The Impact of Out-of-Working-Hours Timing of Cesarean Sections on the Decision-to-Incision Interval

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Background: The decision-to-incision (D-I) interval in cesarean sections is clinically relevant and has detrimental effects on neonatal outcomes when the procedure is delayed.

Objective: To evaluate the effect of decision timing (during or outside of working hours) on the D-I interval on emergency cesarean sections and neonatal outcomes.

Design: A Retrospective Cohort Study.

Setting: Bahrain Defence Force Hospital, Bahrain.

Method: Patients who underwent emergency cesarean sections from January 2018 to June 2018 were reviewed and divided into two groups: those whose cesarean sections occurred outside of working hours (Group I) and those that occurred during working hours (Group II). The following were documented: maternal age, parity, gestational age, time of the decision to perform the cesarean, time of anesthesia, time of actual skin incision, delivery time, baby weight, gender, Apgar score, Neonatal Intensive Care Unit (NICU) admission, and length of stay in the NICU. The D-I interval of emergency cesarean sections was our primary outcome and the neonatal outcome was our secondary outcome. Data were analyzed using StatsDirect software. A P-value of less than 0.05 was considered statistically significant.

Result: One hundred eighty-nine patients were delivered by emergency cesarean section; 138 (73%) patients were in Group I and 51 (26.9%) were in Group II. Anesthesia duration was 7 minutes in Group I and 8 minutes in Group II (P=0.23). The mean duration of surgery in Group I was 58.3 minutes, whereas in Group II it was 52.9 minutes (P=0.21). Thirty-eight (27.5%) patients in Group I and 16 (31.4%) in Group II were category 1 indications. Surgery for category 2 indications took longer in Group II than in Group I, 37.9 minutes compared to 26.9 minutes, (P=0.0004). Similarly, the time interval for category 3 was longer in Group II compared to Group I; however, this difference was not statistically significant (P=0.09). The birth weight, NICU admission, length of stay in the NICU, and Apgar score values were similar between the two groups.

Conclusion: The D-I interval did not differ between the category 1 cesarean deliveries that occurred during working hours and those that occurred outside of working hours; however, category 2 cesareans were delayed during working hours. There were no differences in neonatal outcomes.

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The decision-to-incision (D-I) interval is defined as the interval from the time of the decision to perform cesarean delivery to the time of actual skin incision. It has been established by the American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) that in cases of emergency cesarean sections, the D-I interval changes are based on the indication category[1]. In the past, cesarean sections were classified as either "emergency"

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or "elective". In 2010, the RCOG further classified the urgency of cesarean section into 4 categories, depending on the level of maternal and fetal compromise. Category 1 is when there is an immediate threat to the life of the mother or fetus. Category 2 is when there is a maternal or fetal compromise that is not immediately life-threatening. Category 3 comprises cases where the fetal or maternal health is not endangered but demands early delivery. Category 4 comprises of non-emergency or planned deliveries that can be performed according to the time suitable to the mother and maternity services[1,2].

Although a relation to fetal outcome has not been established, the RCOG suggested that the D-I intervals in categories 1 and 2 are at most 30 minutes and 75 minutes, respectively[2]. RCOG has used the 30-minute and 75-minute rules as a clinical assessment rather than as a judgment of the performance of the hospital or staff[3]. It can be challenging for obstetric units to achieve this interval due to many factors. In a systematic review of the literature on the achievability of 30-minute D-I intervals, the author concluded that delivery within 30 minutes was not achieved in a substantial proportion of cases[4]. One of the main factors that increase D-I intervals is a delay in arranging the operating theater and transporting the patient[2]. Various studies have established that only 40-65% of developed countries manage to deliver within the 30-minute period, whereas in developing countries, only 0-20% of cesarean procedures are performed within the proposed limit[5].

The D-I interval is clinically relevant as it can have detrimental effects on neonatal outcomes; however, the clinical significance of failing to achieve this standard remains uncertain[4].

The aim of this study is to evaluate the effect of decision timing (during or outside of working hours) on the D-I interval on emergency cesarean sections and neonatal outcomes.

