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The comparison of maternal and neonatal outcomes between planned and emergency cesarean deliveries in placenta previa patients without placenta accreata spectrum

Zeynep Gedik Özköse[1], Süleyman Cemil Oğlak[2], Fatma Ölmez[3]

[1]Department of Perinatology, Health Sciences University, Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey
[2]Department of Obstetrics and Gynecology, Gazi Yaşargil Training and Research Hospital, Diyarbakır, Turkey
[3]Department of Obstetrics and Gynecology, Health Sciences University, Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey

ABSTRACT

Objectives: This study aims to investigate whether a significant difference exists in maternal and fetal outcomes between planned cesarean delivery (PCD) compared to emergency cesarean delivery (ECD) in placenta previa (PP) patients without placenta accreata spectrum (PAS) in a tertiary referral hospital.

Material and methods: This retrospective cohort study included 237 singleton pregnant women who were diagnosed with PP without PAS at the time of delivery. PP patients who were delivered at the scheduled time were included in the PCD group. Patients with PP delivered in an emergency setting before the scheduled date were assigned to the ECD group. We recorded demographic and clinical characteristics, maternal and neonatal outcomes.

Results: Of the 237 patients who met the inclusion criteria, 157 patients (66.8%) underwent PCD, and 80 patients required ECD (33.2%). Patients' hospitalization and pre-discharge hemoglobin levels were significantly lower in the ECD group (11.25 ± 1.97 g/dL and 9.74 ± 2.09 g/dL, respectively) than in the PCD group (10.77 ± 2.67 g/dL and 9.27 ± 2.70, $p = 0.002$ and $p = 0.004$, respectively). While six patients (7.5%) were required intensive care unit (ICU) admission in the ECD group, no patient was required to follow up in ICU in the PCD group ($p < 0.001$). The hospital length of stay (LOS) was tended to be significantly longer in the ECD group (2.8 ± 0.7 days) than in the PCD group (2.4 ± 0.6 days, $p < 0.001$). Neonatal outcomes of birth weight, Apgar scores, NICU admission, and neonatal death were significantly better in the PCD group than in the ECD group.

Conclusions: The PCD group has better maternal outcomes, including preoperative and discharge hemoglobin levels, ICU admission and hospital LOS, and better neonatal outcomes than the ECD group. Clinicians should pay regard to that scheduling the delivery to advanced pregnancy weeks has a failure possibility, and patients could not reach the scheduled day due to the emergency states.

Key words: Placenta previa; severe hemorrhage; emergency cesarean delivery; planned cesarean delivery

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INTRODUCTION

Placenta previa (PP) is identified by the abnormal placenta overlying the endocervical os, and it is known as one of the most challenging complications leading to maternal and fetal-neonatal morbidity and mortality [1]. The prevalence of PP is increasing, accounting for five per 1000 pregnancies, and there is some evidence suggestive of regional variation [2]. More than 90% of PP in mid-trimester will resolve by delivery, but complete PP is more probably to persist [3]. The accurate pathogenesis of PP remains unknown, but previous uterine surgery such as cesarean delivery, and myomectomy, is associated with an increased risk [4]. The other predominant risk factors of PP are advanced maternal age, multiparity, smoking, underlying infertility and assisted reproductive technology, and conditions that may cause endometrial tissue injury, including habitual abortion and curettages [5, 6].

Corresponding author:
Süleyman Cemil Oğlak
Department of Obstetrics and Gynecology, Gazi Yaşargil Training and Research Hospital, Diyarbakır, Turkey
e-mail: sampson_21@hotmail.com

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Pregnancies complicated with PP clinically presents with painless, recurrent vaginal bleeding throughout pregnancy, frequently in the third trimester of gestation, and are at increased risk of morbidity, including blood transfusion, peripartum hysterectomy, vasa previa, postpartum hemorrhage, longer hospital length of stay (LOS), and sepsis [7]. Meanwhile, PP might be complicated by placental villi invasion beyond the decidua basalis causing placenta accreata spectrum (PAS; placenta accreata, increata, or percreata), and can lead to catastrophic hemorrhage, multiple complications, and even death [8]. Also, neonates born to patients with PP have been known to have neonatal complications often related to preterm delivery, including reduced birth weight, lowered Apgar scores, an increased risk of respiratory distress syndrome, and required neonatal intensive care unit (NICU) admission [9, 10].

