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**Determining emergency cesarean risk factors in placenta previa cases: a Prospective Cohort Study**

*Emergency cesarean risk factors in placenta previa*

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## Abstract

**Objective.** The aim of the current study was to determine the emergency cesarean section risk factors for patient with placenta previa.

**Materials and Methods.** A total of 98 placenta previa cases were enrolled the current prospective cohort study between November 2018 - June 2019. The time, number and frequency of vaginal bleeding episodes, emergency cesarean section requirement, presence of adhesive pathologies was recorded.

**Results.** The mean cervical length was 35.7 ( $\pm 8.3$ ) mm. Patients with presence of vaginal bleeding before the 28th week (OR = 11 (95% CI 1.85–65.07);  $p < 0.001$ ); participants who had two or more bleeding occurrences (OR = 7.39 (95% CI 1.83–29.80);  $p = 0.001$ ); patients with cervical length measurements  $< 30$  mm (OR = 2.91 (95% CI 0.64–13.14);  $p = 0.039$ ) had higher risk of emergency cesarean section. Emergency cesarean section rate was 12%. No relation was shown between the emergency cesarean section and invasion pathologies in cases with placenta previa ( $p = 0.241$ ).

**Conclusions.** The risk of emergency cesarean section is high in patients who had a vaginal bleeding before the 28<sup>th</sup> gestational week, had two or more bleeding episodes throughout their pregnancy and patients with cervical length was less than 30 mm.

**Keywords:** Emergency cesarean section; invasion anomalies; placenta previa; preterm birth.

## Introduction

Peripartum hemorrhages leading the causes of maternal morbidity and mortality despite the accumulation of knowledge and technological advances in modern obstetrics [1]. Placenta previa cases constitute a significant part of peripartum hemorrhages. The etiology for severe peripartum hemorrhages can be categorized under placenta previa (23.4%), uterine atony (73.2%) and genital tract trauma (3.4%) [2][3].

Placenta previa (PP) is defined as the extension of the placental tissue to the internal cervical os. In a meta-analysis of 58 observational studies, the prevalence of PP was 3.5-4.6 per 1000 live births [4]. Although this rate appears to be higher in the early weeks of gestation, decreases with the upward migration of the placenta in the later gestational weeks.

The main concern related to PP is the spontaneous hemorrhage, which require emergent medical interventions. The literature is cloudy, and clear information cannot be seen, especially in terms of hospitalization time. Prediction of time of delivery, time and method of surgery are important and contentious in the management of PP cases [5]. The current study conducted for to individualize the emergency cesarean section risk for patient with PP.

## Materials and methods

This prospective cohort study was conducted in the Department of Obstetrics and Gynecology at the Ege University School of Medicine between November 2018 - June 2019.

The Ege University Ethics Committee approved the trial with 18-10.2/37 reference ID in September 2018. Written informed consent was obtained from all individuals. The trial was registered in ClinicalTrials.gov with the number NCT04264234 and name “Management of Placenta Previa Cases and Determination of Hospitalization Criteria”.

Inclusion criteria are diagnosis of placenta previa, admission before 28. pregnancy weeks, low risk in first trimester screening test and no malformation in ultrasonographic fetal anomaly screening test. Exclusion criteria are multiple pregnancy, pregnancy complicated by preeclampsia, gestational hypertension and gestational diabetes mellitus which may cause maternal indications for preterm delivery.

PP cases were included in the study at 28 weeks of gestation. Gestational age was based on last menstrual period. The time, number and frequency of vaginal bleeding episodes were recorded. Follow-up for vaginal bleeding episodes continued until the delivery. The cases are hospitalized at 32 weeks of gestation in our clinic as in many others. At 32 weeks of gestation, the cases were evaluated with vaginal ultrasonography. Ultrasonographic examination performed by same experienced physician (M.E.) for all patients using a Voluson E8 ultrasound machine (GE Healthcare, UK) with a Rab 4-8d 4D probe (GE Healthcare, UK) and a multifrequency 5–7.5 MHz transvaginal probe (GE Healthcare, UK) to avoid inter-sonographer variability and bias [6]. The cervical length was evaluated with vaginal ultrasonography after bladder evacuation. The cervical length was measured between the external and internal os at sagittal plane. The mean length was recorded after 3 measurements.

