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Incidence of Fetal Growth Restriction in Women with Preeclampsia

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Abstract

Background: Preeclampsia (PE), accompanied by fetal growth restriction (FGR), is one of the causes of perinatal and maternal morbidity and mortality. Some known pregestational conditions and obstetrical complications, together with PE, play a critical role in developing fetal complication outcomes, including FGR. This study aimed to investigate the relationship between pregestational conditions & obstetrical complications and fetal outcomes in women with PE.

Methods and Results: This retrospective study was conducted at the University Clinical Center of Kosova, Clinic of Gynecology and Obstetrics. We have reviewed all the medical records of 226 pregnant patients with preeclampsia who delivered by cesarean section (C-section) between January 2017 and December 2021. The mean gestational age at delivery was 34 weeks and 6 days, indicating that most of our cases had experienced preterm delivery. Preeclampsia was defined according to the ACOG criteria. Most patients diagnosed with preeclampsia (78.8%) have no other pregestational conditions or obstetrical complications. Among other obstetrical complications, placental abruption and oligohydramnios are the most common (8.8% and 8.0%, respectively). Fetal growth abnormalities were detected in 86 cases (38.1%): FGR in 85 cases (37.6%) and macrosomia in only one case (0.44%) (P<0.0001) in a diabetic patient. A weak statistically significant positive correlation was found between gestational age and FGR (r=0.216, P=0.001).

Conclusion: A positive correlation between gestational age in PE and FGR indicates common pathophysiological mechanisms linking PE and FGR. Preeclampsia can have a direct adverse impact on the fetal growth.(**International Journal of Biomedicine. 2024;14(3):458-463.)**

Keywords: preeclampsia • obstetrical complications • fetal growth restriction • oligohydramnios

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Abbreviations

ACOG, American College of Obstetricians and Gynecologists; **ET**, embryo transfer; **FGR**, fetal growth restriction; **IUD**, intrauterine death; **IVF**, in vitro fertilization; **PE**, preeclampsia.

Introduction

Preeclampsia (PE) is a pathological condition that affects 2-8 % of pregnant women. It is clinically manifested with a state of new-onset maternal hypertension and proteinuria, which occurs most often after 20 weeks of gestation.[1-6] There is a diversity of risk factors in PE. The research about the pathogenesis of PE has found hemodynamic changes mostly manifested by abnormal placentation and endothelial dysfunction.[2-5,7-9] The pathophysiology of PE has been shown to involve abnormal shallow trophoblastic invasion of the maternal uterine spiral arteries early in pregnancy,[10] resulting in decreased blood flow to the uteroplacental bed and persistent placental hypoxia throughout pregnancy[11] and widespread endothelial dysfunction.[12] It should be noted that the major clinical manifestations of PE, such as hypertension, renal dysfunction and proteinuria, liver dysfunction, thrombocytopenia, and increased vascular permeability with edema affecting the periphery, brain, and liver, are the result of this endothelial dysfunction.[13] Similar changes in the placenta are also observed in pregnancies affected by fetal growth restriction (FGR)

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without concomitant preeclampsia.[14] Early-onset preeclampsia (<34 weeks of gestation) is usually associated with FGR. Preeclampsia complicated by FGR results in a more severe preeclamptic phenotype

Thus, PE and FGR are interrelated disorders caused by placental and endothelial dysfunction. It has been shown that 12.8–58.6% of women with severe early preeclampsia are diagnosed with FGR,[15,16] and approximately 15% of FGR pregnancies[17] are affected with preeclampsia later in gestation. Preeclampsia is known as the leading cause of maternal mortality worldwide. Since PE is often accompanied by FGR (fetal growth restriction), it is also one of the causes of perinatal morbidity and mortality. FGR can be defined as an estimated fetal weight or abdominal circumference less than the 10th percentile for the gestation age by prenatal ultrasound evaluation.[18,19] Several studies have shown that preexisting gestational conditions and obstetrical complications, such as cardiovascular diseases, diabetes, preeclampsia, placental abruption, and oligohydramnios, are also known as risk factors that are supposed to play a significant role in developing fetal complication outcomes, including FGR.[20-26]

This study aimed to investigate the relationship between pregestational conditions & obstetrical complications and fetal outcomes in women with PE.

Materials and Methods

This retrospective study was conducted at the tertiary University Clinical Center of Kosovo, Clinic of Gynecology and Obstetrics. We have reviewed all the medical records of 226 pregnant patients with preeclampsia who delivered by cesarean section (C-section) between January 2017 and December 2021. The study included PE patients with and without other pregestational conditions and obstetrical complications. The exclusion criteria were twins, multiple pregnancies, eclamptic patients or those with HELP syndrome and essential hypertension, also patients with any type of cancer, the presence of unknown etiology of ascites, or any current or chronic infectious diseases. We also did not include patients who underwent IVF and ET procedures to conceive.

