, but requires the delivery of the fetus within 75 minutes of the decision.

Decision Delivery Interval (DDI) is the total time taken from the decision to perform an emergency Caesarean section (ECS) by the attending obstetrician and gynaecologist, as recorded in the preoperative order, to the delivery of the baby. The collected data was analyzed using SPSS version 16. Descriptive data for continuous variables was presented as median (interquartile range) or mean (standard deviation). Categorical variables were presented as numbers and percentages. A *p*-value of less than 0.05 was considered statistically significant, with a confidence interval of 95%.

Results

A total of 2,131 deliveries by Caesarean section were conducted during the study period. Of these, 1,284 were elective, and 847 were emergency. After reviewing the medical documents, 332 women undergone Category 1 and Category 2 emergency caesarean sections were included in the study. The remaining 515 were excluded from the study due to multiple pregnancies or incomplete documents.

Out of the selected 332(100%) ECS, Category 1 were 126(38%) and 206(62%) category 2 respectively. The commonest indications in category 1 were fetal distress, eclampsia, and antepartum hemorrhage.

While suspicious CTG with the slow progress of labor and oligohydramnios intrauterine growth retardation with abnormal Doppler in category 2 ECS.

In both groups, majority of the patients, 201(59.6), were primipara and 131(38.9) multipara. The duration of pregnancy at 37 weeks was recorded in 210(62.3) and preterm less than 37 weeks in 122(36.2). Spinal anesthesia was used in 292(71.2) as compared to general anesthesia in 40(28.8) (Table 1).

Regarding DDI, the study found that only 30.95% of

Table 1: Demographic variables of ECS

Variables	DDI total 332(100)	Percent	Mean (SD)
Age (years)			
<35	237	71.3	9.13 (4.5)
>35	95	28.6	6.13 (4.0)
Gravida			
Primigravida	201	59.6	7.64 (4.6)
Multigravida	131	38.9	7.21(4.0)
Gestational age (weeks)			
Preterm	122	36.2	7.01 (3.5)
Term	210	62.3	8.05 (4.3)
Types of anesthesia			
Spinal anesthesia	292	71.2	8.3 (6.1)
General anesthesia	40	40	40

Category 1 emergency Caesarean sections (ECS) and 20.5% of Category 2 ECS were performed within the recommended timeframe of 30 minutes and 75 minutes, respectively. Moreover, the median (interquartile range) of DDI was 45 (37-54) and 90 (75-98) minutes (Figures 1 and 2).

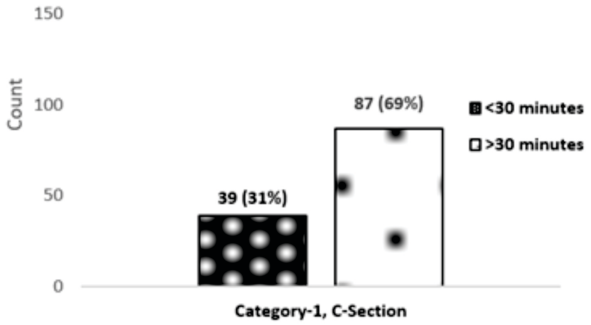

Fig 1: Decision to Delivery Interval Category-1, C-Section (n=206)

In Category 1 ECS, 23 babies had an APGAR score of less than 7 at 1 minute of birth. Two-thirds of these babies (22) were delivered after 30 minutes of the decision to perform the emergency delivery. The likelihood of delivering a baby with a low APGAR score was 65% less when delivered within 30 minutes of the DDI (Table 2). The meconium staining

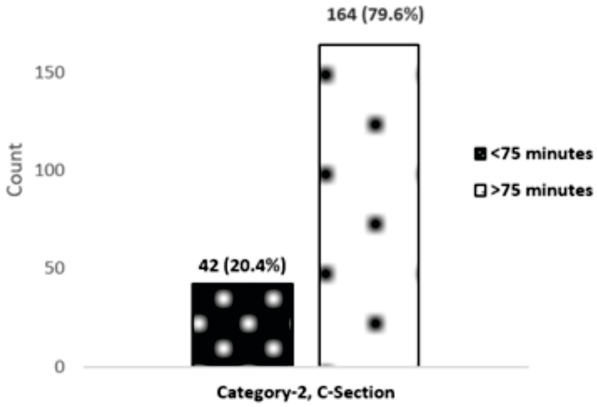

Fig 2: Decision to Delivery Interval Category-2, C-Section (n=206)

of the amniotic fluid was present in 11.1% of the babies. The chance of having meconium staining was 82% less when the babies were delivered within 30 minutes of the DDI. Eleven babies (14.1%) required intensive care (Table 2).