Cesarean section was scheduled between 36 0/7 and 37 6/7 weeks of gestation for participants. Deliveries before the scheduled time were defined as emergency cesarean section. The cases were evaluated at the time of delivery in terms of delivery type, delivery time, emergency cesarean section requirement, blood transfusion, type of surgery, operative techniques for bleeding control and presence of adhesive pathologies.

For statistical analyses, categorical variables were analyzed with frequency tables, and descriptive statistics were calculated for continuous variables. The Shapiro-Wilk normality test was used to analyze if continuous data were normally distributed. As the data were not normally distributed, the Wilcoxon signed-rank test was employed. The significance level was taken as 0.05 in all hypothesis tests. Based on previous data, we calculated that for a power of 80% and significance of 5%, a minimum sample of 90 participants was required. Considering of a possible exclusion and dropouts, we enrolled 98 participants to the cohort. IBM SPSS Version 25.0 statistical package program were used for all statistical analyses.

## Results

Ninety-eight PP cases who applied to Ege University School of Medicine, Department of Gynecology and Obstetrics were enrolled between November 2018 - June 2019 in the current prospective cohort study. Seven participants whose pregnancy was complicated by preeclampsia and gestational diabetes mellitus were excluded from the study. Their treatment and follow-up were carried out appropriately. After exclusions, 91 participants were included to the cohort (Figure 1).

The age range of the participants was between 20-50 years. The median age of the participants was 32 (19-45). Clinical characteristics and demographic data were shown in the Table 1. The placenta was located centrally and closed the internal cervical os in 75 of the 91

participants. In cases where the placenta was closer than 20mm to the internal cervical os, 14 thin-edge placentas two with thick-edge placentas was determined. There were no vaginal bleeding episodes immediately after vaginal ultrasonography.

The earliest prenatal bleeding was noted at 23<sup>rd</sup> week of gestation. A total of 46 participants had at least one vaginal bleeding episodes (50.5%). In 91 participants, 79 episodes of vaginal bleeding were evaluated throughout the study. The median number of vaginal bleedings was 1 (0-10). Patients with presence of vaginal bleeding before the 28th week had higher risk of emergency cesarean section (OR = 11 (95% CI 1.85–65.07);  $p < 0.001$ ). Participants who had two or more bleeding episodes had higher risk of emergency caesarian section compared to participants who did not have (OR = 7.39 (95% CI 1.83–29.80);  $p = 0.001$ ).

The mean cervical length was 35.7 ( $\pm 8.3$ ) mm. Cases with cervical length measurements  $< 30$  mm had higher risk of emergency cesarean section (OR = 2.91 (95% CI 0.64–13.14);  $p = 0.039$ ).

The mean gestational age at birth for all study group was 36 weeks and 5 days, and for scheduled caesareans was 37 weeks and 2 days. The earliest delivery was performed as emergency cesarean section at 32 0/7 weeks of gestation. Caesarean section was performed for all cases. Emergency cesarean section rate was 12% (11 of 91 surgery).

There was no need for additional interventions for bleeding control in 62 surgeries. Among other cases, Bakri Balloon was employed for four patients to control bleeding. Bilateral uterine arteries were tied in four surgeries. Five participants underwent segmental resection, five participants underwent segmental resection and bilateral uterine artery ligation and bilateral hypogastric artery ligation. Twelve patients had to undergo cesarean hysterectomy (Table 2).

Before delivery, 21 units of erythrocyte suspension (ERT) were transfused to 10 cases. A total of 56 units of ERT were transfused to 24 cases at surgery. In postpartum period, 40 units of ERT were transfused to 20 women (Table 2).

The mean week of delivery was 36 5/7 ( $\pm 1.41$ ). The mean birth weight of newborns was 2923 ( $\pm 457.3$ ) g. The median APGAR score in 1-minute was 8 (6-10) and mean 5-min APGAR score was 10 (7-10). Six of the 91 newborns admitted to neonatal intensive care unit (NICU).