The optimal delivery timing in PP patients remains controversial. To reduce the spontaneous hemorrhage rates, which increase proportionally with advancing gestational age, the Society for Maternal-Fetal Medicine (SMFM) recommended for patients with uncomplicated PP an elective cesarean delivery between $36^{0/7}$ and $37^{6/7}$ weeks of pregnancy, without fetal maturity documentation by amniocentesis [11]. However, approximately 40% of PP patients present in an emergency or preterm setting and deliver before the scheduled date [12].

This study aims to investigate whether a significant difference exists in maternal and fetal outcomes between planned cesarean delivery (PCD) compared to emergency cesarean delivery (ECD) in PP patients without PAS in a tertiary referral hospital.

MATERIAL AND METHODS

This retrospective cohort study included 237 singleton pregnant women who were diagnosed with PP without PAS at the time of delivery and delivered in Kanuni Sultan Süleyman Training and Research Hospital between January 2014 and December 2018. The Ethics Committee of the hospital approved the study (2019/02/25). We delivered all the patients by cesarean delivery in our hospital after 24 weeks of gestation. We excluded patients diagnosed with multiple pregnancies, PAS, and previous history of cesarean delivery, myomectomy, and dilatation and curettage (D&C). Previous studies have demonstrated a correlation between occult PAS and previous uterine interventions, including cesarean section or D&C [13, 14]. Therefore, we also excluded patients with a history of cesarean section and D&C for minimizing the risk of PAS. We also excluded patients referred to our hospital after being delivered elsewhere, and women with gestational hypertensive disorders, since the ECD might be required for different reasons than the placenta location.

We classified the PP based on the association between the placenta and the internal cervical os and reported it as complete PP when the placental tissue overlying the internal cervical os totally or partially. We defined the PP marginalis for patients with placental tissue within 20 mm from the internal cervical os [15]. The mid-pregnancy routine fetal anomaly scan should include placental localization, thereby identifying women at risk of PP [16]. We diagnosed PP during the transabdominal second-trimester scan and then evaluated by transvaginal ultrasound in the third trimester. We also confirmed the diagnosis at the time the patient was admitted for hemorrhage or delivery and intraoperatively.

According to our clinical protocol, patients with PP were followed up in our hospital and scheduled to undergo cesarean delivery between $36^{0/7}$ and $37^{0/7}$ weeks of pregnancy. PP patients who were delivered at the scheduled time were included in the PCD group. Patients with PP delivered in an emergency setting before the scheduled date were assigned to the ECD group. We classified the symptoms which required ECD were as follows: severe hemorrhage without labor contractions, premature onset of delivery defined as regular contractions or ruptured membranes with or withour hemorrhage, and suspected fetal distress described as nonreassuring fetal heart rate tracing on cardiotocography [12].

We obtained maternal demographic and clinical characteristics, including maternal age, gravida, parity, previous abortion, conception type (spontaneous, or assisted reproduction technology), PP type (complete, partial, and marginal), predominant placenta localization (anterior, posterior), the presence of antepartum bleeding, gestational week at hospitalization, and preoperative hemoglobin values. We examined maternal outcomes, including the reason of ECD, pre-discharge hemoglobin values, blood or blood product transfusion necessity, additional surgical (intrauterine sutures, Hayman suture, internal iliac artery ligation, and hysterectomy) or non-surgical procedures (balloon tamponade), maternal intensive care unit (ICU) admission, hospital length of stay (LOS), maternal morbidity, and maternal death. We recorded neonatal outcomes, including fetal presentation at birth, gestational week at delivery, birth weight, first and fifth minute Apgar scores, small for gestational age (SGA), neonatal ICU admission, and neonatal death.