The baseline characteristics included maternal age, length of pregnancy (weeks, days), and co-existence of other conditions such as anemia, cardiac disease, type 1 diabetes, thyroid disorders, oligohydramnios, placental abruption, renal diseases, uterine rupture, and epilepsy. Fetal outcomes were classified into gestational age, birth weight, presence of FGR, and intrauterine death (IUD).

Preeclampsia was defined according to the criteria of the American College of Obstetrics and Gynecology guidelines (ACOG)[27] as the presence of one or more of the following: blood pressure ≥140/90 mmHg on two or more occasions at least 4 hours apart after 20 weeks of gestation in a woman whose blood pressure has previously been normal, proteinuria >300 mg/day per 24 hours urine collection, or in the absence of proteinuria the presence of new-onset hypertension with any of the complications, such as thrombocytopenia (platelet count less than 100,000/microliter), renal insufficiency, elevated blood levels of liver enzymes to twice normal concentrations, pulmonary edema, cerebral or visual symptoms.

The gestational age was estimated according to the last menstrual period date. If the woman was unsure of the last menstrual period or the irregular menstrual cycle, the first ultrasonography examination was used for the exact estimation. We defined FGR as an estimated fetal weight less than the 10th percentile for the gestation age confirmed by a first-trimester ultrasound. Oligohydramnios was diagnosed as the amniotic fluid index below the 5th percentile for the gestational age or ≤5 cm. All the concomitant conditions were verified from previous medical reports or history. All data used in our medical history review were recorded before delivery and during the hospital stay.

Statistical analysis was performed using the statistical software package SPSS version 22.0 (SPSS Inc, Armonk, NY: IBM Corp). Baseline characteristics were summarized as frequencies and percentages for categorical variables and as mean ± SD for continuous variables. The one-way chi-square test was used to test the statistical significance of differences in a one-way classification system. Pearson's correlation coefficient (r) was used to determine the strength of the relationship between the two continuous variables. A probability value of $P<0.05$ was considered statistically significant.

Results

Of all 226 patients, 178 (78.8%) patients were diagnosed with preeclampsia without other obstetrical complications or pregestational conditions (Table 1).

Table 1.

Pregestational conditions and Obstetrical complications in PE patients

	Frequency	Percent	Statistics
Preeclampsia only	178	78.8	
Pregestational conditions			
Anemia	1	0.44	χ^2=0.7143 DF=5 P=0.9822
Heart disease	1	0.44	
Type 1 diabetes	2	0.88	
Epilepsy	1	0.44	
Thyroid disorders	1	0.44	
Renal disease	1	0.44	
Obstetrical complications			
Oligohydramnios	18	8.0	χ^2=30.1220 DF=3 P<0.0001
Placental abruption	20	8.8	
Uterine rupture	1	0.44	
Polyhydramnios	2	0.88	
Total	226	100.0	

The most common obstetrical complications in our study were placental abruption (8.8%), followed by oligohydramnios (8.0%), polyhydramnios (0.88%), and complete uterine rupture was encountered in only one case (0.44%) (P<0.0001). Among pregestational conditions, type 1 diabetes (0.88%), renal disease (0.44%), anemia (0.44%), heart disease (0.44%), thyroid disorders (0.44%), and epilepsy (0.44%) were found with equal frequency (P=0.9822) (Table 1).

Our results showed that the mean maternal age was 29 (16–46). The mean gestational age at delivery was 34 weeks and 6 days or 244 days, indicating that most of our cases had experienced preterm delivery (Figure 1). The mean fetal weight was 2189 g (570-4600 g), and the mode for fetal weight was 2000 g (Fifure 2) .