METHOD

Emergency cesarean deliveries from January 2018 to June 2018 were included in the study. The patients were divided into two groups: Group I, the decision was made outside working hours; Group II, the decision was made during working hours. All patients with missing records were excluded. The working hours were from 7:00 hours to 14:00 hours; weekends (Friday and Saturday) and public holidays were considered outside working hours. The D-I interval in our analysis implied the time interval between the documented timing of the decision to perform an emergency cesarean in the electronic system up to the time that the actual skin incision was made.

The emergency procedures included cesareans performed for umbilical cord prolapse, placental abruption, placenta previa with hemorrhage, non-reassuring fetal heart rate pattern, uterine rupture, and fetal distress. The emergency coding for emergency cesarean sections at the BDF Hospital are as follow: Category 1: acute direct danger to the life of the woman or fetus, incision to be taken in less than 30 minutes. Category 2: maternal or fetal condition that is not life-threatening, the incision can be taken in less than 60 minutes. Category 3: demands early delivery but there is no maternal or fetal possessed effect, allowed delivery before 240 minutes. Category 4: delivery to be done at a time convenient to the woman and the cesarean section team, delivery should be within 1440 minutes.

Maternal age, parity, gestational age, indication for surgery, decision time, incision time, duration of surgery, delivery time, Apgar score, neonatal intensive care unit (NICU) admissions, and length of stay in the NICU were documented. The neonatal outcomes for all the deliveries were recorded.

The collected data were analyzed using the StatsDirect statistical package, version 3.1.22. A two-sided, unpaired t-test was and Mann-Whitney U test were used. The Chi-squared test was used to assess any differences. The Fisher-Freeman-Halton exact test was used in crosstabs. P-values less than 0.05 were considered statistically significant.

RESULT

One hundred eighty-nine patients were included in the study; 138 (73%) patients had their surgeries done outside working hours (Group I) and 51 (26.9%) patients had surgeries within working hours (Group II). Both groups were comparable with regards to nationality, maternal age, number of previous pregnancies and previous deliveries, gestational age, and the presence of previous cesarean sections, table 1.

Table 1: Patient's Characteristics

	Surgery Out of Working Hours (group 1)(N=138)	Surgery within Working Hours (group 2) (N=51)	P-value
Nationality N (%)			
Bahraini	80 (58%)	27 (52.9%)	0.54***
Non-Bahraini	58 (42%)	24 (47.1%)	
Maternal age years mean ± SD	31.1±5.5	31.5±6.5	0.68*
Previous pregnancy mean ± SD	3.1± 2.4	3.4±2.8	0.54*
Previous delivery mean ± SD	1.7± 2.1	1.9±2.3	0.67*
Gestational age in weeks Median	37	37	
Previous caesarean mean ± SD	0.4± 0.7	0.6±0.8	0.12*

The anesthesia duration was 7 minutes in Group I and 8 minutes in Group II (P=0.23). One hundred nineteen (86.2%) in Group I and 46 (90.2%) in Group II received spinal anesthesia. Seventeen (12.3%) in Group I and 5 (9.8%) in Group II received general anesthesia, but this difference did not reach statistical significance (P=0.89). In Group I, the mean duration of surgery was 58.3 minutes and in Group II, 52.9 minutes (P=0.21). Category 1 indications comprised 38 (27.5%) in Group I and 16 (31.4%) in Group II. Overall, the rates of the different indication categories were comparable between the two groups. There was no difference in the D-I interval between the 2 groups; however, when analyzing the interval based on the category, we noticed that surgery for category 2 indications had longer intervals during working hours, compared to those outside working hours, 37.9 minutes compared to 26.9 minutes, respectively (P=0.0004). Similarly, for category 3, the time interval was longer during working hours than outside working hours, but this difference was not statistically significant (P=0.09), see table 2.

Table 2: Procedure Information

	Surgery Out of Working Hours (group 1) (N=138)	Surgery within Working Hours (group 2) (N=51)	P-value
Anesthesia duration in minutes median	7	8	0.23**
Type of anesthesia			
Epidural	2 (1.5%)	0 (0)	0.89****
General	17 (12.3%)	5 (9.8%)	
Spinal	119 (86.2%)	46 (90.2%)	
Surgical duration minutes mean ± SD	58.3±26.8	52.9±23.4	0.21*
Indication category **N (%)**			
category 1	38 (27.5%)	16 (31.4%)	
category 2	47 (34.1%)	18 (35.3%)	
category 3	45 (32.6%)	15 (29.4%)	
category 4	8 (5.8%)	2 (3.9%)	0.92****
Decision to incision interval: Total minutes median	30	32	0.35**
Indication Category 1 mean ± SD	24.7±11.5	23.3±9.6	0.65*
Indication Category 2 mean ± SD	26.9±10.51	37.9±11.1	0.0004*
Indication Category 3 mean ± SD	55±40.5	78.7±59.7	0.09*
Indication Category 4 mean ± SD	190±139.4	17.5±10.6	0.13*

