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The relationship between time of delivery and composite outcomes in women who sent to the intermediate intensive care unit after delivery

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Abstract

Aim: In this study, we evaluated the effects of delivery time on maternal-fetal outcomes by evaluating patients who were taken to the gynecological intermediate intensive care unit according to their delivery hours.

Materials and Methods: This study cohort included 292 women aged 18-45 years, whom we followed up in the postpartum gynecological intermediate intensive care unit. We divided the patients into three groups according to the time they gave birth. Those who gave birth between 08:00-16.00 formed group1, those who gave birth between 16:00-24:00 group2, and those who gave birth between 24:00-08:00 formed group 3. We compared all collected data between groups.

Results: Hysterectomy (45(36%)) and blood transfusion (35(28%)) rates in the first group were higher than the other groups ($p < 0.001$). Drain placement rates were higher in group 3 (48 (84.2%), $p < 0.001$). No other operative approach and complications were significantly different between the three groups.

Conclusion: Regarding maternal-fetal outcomes and surgical complications, making the delivery outside of working hours or after 24:00 may not have a negative effect.

Introduction

Maternal and fetal outcomes are directly related to the development levels of countries. In this sense, it is essential to improve the results. That is why obstetricians worldwide strive to reduce the negative consequences of childbirth, which is the foundation of our existence. In recent years, it has been stated that in addition to patient-related risks, physicians' working conditions can have a significant impact on poor outcomes. According to population-based studies, worse obstetric and neonatal outcomes have been shown in night or weekend deliveries [1]. Although there is no objective study on whether the working conditions that cause insomnia affect the performance of the surgeon; It is known that sleeplessness physiologically affects the individual's cognition and decision-making ability [2]. This situation can be potentially harmful to patients and the healthcare system as a whole.

In a study, maternal and fetal adverse outcomes such as low APGAR score, postpartum hemorrhage, and wound infection were more common in night shifts [3]. In general, such studies in European populations included high-risk, primarily pregnant women. This situation is usually associated with the absence of a specialist physician for 24 hours or long working hours. On the other hand, studies examining maternal outcomes have shown that maternal mortality rates do not increase in cesarean sections performed at night [4]. In addition, a similar study conducted in recent years has shown that experienced healthcare personnel working 24 hours a day reduces the negative consequences of postpartum hemorrhage [5].

As in many countries, there is no clear data on maternal and fetal adverse outcomes that occur according to night and day or shift hours in our country. This study aimed to evaluate patients hospitalized in the gynecological intensive care unit according to their delivery hours. Thus, we will reveal the relationship between the time of delivery and the patients who need to be followed more closely.

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Materials and Methods

This retrospective cohort study, which we conducted in our obstetrics clinic, covered 1 June 2016 and 30 May 2021. The study cohort consists of 292 pregnant women aged 18 up to 45 years followed-up intermediate intensive care unit after delivery. Bursa Yüksek İhtisas Training and Research Hospital Ethics Committee approved the study with the protocol number 2011-KAEK-25 2021/06-13. We obtained signed informed consent from all participants.

We included patients who needed to be followed up in the intermediate intensive care unit for any reason after birth. The patients were non-smokers and had no comorbid diseases. In addition, patients with elective cesarean section were also included in the study.Patients who were hospitalized to the primary intensive care unit, suspected or positive of Covid 19, and whose database data could not be accessed were out of the study.

We divided the patients into three groups, as eight-hour groups, according to the time they gave birth, starting at 08:00 in the morning. After giving birth, puerperal women whom we took to the intermediate intensive care unit formed groups. All of the shifts had a trained team for emergencies and a specialist physician at the top. Postpartum hemorrhage diagnosis and cesarean section indications were all made by specialists and followed up by our team. Cesarean section is routinely performed in our clinic, using a Pfannenstiel incision to the abdomen and a Kerr incision to the uterus. We routinely repair uterine incisions with singlelayer suturing with number 1 polyglactin absorbable suture material. We determined the criteria for admission to the intermediate intensive care unit following the guidelines [6].

The study team recorded the demographic features, mode of delivery, cesarean section indications, an obstetric status that poses a maternal risk, perioperative complication, need for drain, preoperative and postoperative laboratory values, fetal outcomes, and duration of hospitalization. We compared all these data between the groups.