In Category 2 emergency Caesarean sections (ECS), 32.04% of the babies had an APGAR score of less than 7 at 1 minute of birth. Of these babies, 36.2% were delivered after 75 minutes of the decision to perform the emergency delivery. The likelihood of delivering a baby with a low APGAR score was 32%

Table 2: Neonatal outcome Category-1 C-section

Neonatal outcomes	Within 30 min (n%)	After 30 min (n%)	Total (n%)	*p*-value
One-minute Apgar score				
<7 score	10 (26)	19 (22)	29 (23)	0.021
≥7 score	29 (74)	68 (78)	97 (77)	
Five-minute Apgar score				
<7 score	12 (31)	16 (18)	28 (22)	0.372
≥7 score	27 (69)	71 (82)	98 (78)	
Presence of meconium				
Present	6 (15.4)	8 (9)	14 (11.1)	0.020
Absent	33 (84.58)	79 (91)	112 (88.9)	

Table 3: Neonatal outcome Category-2 C-section

	Decision to deliver			
Neonatal outcomes	**Within 75 min (n%)**	**After 75min (n%)**	**Total n (%)**	***p*-value**
One minute Apgar score				
<7 score	27 (27.5)	39 (36.2)	66 (32.04)	0.320
≥7 score	71 (72.5)	69 (63.8)	140 (67.96)	
Five minute Apgar score				
<7 score	15 (15.38)	19 (17.6)	34 (16.5)	0.372
≥7 score	83 (84.7)	89 (82.4)	172 (83.5)	
Presence of meconium				
Present	26 (26.5)	24 (33.3)	50 (24)	0.031
Absent	72 (73.5)	84 (77.7)	156 (76)	

less when the baby was delivered within 75 minutes of the DDI (Table 3).

The meconium staining was present in 24% of the babies. Most of these cases (39) appeared in babies delivered after 75 minutes of the DDI. The chance of having meconium staining was 21% less when the babies were delivered within 75 minutes of the DDI. Hence, the delayed DDI is associated with an increased risk of low APGAR scores and meconium staining in Category 2 ECS and is not statistically significant (p=0.07). Regarding the maternal outcomes, there are more cases of post-operative fever 74 (36) vs 22 (13.3) in category 2 than in category 1 ECS (Figure 3 and 4).

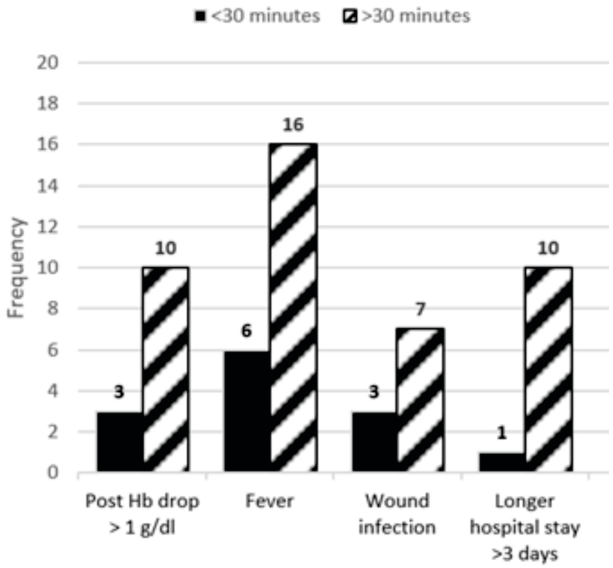

Fig 3: Maternal Outcome Category-1, Emergency Caesarean Sections (n= 206)

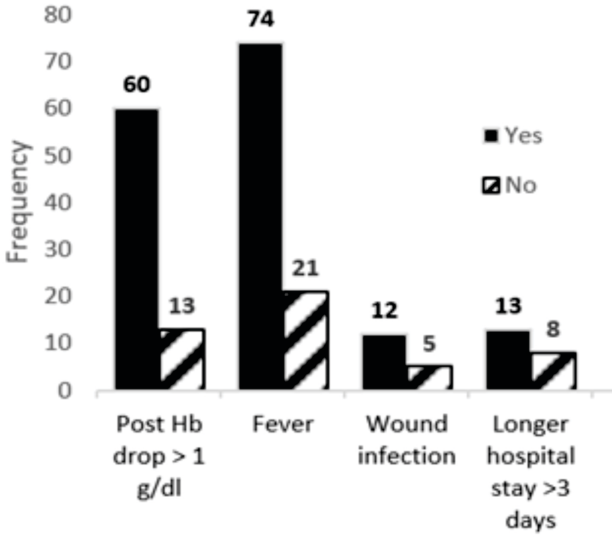

Fig 4: Maternal Outcome Category-2, Emergency Caesarean Sections (n= 206)