The lower uterine incision was sutured in patients who did not require additional surgery. Intrauterine suture, bakri balloon, Hayman suture, bilateral internal iliac artery ligation (IIAL), and/or hysterectomy was performed in patients requiring additional intervention according to the severity of bleeding and in the presence of uterine atony. Maternal morbidity was defined as at least one of the following complications being occurred: Postpartum fever (dehydration,

atelectasis), postpartum infection (urinary tract, wound site), bladder injury, and ureter injury. SGA was defined as < 10th centile for birthweight [7].

Statistical analysis

Nominal and ordinal parameters were described by frequency analysis, and scale parameters were evaluated as mean and standard deviations. Chi-square and Chi-square likelihood-ratio tests were used for differences between nominal and ordinal parameters. For scale parameters, normality was analyzed with the Kolmogorov Smirnov test. For normally distributed parameters, the Independent-samples t-test was used, whereas the Mann-Whitney U test was used for nonparametric distributed parameters. All analyses were performed at SPSS 17.0 for Windows (SPSS Inc., Chicago, IL, USA) program at a 95% confidence interval with a 0.05 alpha significance level.

RESULTS

During the study period, a total of 251 pregnant women with PP without PAS were admitted to our hospital. After applying the exclusion criteria and withholding patients with missing medical records, 237 patients were included in our study.

We summarized the demographic and clinical characteristics of the patients in Table 1. There were no significant differences between the groups regarding maternal age, gravidity, parity, previous abortion history, number of ART pregnancies, PP type, and predominant placenta localization. The presence of antepartum bledding was significantly higher in the ECD group (53.8%) than in the PCD group (6.4%, p < 0.001). Antenatal care in 58 (24.4%) of the 237 patients were performed in other healthcare facilities. Of these, 19 patients are determined to be delivered soon after admission with emergency conditions. Thirty-nine patients were referred to our clinic after 32 weeks of gestation and scheduled to undergo cesarean delivery between 36$^{0/7}$ and 37$^{0/7}$ weeks of pregnancy. Of the remaining 179 women, 118 patients achieved to reach the planned cesarean delivery day, 61 patients were operated on with emergency complaints before they reached the planned surgery day or before operation scheduling. Finally, 157 patients (66.8%) underwent PCD, and 80 patients required ECD (33.2%). The indications for ECD were severe bleeding (64 patients, 80%), early onset of labor or preterm premature rupture of membranes (9 patients, 11.3%), and nonreassuring fetal heart rate tracing on cardiotocography (7 patients, 8.8%).

We presented the maternal outcomes of the patients in Table 2. Patients' hospitalization and pre-discharge hemoglobin levels were significantly lower in the ECD group (11.25 ± 1.97 g/dL and 9.74 ± 2.09 g/dL, respectively) than in the PCD group (10.77 ± 2.67 g/dL and 9.27 ± 2.70, p = 0.002 and p = 0.004, respectively). However, preoperative, per-operative, and postoperative blood or blood prod-

Table 1. Demographic and clinical characteristics of the patients

	Planned CD (n = 157)	Emergency CD (n = 80)	p
Maternal age, years	31.26 ± 5.84	31.21 ± 6.14	0.953[a]
Gravidity	2.74 ± 1.75	2.90 ± 2.11	0.745[b]
Parity	1.22 ± 1.35	1.25 ± 1.23	0.632[b]
Nulliparity, n (%)	97 (61.7%)	80 (65%)	0.566[c]
Previous abortion	0.48 ± 0.87	0.65 ± 1.31	0.653[b]
ART pregnancy, n (%)	16 (10.2%)	7 (8.8%)	0.723[c]
Placenta previa type, n (%)			0.491[c]
Marginal	50 (31.8%)	22 (27.5%)	
Complete (Totalis and partialis)	107 (68.2%)	58 (72.5%)	
Predominant placenta localization, n (%)			0.187[c]
Anterior	53 (33.8%)	34 (42.5%)	
Posterior	98 (63.4%)	40 (50.0%)	
In the balance	6 (3.8%)	6 (7.5%)	
Antepartum bleeding, n (%)	10 (6.4%)	43 (53.8%)	**< 0.001[c]**
Hospitalization week, mean ± SD	36.27 ± 2.20	32.89 ± 4.13	**< 0.001[b]**
Admission at delivery, n (%)			0.853[c]
Follow up	118 (75.2%)	61 (76.3%)	
Referral	39 (24.8%)	19 (23.8%)	