Postpartum hemorrhage (PPH) descripted as cumulative blood loss of 1000 ml or more of blood loss accompanied by signs and symptoms of hypovolemia within 24 hours following the labor process [7]. For postpartum hemorrhage prophylaxis in our clinic, we routinely administered 20 U of oxytocin in 500 ml of Ringer's lactate after the birth of the baby and 0.2 mg of methylergonovine IM after placental delivery. If necessary, extra uterotonic agents were administered routinely as an infusion of 20IU oxytocin in 500 mL ringer lactate, 200 µg intravenous methylergometrine, and 800 µg rectal misoprostol in each patient. First of all, Bacri Balon was applied to patients with medical treatment failure, and if this method failed, aortic compression was performed to prepare the patient for laparotomy. In patients who are re-operated with PPH diagnosis, we routinely performed uterine artery ligation and some compression sutures. If we could not get successful results from these interventions, we applied hypogastric artery ligation and hysterectomy as a last option. This approach is our routine service protocol. Hemoglobin (Hg) and hematocrit (Hct) differences mean subtracting preoperative hg and hct values from postoperative hg and hct values.

The study's primary purpose is to compare the maternal and fetal outcomes with the time of birth. Our secondary aim is to investigate the relationship between surgical complications and delivery time and the factors that play a role in predicting the duration of close follow-up.

Statistical analysis

Statistical analysis was carried out using the SPSS program (version 20, SPSS, Chicago, IL). Data were expressed as average ± SD and in percentages. Continuous variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov / Shapiro-Wilk's test) to determine whether or not they are normally distributed. If the numerical data was nonparametric, Kruskal–Wallis test was conducted; if it was parametric, an ANOVA test was carried. Differences between groups were evaluated using post hoc tests. Post-hoc analysis was performed using the Tukey test. Categorical data were compared through the use of the Chi-square test. Multiple linear regression analysis was used to predict the duration of the intermediate intensive care unit after delivery. P-value <0.05 was accepted as statistically significant.

Results

During the study period, 39,760 live births took place in our hospital. Two hundred ninety-two women that meet our inclusion criteria were included in the study. In total, 272 patients were made cesarean, and 20 patients gave birth vaginally. Of these patients, 125 (42.8%) patients were at 08:00-16:00 group (group 1), 110 (37.6%) were at 16:00-24:00 group (group 2), and 57 (19.6%) were at 24:00-08:00 group (group 3).

Demographic and clinical characteristics of women sent to the intermediate intensive care unit after delivery is provided in Table 1. Preoperative hg and hct values were significantly lower in group 3 compared to other groups (11.1(4.5-13.6) g/dl, p= 0.001), (32.7(13.6-41.7) %, p<0.001), respectively. While the most common cesarean indication in all three groups was preeclampsia, there was a significant difference between the groups in terms of indications (p<0.001). Postoperative hg and hct values were significantly lower in group 3 compared to other groups (9.1(5.6-13.5), p<0.001) g/dl, (27(16.6-39.7) %, p<0.001), respectively. Hg (1.8(0.3-5.9) g/dl, p: 0.028) and hct (1.8(0.3-5.9) %, p= 0.013) differences were significantly higher in group 3. Intermediate intensive care unit follow-up and hospitalization times were significantly different between groups (p: 0.001, p: 0.022, respectively) (Table 1).

Table 2 summarizes the operative approach and complications of women sent to the intermediate intensive care unit after delivery. The first group (n=75 (60%)) mostly received general anesthesia, while the group 2 (n=71 (64.5%)) and 3 (n=30 (52.6%)) mostly received spinal anesthesia (p<0.001). Hysterectomy (n=45 (36%)) and blood transfusion (n=35 (28%)) rates in the first group were higher than the other groups (p <0.001). Drain placement rates were higher in group 3 (n=48 (84.2%), p<0.001). No other operative approach and complications

Table 1. Demographic and clinical characteristics of women who sent to the intermediate intensive care unit after delivery.

	Group 1 (n=125)	Group 2 (n=110)	Group 3 (n=57)	p
Maternal age (years)	33(21-49)	31(19-45)	34(21-51)	0.119
Body mass index	29.6 (21.2-44)	29.6 (19.3-45.7)	29.6 (20-42.3)	0.829
Gestational age	31 (18-42)	29.5 (17-42)	32 (19-42)	0.122
Preoperative Hemoglobin	11.9(6.5-15.9)	11.8(6.7-15.9)	11.1(4.5-13.6) [a,b]	0.001
Preoperative Hematocrit	35.1(20.1-45.1)	36.1(21-46.8)	32.7(13.6-41.7)[a,b]	<0.001
Delivery type				0.495
Vaginal	7(5.6%)	7(6.4%)	6(10.5%)	
Cesarean	118 (94.4%)	103(93.6%)	51(89.5%)	
Indications (n; %)				<0.001
Placenta previa	13(10.4%)	2(1.8%)	3(5.3%)	
Placental invasion	29(23.2%)	4(3.6%)	2(3.5%)	
Ablatio placenta	8(6.4%)	6(5.5%)	5(8.8%)	
Preeclampsia	61(48.8%)	83(75.5%)	37(64.9%)	
Previous cesarean	5(4%)	5(4.5%)	2(3.5%)	
HELLP	2(1.6%)	3(2.7%)	2(3.5%)	
Postoperative Hemoglobin	10.8(7.5-14.9)	11(5.5-14.4)	9.1(5.6-13.5)[a,b]	<0.001
Postoperative Hematocrit	32.7(21.8-43.3)	33.5(17.1-41.7)	27(16.6-39.7) [a,b]	<0.001
Hemoglobin difference	0.8(0.1-5.4)	0.8(0.2-4.7)	1.8(0.3-5.9) [a,b]	0.028
Hematocrit difference	2.4(0.6-15.4)	2.6(0.4-15)	5.7(0.1-16.5) [a,b]	0.013
Fetal birth weight (gram)	2385(640-4550)	2170(500-4400)	2020(580-3860)	0.504
1. minute Apgar	8(0-9)	9(0-9)	9(0-9)	0.603
5. minute Apgar	9(0-10)	10(0-10)	10(0-10)	0.397
Intermediate intensive care unit (day)	2 (0-9)	3 (0-14) [a]	3 (1-8)	0.001
Hospitalization (day)	5 (2-41) [b]	4(1-23)	5(2-20)	0.022