The decision-to-delivery interval (DDI) is a critical period affecting maternal and neonatal outcomes in emergency cases. The present study found that only 39.5% of Category 1 emergency Caesarean sections (ECS) were performed within the recommended DDI of 30 minutes. This is similar to the findings of a study conducted in Oman.[4]

In contrast, only 5.7% of Category 1 ECS were performed within 30 minutes in other studies.[5,6] The findings of the present study for Category 2 ECS, with 20.5% of DDIs less than 75 minutes, are comparable to 48%[7] in another study.

Similar to other studies, the commonest indication for ECS in our study is fetal distress or non-reassuring FHR pattern in 42% of the cases.[8-10]

The mode of anesthesia can have an impact on the decision-to-delivery interval (DDI). The study found that spinal anesthesia was used in 71.2% of Category 1 emergency Caesarean sections (ECS), lower than the 97.2% reported in a study by Tashfeen. General anesthesia was used in 28.8% of cases, comparable to the 26.3% reported in a study by Wong.[11] A prospective study by Elkafrawi et al. found that general anesthesia was significantly associated with shorter DDIs than regional anesthesia for emergency Caesarean section.[11,12]

Like other studies, our study found no significant difference in neonatal outcomes after delays in decision-to-delivery interval (DDI).[13]

Andisha and Cronje[14] have identified that delays of more than 75 min were considerably linked with poor feto-maternal outcome in ECS. In index study, newborns born with delays more than 30 minutes had no statistically significant adverse outcome, which is also supported by Heller G et al. and Temesgen MM et al. [15,16]

In our study, 66 (32.04%) newborns had a low Apgar score of less than 7 at 1 minute of birth. Of these, 39 (36.2%) were delivered after 75 minutes of the decision to perform the emergency Caesarean section. The probability of a baby being born with a low Apgar score of less than 7 was 32% less when they were delivered within 75 minutes of the decision. These findings are similar to studies by Bishop D and Mamaru.[17,18]

Among 126 patients who had category 1 ECS with DDI delays of more than 30 min, the chances of post-operative complications include a drop in Hemoglobin >1g/dl in 10%, fever in 22%, wound infections in 7%, prolonged hospital stay of more than three days in 5%. Relatively more cases of maternal post-operative complications were seen among 206 patients of category 2 ECS with DDI more than 75 min like a drop in Hemoglobin >1g/dl in 60%, fever in 74%, wound infections in 12%, prolonged hospital stay of more than three days in 13%. Other studies have also demonstrated that 27% of mothers had one or more complications after delayed DDI for ECS.[19,20]

All obstetric units must work to improve the time to delivery in emergency Caesarean sections. This can be done by recognizing and addressing inadequacies implementing regular emergency team drills, audits[21], and prioritization of cases based on the urgency of the feto-maternal situation.

Conclusion

Our study found delays in the decision-to-delivery interval (DDI) for both category 1 and category 2 emergency Caesarean sections. However, there was no statistically significant effect on maternal and neonatal outcomes.

Limitations of Study

The study has limitations, including the lack of follow-up for the long-term effects of delays in the decision-to-delivery interval (DDI) on the mother and fetus. Further studies are needed to identify the factors associated with delays, such as the time of day of surgery, the time taken for patient preparation, infrastructure challenges for transfer of the patient to the operating theater, the time of induction of anesthesia, and the skill of the operating surgeons. Moreover, in cases of fetal distress, the non-availability of umbilical cord blood pH analysis can affect the decision for urgent delivery.

Further studies should be conducted to determine the decision-to-delivery interval (DDI) in various specific subgroups to evaluate the actual causes of delay in detail. Further research will be needed to identify factors contributing to delayed DDI and develop strategies to reduce delays.

Authors Contribution

SP: Idea conception, study designing, data collection, data analysis, results and interpretation manuscript writing or proof reading

SW: Data collection, manuscript writing and proof reading

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