[a]Independent-samples t-test; [b]Mann Whitney U test; [c]Chi-square test

Table 2. Maternal outcomes of the patients

	Planned CD (n = 157)	Emergency CD (n = 80)	p
Preoperative hemoglobin, g/dL	11.25 ± 1.97	10.77 ± 2.67	**0.002[a]**
Pre-discharge hemoglobin, g/dL	9.74 ± 2.09	9.27 ± 2.70	**0.004[a]**
Preoperative transfusion, n (%)			0.212[b]
None	150 (95.5%)	75 (93.8%)	
Erythrocyte	1 (0.6%)	3 (3.8%)	
Intravenous iron	4 (2.5%)	2 (2.5%)	
Erythrocyte+Fresh Frozen plasma	2 (1.3%)	0 (0%)	
Per-operative transfusion, n (%)			0.256[b]
None	150 (95.5%)	77 (96.3%)	
Intravenous iron	3 (1.9%)	0 (0%)	
Erythrocyte+Fresh Frozen plasma	4 (2.5%)	3 (3.8%)	
Postoperative transfusion, n (%)			0.649[b]
None	145 (92.4%)	70 (87.5%)	
Erythrocyte	3 (1.9%)	2 (2.5%)	
Intravenous iron	3 (1.9%)	2 (2.5%)	
Erythrocyte+Fresh Frozen plasma	6 (3.8%)	6 (7.5%)	
Additional procedures, n (%)			0.771[b]
None	120 (76.5%)	61 (76.3%)	
Intrauterine suture	18 (11.5%)	6 (7.5%)	
Balloon tamponade	11 (7.0%)	8 (10.0%)	
Hayman suture	3 (1.9%)	2 (2.5%)	
Hysterectomy	4 (2.5%)	3 (3.8%)	
Internal iliac artery ligation	1 (0.6)	0 (0%)	
Maternal morbidity (fever, infection), n (%)	5 (3.2%)	3 (3.7%)	0.226[b]
ICU admission, n (%)	0 (0%)	6 (7.5%)	**< 0.001[b]**
Hospital length of stay, days	2.4 ± 0.6	2.8 ± 0.7	**< 0.001[c]**
Maternal death, n (%)	0 (0%)	1 (1.2%)	0.140[b]

[a]Mann-Whitney U Test; [b]Chi-square likelihood-ratio; [c]Independent-samples t-test

uct transfusion rates were similar between the groups. There were no significant differences between the groups regarding requiring additional procedures during the cesarean section. While six patients (7.5%) were required ICU admission in the ECD group, no patient was required to follow up in ICU in the PCD group ($p < 0.001$). The hospital LOS was tended to be significantly longer in the ECD group (2.8 ± 0.7 days) than in the PCD group (2.4 ± 0.6 days, $p < 0.001$). Five (3.2%) patients in the PCD group and three (3.7%) patients in the ECD group suffer from postoperative fever or surgical site infection ($p = 0.226$). No patient experienced bladder injury, bowel injury, post-operative intrabdominal infection, re-operation, or sepsis. There was one maternal death in the ECD group. The patient was 22 years old and had a congenital heart disease that complicated with Eisenmenger syndrome. Her pregnancy was complicated with complete PP and hospitalized due to antepartum bleeding episodes at 25 weeks of pregnancy. She underwent ECD due to severe hemorrhage at 31 weeks of pregnancy. She died two days after the surgery due to pulmonary hypertension and pulmonary edema in ICU.

We showed the neonatal outcomes of the groups in Table 3. Gestational week at delivery, birth weight, and 1-minute and 5-minute Apgar scores were significantly higher in the PCD group than in the ECD group. The presence of SGA infants was not different between the groups; 9.5% (n = 15) in the PCD group and 11.2% (n = 9) in the ECD group ($p = 0.441$). The frequency of NICU admission was significantly higher in the ECD group (13.7%) than in the PCD group (5.7%, $p = 0.036$). There were six neonatal deaths in the ECD group, and this account was significantly higher than in the PCD group (0%, $p < 0.001$).