Data presented as n (%) or median (min-max). P value<0.05 was statistically significant.
[a]There was a significant difference with compared group 1 in post-hoc comparison.
[b]There was a significant difference with compared group 2 in post-hoc comparison.
[c]There was a significant difference with compared group 3 in post-hoc comparison.

Table 2. Operative approach and complications of women who sent to the intermediate intensive care unit after delivery.

	Group 1 (n=125)	Group 2 (n=110)	Group 3 (n=57)	p
Anesthesia method				<0.001
Spinal anesthesia	50(40%)	71(64.5%)	30(52.6%)	
General anesthesia	75(60%)	39(35.5%)	27(47.4%)	
B-Lynch suture n (%)	2(1.6%)	4(3.6%)	3(5.3%)	0.379
Uterine artery ligation n (%)	2(1.6%)	2(1.8%)	4(7%)	0.087
Hypogastric artery ligation n (%)	7(5.6%)	1(0.9%)	2(3.5%)	0.143
Hysterectomy n (%)	45(36%)	9(8.2%)	11(19.3%)	<0.001
Relaparotomy n (%)	7(5.6%)	3(2.7%)	6(10.5%)	0.122
Blood transfusion n (%)	35(28%)	10(9.1%)	7(12.3%)	<0.001
Drain follow-up n (%)	30(24%)	26(23.6%)	48(84.2%)	<0.001

Data presented as n (%). P value<0.05 was statistically significant.

were significantly different between the three groups (Table 2).

Comparison of re-laparotomy patients due to indications of postpartum hemorrhage are provided in Table 3. Of the 35 patients with placental invasion anomaly, n=4 (11.4%) who underwent partial resection was reopened due to vaginal bleeding. 3 (15.8%) of the patients who had cesarean due to ablatio placenta and 2 (16.7%) of the patients who were taken due to previous cesarean history were reopened due to bleeding (p: 0.011) (Table 3).

Age, Body mass index (BMI), cesarean section-time, presence of drain, blood transfusion, and hysterectomy variables were used with the Multiple Linear Regression Analysis Enter method to analyze the factors that play a role in predicting the duration of close follow-up. The model with the best performance according to the results that; YTKS: 2.871(delivery time) + 0.673(Drain follow-up) + 0.688(Blood transfusion) (R2: 0.482, p<0.001) (Table 4).

Table 3. Comparison of re-laparotomy patients due to indications of postpartum hemorrhage.

Indications (n; %)	Relaparotomy non-performed (276,94.5 %)	Relaparotomy Performed (16, %5.5)	p value
	(n, %)	(n, %)	
Placenta previa (18; 6.2)	16, 88.9%	2, 11.1%	0.011
Placental invasion (35; 12)	31, 88.6%	4, 11.4%	
Ablatio placenta (19; 6.5)	16, 84.2%	3, 15.8%	
Preeclampsia (181; 62)	178, 98.3%	3, 1.7%	
Previous cesarean (12; 4.1)	10, 83.3%	2, 16.7%	
Atoni after vaginal delivery (20; 6.8)	18, 90 %	2, 10%	
Hellp (7; 2.4)	7, %100	0	

Data presented as n (%). P value<0.05 was statistically significant.

Table 4. Multiple lineer regression for predicting the duration of intermediate intensive care unit after delivery

	B	P	OR
Delivery time	2.871	<0.001	11.875
Drain follow-up	0.673	0.028	2.207
Blood transfusion	0.688	0.059	1.898

B: Standardized regression coefficient. OR: odds ratio. p values with statistical significance (p < 0.05) are shown in bold.