Total of 91 participants who enrolled the current study were hospitalized for 1765 days in total. The shortest hospitalization time until delivery was 1 day and the longest was 54 days. The median duration of stay in hospital until delivery was 18 (1-54) days, while hospital stays was 2 (2-5) days after cesarean section.

There was no placental invasion pathology in 74 of 91 cases. According to the pathological reports, placenta accreta was detected in seven cases. Placenta increta found in five cases and placenta percreta was determined in five cases. Placenta accreta, increta and percreta risk for a patient with PP were 7.6%, 5.4% and 5.4%, respectively in our series. The number of pregnancies ( $p=0.004$ ) and the number of previous cesarean sections ( $p<0.001$ ) were significantly related with placental invasion pathologies. In addition, as an important information obtained from the study, no relation was shown between the emergency cesarean section and invasion pathologies in cases with PP ( $p = 0.241$ ).

## Discussion

PP cases constitute one of the patient groups that are difficult to manage in modern obstetric practice [7]. Physicians are cautious at management but hospitalization for follow up brings several negative effects like hospital infections, increased workload, and extra economic burden on health systems. In addition, care should be tailored to their individual needs, given the many reasons listed. The current study was planned to determine the risk factors for emergency caesarian section and contribute to patient management.

The main problem in the management of patients with PP is to determine the requirement of emergency cesarean section. Management of these patients should be carried out by an experienced team which including obstetricians, anesthesiologists, and neonatologists in centers of excellence. In addition, there should be a well-equipped blood bank for possible peripartum hemorrhages. These requirements cause patients to be hospitalized for long periods of time.

Bleeding is a very important complaint and finding that should be followed carefully in the PP patient group. According to a study, 10% of the patients whose pregnancies were complicated by PP reach the term without bleeding. Despite this high rate, 50.5% of participants had at least one vaginal bleeding episode in our series. Hospitalization at 32 weeks of gestation can be the cause of this low rate. There were no studies that specifically addressed hospitalization for patients with PP [8]. Outpatient management acceptable when adequate resources available to allow rapid return to the hospital. PP cases are hospitalized to our center at 32 weeks of gestation as a tertiary referral hospital serving the entire region. Studies have shown that patients in whom the placenta completely covers the internal cervical os, has earlier and more frequent bleeding compared to patients whose placenta is close to the cervical os [9]. In addition, cervical length under 3 cm and gradually shortening of this length has predictive value in terms of bleeding risk [10,11]. The number of bleeding periods is correlated with the emergency cesarean section risk and the need for the transfusion of red cell concentrates [12]. Fishman et al. showed that vaginal bleeding episodes before 34<sup>th</sup> gestational weeks was a risk factor for emergency cesarean delivery (Odds ratio: 17.7) and preterm birth (Odds ratio: 11.8). Furthermore, there is a positive correlation with number of vaginal bleeding attacks with emergency cesarean section incidence ( $p < 0.001$ ) [13]. Conversely, according to a retrospective study, there was no relation between poor obstetrics outcomes and severe vaginal bleeding. [14]. Our study revealed that vaginal bleeding before the 28<sup>th</sup> gestational week related with a higher emergency cesarean section risk (OR = 11 (95% CI 1.85–65.07);  $p < 0.001$ ). In addition, according to our study, participants who had two or more bleeding episodes had higher risk of emergency caesarian section compared to participants who did not have (OR = 7.39 (95% CI 1.83–29.80);  $p = 0.001$ ). Studies conducted show that patients who had not vaginal bleeding during pregnancy will not require an emergency cesarean section [15–18].

Another important parameter in determining the requirement for emergency cesarean delivery is length of cervical canal. Ultrasonographic length of cervical canal is related to preterm delivery, especially women who had previous preterm delivery. Relative risk for preterm delivery is 3.8 in when length of cervical canal  $< 30$  mm [19]. In a prospective study, there was a significant relation between preterm delivery, increased uterine activity and obstetrics hemorrhage risk with decreased cervical length ( $< 30$  mm) in women with diagnosis of PP [20]. The current trial has been shown that women with PP and the cervical length under 30 mm have higher risk for emergency cesarean section compared to women with PP and the cervical length  $\geq 30$  mm (OR = 2.91 (95% CI 0.64–13.14);  $p = 0.039$ ).