Table 3. Neonatal outcomes of the groups

	Planned CD (n = 157)	Emergency CD (n = 80)	p
Fetal presentation, n (%)			**0.030[a]**
Transverse	17 (10.8%)	10 (12.5%)	
Breech	12 (7.6%)	15 (18.8%)	
Cephalic	128 (81.5%)	55 (68.8%)	
Gestational week at delivery	36.84 ± 1.75	33.70 ± 3.85	**< 0.001[b]**
Birth weight, g	3041.88 ± 444.47	2417.03 ± 880.78	**< 0.001[b]**
Apgar 1st min	7.83 ± 1.66	6.69 ± 2.23	**< 0.001[b]**
Apgar 1st min < 7, n (%)	15 (9.5%)	33 (41.2%)	**< 0.001[a]**
Apgar 5th min	9.15 ± 1.53	8.43 ± 2.09	**< 0.001[b]**
Apgar 5th min < 7, n (%)	1 (0.6%)	11 (13.7%)	**< 0.001[a]**
Small for gestational age, n (%)	15 (9.5%)	9 (11.2%)	0.441[a]
NICU admission, n (%)	9 (5.7%)	11 (13.7%)	**0.036[a]**
Neonatal death, n (%)	0 (0%)	6 (7.5%)	**< 0.001[c]**

[a]Chi-Square test; [b]Mann-Whitney U test; [c]Chi-square likelihood-ratio

DISCUSION

The current study demonstrates and compares maternal and neonatal outcomes of ECD and PCD in a study cohort consisted of confirmed PP patients without PAS and previous history of cesarean section in a tertiary referral hospital. Our study indicates that the PCD group has better maternal outcomes, including preoperative and discharge hemoglobin levels, ICU admission and hospital LOS, and better neonatal outcomes of birth weight, Apgar scores, NICU admission, and neonatal death than the ECD group.

The optimal delivery timing in PP is a debating issue that is not well-defined in previous researches. Balayla et al. [17], reported that early-term ($37^{0/7}$ and $38^{6/7}$ weeks of pregnancy) delivery in PP was associated with fewer complications and no greater risk than late-preterm ($34^{0/7}$ and $36^{6/7}$ weeks of gestation) delivery. Durukan et al., suggested scheduling a cesarean section for PP patients beyond 38 weeks of gestation concerning fetal lung maturation since maternal mortality is significantly low [18]. Erfani et al. [19], reported that PP patients without PAS and significant hemorrhage and with proper planning and monitoring, cesarean delivery might be safely delayed until 36-37 weeks of gestation in a tertiary referral center. ACOG also recommended scheduling PP patients for ECD at 36 to 37 weeks of pregnancy [20]. In our clinic, we tend to plan for cesarean delivery in PP patients without PAS between 36–37 weeks, if the patient achieves to reach this date.

Though a patient with PP will probably present mild or severe hemorrhage during the pregnancy course, it is not plausible to correctly predict whether a hemorrhage will occur, nor the gestational week, amount, or the number of the bleeding episodes [17]. The decision to perform an ECD was mostly made by the attending surgeon due to severe hemorrhage or premature onset of delivery. This decision could be partly iatrogenic or frequently as a result of a condition that compromises fetal or maternal stability [18]. The mean delivery time of our PCD group (157 patients, 66.2%) was 36.84 ± 1.75 week. Eighty (33.8%) patients required ECD, with a mean gestational age of 33.70 ± 3.85 weeks. Of these emergency deliveries, 80% (64 patients) was due to severe bleeding, 11.3% (9 patients) because of early onset of labor or preterm premature rupture of membranes, and 8.8% (7 patients) was due to nonreassuring fetal heart rate tracing on cardiotocography. Erfani et al., demonstrated that 42.8% of PP patients without morbidly adherent placenta underwent ECD due to bleeding or labor contractions [19]. Durukan et al., observed that 43.8% of patients could not reach the scheduled time and were delivered earlier [18]. We consider that the low ECD rate in our study than in previous studies was because of we exclude patients with PAS and previous history of uterine interventions. Ruiter et al. [12], identified that number of antepartum bleeding episodes, a history of cesarean section, and need for blood transfusion are independent predictors for an ECD. They hypothesized that a placenta overlying a cesarean scar might be prone to antepartum bleeding due to an unusual placental adhesion to scar tissue than to healthy endometrium [12]. Luangruangrong et al. [21], reported that PP patients with antepartum bleeding had significantly higher risks of preterm birth and ECD than the control group. Likewise, antepartum bleeding was significantly higher in the ECD group (53.8%) than in the PCD group (6.4%, $p < 0.001$).