Discussion

In terms of maternal-fetal outcomes and surgical complications, making the delivery outside of working hours or after 24:00 may not negatively affect. There is no marked difference in pregnancy, neonatal, and operative approach, and complications for women sent to the intermediate intensive care unit after delivery in the daytime versus nighttime. However, the time of delivery may affect the length of stay in the intermediate intensive care unit. This situation may cause negative results in terms of cost-effectiveness.

For a long time, many studies were full of data showing that some maternal and fetal complications increase at night [8-10,11]. It is not clear whether this is due to the absence of specialists for 24 hours or to the development of complications due to long working hours. On the contrary, in recent years, the situation has started to change with the arrival of data from clinics that work in shifts and actively accept patients.

Tavares et al. in the study in which 9143 singleton pregnancies were included, there was no significant difference between maternal and neonatal outcomes according to the shift time [3]. They emphasized that employing experienced healthcare personnel 24/7 can prevent adverse outcomes that may occur at night. They had a team who shifted every 12 hours in their study, and unlike our study, they did not include pregnant women under 34 weeks. Patients with elective cesarean were excluded. In addition, they worked with a larger cohort, including low-risk pregnancies they followed in postpartum obstetrics services. We did not exclude elective cesarean sections in our study. In our clinic, PAS + patients are operated on electively. These are usually patients in group 1. In this sense, the fact that the rates of hysterectomy and blood transfusion in Table 2 are higher in group 1 can be attributed to this. However, in our study, we did not distinguish between emergency and elective cases, nor did we conduct a study on the sleep patterns of surgeons performing the operations. As a result, attention deficit and fatigue may be related to other induviduale characteristics besides night shifts.

On the other hand, we included only patients who were followed up in the postpartum intermediate intensive care unit who experienced unexpected difficulties during the operation. Thus, we discussed a patient group that we think would make the main difference between the shifts. We did not limit the week of pregnancy, so we were able to include the outcomes of the patient group, which created the main problem for the obstetrician, into our data.

A recent study shows that the risk of composite maternal adverse outcomes did not vary significantly throughout the time shifts [1]. Yee et al. [5] highlighted that nighttime delivery was not associated with significant differences in postpartum hemorrhage-related management or morbidity. Similarly, Bailit et al. [12] found no essential differences in maternal or neonatal morbidity after unscheduled cesarean delivery according to work shift. In the study conducted with a large patient population, there was no significant difference between the shifts in terms of hysterectomy and blood transfusion, unlike our study. Our hospital is an admission hospital in terms of placenta previa and invasion anomalies. In addition, even if we do not have our follow-up patients, we accept patients with emergency bleeding in the surrounding hospitals on night shifts. We can attribute the significant difference in hysterectomy and related blood transfusion rates performed under daytime conditions to the large number of cases taken electively. However, this should not create the perception that night shifts are more comfortable because drain follow-up is significantly higher in patients who go to the intermediate intensive care unit at night.

On the other hand, our regression analysis shows that giving birth at night increases the time significantly spent in the intermediate intensive care unit. This result means more financial burden on the hospital. In other words, if we had compared the expenses of the patients according to the shifts, we might have encountered a different result.

The common point of all studies was that the human factor could not be ruled out. This situation is intertwined with all the complications that occur regardless of the time difference. The finding in our study that complications do not increase at night does not necessarily mean that errors are evenly distributed across shifts. Because not all medical errors lead to complications and, therefore, complications are an insensitive indicator of errors.

Among the strengths of this study was that we discussed a subject that has been popular recently. We considered a specific group of patients and tried to reach more specific

conclusions. The similarity of the demographic characteristics of the patients in the study groups indicates that the distribution between the groups is homogeneous, and this avoids biases. In addition, since it affects the development levels of countries, the relationship between the time of birth and complications concerns all of us. On the other hand, by establishing a regression model, we predicted the duration of the intermediate intensive care unit after delivery.

Our study has some limitations. First it was a small sample size and a single-center experience. Second due to the nature of our study, we could not access the data of some patients and excluded them. This situation may have led to a lack of some composite outcomes. Third it is not clear how physicians spend their 24 hours. It is unknown what physicians who work actively at night do at other times of the day. Fourth we could not include the data of patients with neonatal complications who did not have maternal necessity to go to the postpartum intermediate intensive care unit but had neonatal complications. We do not think this is a bias. Because the newborn team is a dynamic team that works independently of our clinic and determines how it works within itself. We are not in control of their working style that has changed over the years. Therefore, we think that the neonatal data collected is not meaningful unless our working conditions are similar.

Despite these limitations, in the training hospitals where a team of experts works 24 hours a day, delivery can be made at any hour. In these hospitals, time of delivery may not cause adverse composite outcomes for mother and fetus. For best results, more comprehensive and prospective multicenter studies are necessary.

Ethics approval

Bursa Yüksek Ihtisas Training and Research Hospital Ethics Committee approved the study with the protocol number 2011-KAEK-25 2021/06-13.

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