PP cases except complicated pregnancy by preeclampsia or fetal growth restriction should be delivered between 36<sup>0</sup> – 37<sup>6</sup> gestational weeks, regardless of detecting fetal lung maturation with amniocentesis. The reason behind this is that the risks such as bleeding or emergency cesarean section are higher than the risk of prematurity after this pregnancy week [21]. In our series, in accordance with the literature, the mean week of delivery was 36 5/7. The earliest delivery was performed as emergency cesarean section at 32 0/7 gestational week. Zaitoun et. al. found the emergency cesarean delivery risk in PP cases before 36 weeks as 37.3% [10]. Emergency cesarean section rate was 12.0% (11 of 91 surgery) in the current study. Considering that the hospitalization reduces activity significantly, low emergency cesarean section rate can be explained by long hospitalization, like low vaginal bleeding rate in the current study.

The mean birth weight of newborns in our series was 2923 g. The median APGAR-1' score was 8 and APGAR-5' score was 10. In the light of this information, it would not be wrong to say that delivery performed to avoid emergency cesarean section after 36 0/7 gestational week provides acceptable weight and reactivity for newborns. Fortunately, there has been no maternal or infant death in our series.

The prospective follow-up of 91 patients for three months constitutes the strength of the study in terms of number and follow-up period as a disease such as placenta previa, which is uncommon. In addition, ultrasonographic examination performed by same experienced physician for all patients. Although it is difficult to design a randomized controlled trial due to methodological difficulties, prospective cohort study design without control group was one of the limitations of the study. Participants with multiple pregnancy, pregnancies complicated by preeclampsia, gestational hypertension and gestational diabetes mellitus which may cause maternal indications for preterm delivery excluded from the trial. However, the failure to exclude preterm births of unknown causes should be stated as another limitation.

The risk of emergency cesarean section is high in patients who had a bleeding attack before the 28th gestational week, had two or more bleeding episodes throughout their pregnancy and patients with cervical length was less than 30 mm.

### **Compliance with Ethical Standards**

**Authors contribution:** S.A.A.: Data curation, Writing – original draft; F.O.: Investigation; A.A.: Supervision; A.O.Y.: Methodology; A.M.E.: Visualization, Conceptualization; S.S.: Writing – review & editing

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**Declaration of Interest:** None.

**Ethical approval:** The study was approved by the Ege University Ethics Committee with 18-10.2/37 reference ID in September 2018.

**Informed consent:** Written informed consent was obtained from all individuals.

**Data sharing:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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**Table 1:** Patients characteristics and pregnancy outcomes

<b>Patient characteristics</b>	<b>Mean <math>\pm</math> SD / Median (min-max)</b>
Maternal age (years)	32 (19-45)
Parity <i>N</i> (%)	
<i>Nulliparous</i>	20 (22)
<i>Para1 or more</i>	71 (78)
History of caesarian section <i>N</i> (%)	
0	42 (46.2)
1	32 (35.2)
2 or more	17 (26)
Hospital Stay (days)	18 (1-54)
Gestational age at delivery (weeks)	36 + 5 ( $\pm$ 1.4)
Neonatal birth weight (g)	2923 ( $\pm$ 457)

**Table 2:** Perioperative Outcomes

<b>Perioperative characteristics</b>	<b>N</b>
<u>Cases need for blood transfusion (units)</u> <ul style="list-style-type: none"><li>• <i>Preoperative</i></li><li>• <i>Perioperative</i></li><li>• <i>Postoperative</i></li></ul>	10 24 20
<u>Additional interventions for bleeding control (N)</u> <ul style="list-style-type: none"><li>• <i>None</i></li><li>• <i>Bakri Balloon placement</i></li><li>• <i>Ligation of bilateral uterine arteries</i></li><li>• <i>Segmental resection</i></li><li>• <i>Segmental resection and ligation of bilateral uterine arteries and ligation of bilateral hypogastric arteries</i></li><li>• <i>Cesarean hysterectomy</i></li></ul>	62 4 4 5 5 12

Figure 1: Participants flow chart