Chung et al. [22], demonstrated that antepartum bleeding, preterm delivery, and ECD occurred in a larger percent-

age of patients with major PP, placentas that partially or completely cover the internal cervical os, than those with marginal and low lying placentas. Grönvall et al. [23], stated that patients with complete PP had significantly more blood loss and delivered earlier than patients with minor PP. However, Tuzovic et al. [24], and Ruiter et al. [12] found no difference in the frequency of antepartum hemorrhage and ECD in complete and marginal PP. In this study, complete and marginal PP patients without PAS had similar ECD rates. We consider that these different outcomes could be explained by the different classification of PP types, a broad variation in clinical management, and exclusion criteria of studies.

Severe antepartum and postpartum hemorrhage in PP is associated with increased risk of maternal morbidity, ICU requirement, blood or blood product transfusion, and the necessity for additional drugs and procedures to staunch bleeding, including uterine compression sutures, balloon tamponade, and hysterectomy [22, 25–28]. Durukan et al. [18], found that the total amount of transfused blood and blood products, intraoperative interventions, and ICU requirement were significantly higher, preoperative and predischarge hemoglobin levels were significantly lower in the ECD group than those of the PCD group. Our results have demonstrated that ICU requirement was significantly higher, and hospital LOS were significantly longer in the ECD group than in the PCD group. We found similar results in terms of blood transfusion requirement and intraoperative interventions due to the exclusion of PP patients with the morbidly adherent placenta.

Neonates of the patients with PP are more prone to be born preterm, have lower birth weight, and are more prone to require NICU admission. Lal et al., indicated that increased neonatal morbidity and NICU requirement is mostly associated with the gestational age and birth weight of the newborn, as contrary to the maternal status of PP [7]. Neonates of our ECD patients had significantly lower birth weight, and lower Apgar scores, and higher NICU admission, and higher neonatal death rates than those of our PCD patients. A recent meta-analysis concluded that neonates from pregnancies with PP have a mild increase in SGA risk [29]. The total number of SGA infants in the entire Consortium on Safe Labor database was 10%, which is slightly higher than our study cohort (8.4%) [7]. Also, we demonstrate no significant difference in the rates of SGA infants between ECD and PCD groups.

There are some limitations to this study. This study has been designed retrospectively and has the potential to contain limitations of such studies. Because of the dependence on information reported in the medical records, we could not identify risk factors for all pregnant patients with PP. Also, this study lacks data associated with the number of antepartum bleeding episodes, which is known as an independent predictor for an ECD. The main strength of this study is that PP diagnosis was confirmed at the time the patient was admitted for hemorrhage or delivery, unlike various studies that only used an antenatal diagnosis of PP. Therefore, we ensure that patients with resolved PP were not included.

CONCLUSIONS

The PCD group has better maternal outcomes, including preoperative and discharge hemoglobin levels, ICU admission and hospital LOS, and better neonatal outcomes than the ECD group. Clinicians should pay regard to that scheduling the delivery to advanced pregnancy weeks has a failure possibility, and patients could not reach the scheduled day due to the emergency states. Therefore, PP that persists in the third trimester should be referred to a tertiary center that can manage the complications of PP with a multidisciplinary approach, including an experienced surgical team, robust blood bank support, and maternal and neonatal ICU.

Conflict of interest

The authors declared no conflict of interest.

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