*Unpaired t-test **Mann-Whitney U test ****Fisher-Freeman-Halton exact

Neonatal outcomes were comparable between the 2 groups. The average birth weight was 2.9 kg in Group I and 2.7 kg in Group II (P=0.23). The NICU admission rate was 40 (29%) babies in Group I and 15 (29.4%) babies in Group II (p= 0.95). The average length of stay in the NICU was 17.7 days in Group I and 15 days in Group II. The average 1-minute and 5-minute Apgar scores were 7.5 (P=0.9) and 9 (P= 0.5), respectively, in both groups, see table 3.

Table 3: Clinical Outcome

	Surgery Out of Working Hours (group 1) (N=138)	Surgery within Working Hours (group 2) (N=51)	P-value
Birth weight Kg median	2.9	2.7	0.23**
Apgar score at 1 minute mean ± SD	7.5±2.1	7.5±1.8	0.92*
Apgar score at 5 minutes median	9	9	0.51**
NICU admission N (%)	40 (29%)	15 (29.4%)	0.95***
Length of stay in NICU days mean ± SD	17.7±20.4	15±15.1	0.65*

*Unpaired t-test **Mann-Whitney U test ***Chi-square test

DISCUSSION

There is an increased tendency to pursue cesarean delivery in most obstetric units. The rate varies considerably as it is influenced by the nature of the healthcare provider and the complexity of the population. Approximately 25% of deliveries are now performed by cesarean section; 15% are performed under emergency indications and 10% under elective indications. The decision of a cesarean section is dependent on maternal characteristics, clinical judgment and associated risk factors[6].

Emergency cesarean sections are classified based on the level of urgency and the indications for cesarean section[1]. One critical factor is the actual working capacity of the labor unit at the time of the decision. Working hours tend to have optimal staffing levels and senior expertise is available at all levels. In contrast, out-of-working-hours shifts can be limited to the minimum required level of staffing.

In our study, no delay was found in the total intervals of all emergency categories outside working hours; no delay with Category 1 emergency cesarean sections was found. Category 2 emergency cesarean sections delay was found in our analysis; the delay occurred during working hours. The indication of an emergency cesarean has to be a category 1 emergency to stop the ongoing elective list. Category 2 indications would not be considered a priority to stop the list nor make it necessary to allocate extra staffing. Khemanat et al found better cesarean section performance outside working hours. In every indication of cesarean section, better performance was observed outside normal working hours, indicating that efficient patient transport and easier access to the operating room and staff[7].

The neonatal outcomes in emergency cesarean deliveries depend upon the timing of the decision and the actual skin incision time. The time goals for category 1 and 2 cesarean sections are 30 minutes and 75 minutes, respectively. Gupta et al concluded that failure to meet these time goals is associated with adverse maternal outcomes, but not with adverse neonatal outcomes[8]. In our analysis, we noted that neonatal outcomes were similar between the groups within or outside normal working hours. The 1-minute and 5-minute Apgar scores for the newborns were similar in both groups. Palmer et al found that the Apgar scores observed in the newborns were more than or equal to 7 at the end of 5 minutes, regardless of the D-I interval[9].

One limitation of our study is the retrospective nature of the analysis, which causes limited access to the information, especially for Category 4 cases. We had only two Category 4 cases. Therefore, the presence of any missing data or missing information required us to exclude those cases. Furthermore, there was limited information available on the factors that would delay the emergency cesarean sections. Prospective studies that identify the reasons for delays and the factors that affect the cesarean delivery interval will give us more insight into how to tackle this issue and improve patient care.

CONCLUSION

The D-I interval was not different between cases that occurred within working hours and those outside working hours for Category 1 emergency cesarean sections; however, Category 2 cesarean section were delayed during working hours. There were no differences in neonatal outcomes between the two groups.

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