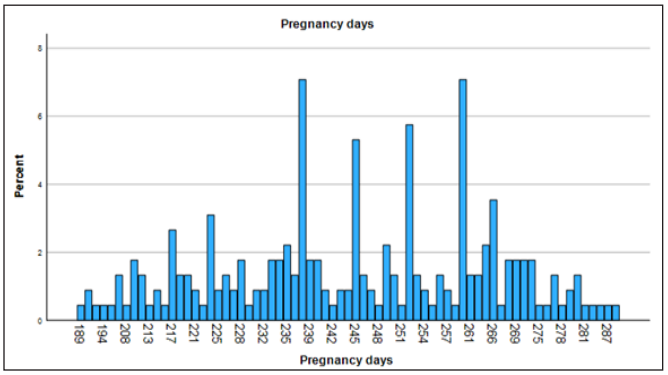

Fig. 1. *Length of pregnancy (pregnancy days) in patients with PE.*

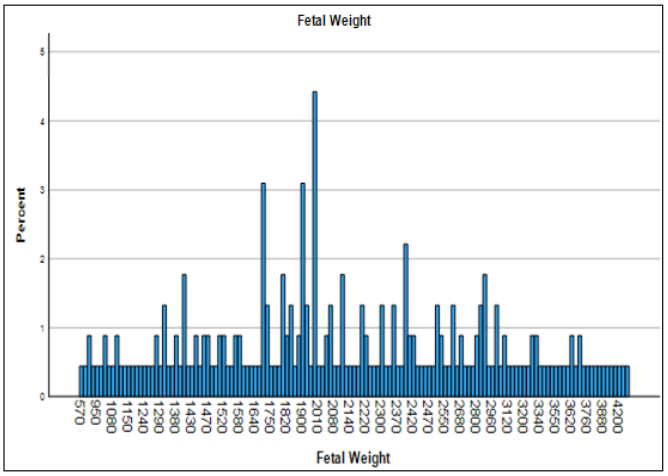

Fig. 2. *Fetal weight (g) in patients with PE.*

As for the fetal outcomes, there were normal outcomes in 139 cases (61.5%) of all deliveries. Fetal growth abnormalities were detected in 86 cases (38.1%): FGR in 85 cases (37.6%) and macrosomia in only one case (0.44%) (P<0.0001) in a diabetic patient. Intrauterine death was found in one case (0.4%) and was associated with placental abruption (Table 2).

A statistically significant weak positive correlation (r=0.216, P=0.001) was found between gestational age and FGR in a patient with PE. Other variables studied did not show significant relationships (Table 3).

Tab. 2.

Fetal outcomes frequency in PE patients

	Frequency	Percent
Normal outcomes	139	61.5
Fetal growth abnormalities		
FGR	85	37.6
Fetal macrosomia	1	0.44
P<0.0001		
Intrauterine death	1	0.44
Total	226	100.0

Table 3.

Correlation between study variables in women with PE.

		Gestational age	Maternal age	FGR
Gestational age	r	1	-0.12	0.216
	Sig (2-tailed)		0.857	0.001
	n	229	229	226
Maternal age	r	-0.012	1	-0.014
	Sig. (2-tailed)	.857		0.831
	N	229	229	226
FGR	r	0.216	-0.014	1
	Sig. (2-tailed)	0.001	0.831	
	n	226	226	226

Discussion

Preeclampsia is often classified as early-onset (< 34 weeks) or late-onset (≥ 34 weeks).[28,29] Early-onset PE is associated with a higher risk of adverse maternal and fetal outcomes than late-onset PE.[30] Early onset preeclampsia (<34 weeks of gestation) is usually associated with FGR. Currently, the incidence of FGR is expected to increase worldwide due to the increasing number of cases of infertility treatment, multiple pregnancies, occupational stress, late motherhood, and exposure to factors causing FGR. FGR is related to preterm delivery, leading to an increased risk of disability in surviving infants.

Our results indicate that the mean maternal age of PE patients was 29 years, with a range from 16 years to 46 years. The mean gestational age at delivery in preeclampsia was 34 weeks and 6 days, indicating that most of our cases had

experienced preterm delivery. On the other hand, regarding fetal weight and outcomes, the mean fetal weight was 2189 g, with a mode of 2000 g. This suggests that the majority of infants had a relatively normal weight. However, as for the fetal outcomes, fetal growth abnormalities were detected in 86 cases (38.1%): FGR in 85 cases (37.6%) and macrosomia in only one case (0.44%) (P<0.0001) in a diabetic patient. One case (0.44%) of an IUD was associated with placental abruption.

Based on the study's overall results, it can be noted that most patients diagnosed with preeclampsia (78.8%) did not have any other pregestational conditions or obstetrical complications. However, among other obstetrical complications, placental abruption was the most common (8.8%), emphasizing the need for careful monitoring and management of patients with preeclampsia, as placental abruption can have serious maternal and fetal consequences; many studies showed the same results.[31-37] Oligohydramnios was the second obstetric complication (8.0%) in this study, which is also known as an independent risk factor for early neonatal morbidity in preterm patients with PE.[38,39] Although, in our study, the incidence of diabetes mellitus (0.88%), renal disease, and heart disease (0.44%) was low, they are well-known as predisposing factors for PE. The correlation analysis showed a weak but statistically significant positive correlation between gestational age and FGR, indicating common pathophysiological mechanisms linking PE and FGR.

This study is limited by its retrospective design and relatively small sample size. A larger sample size is required to assess the relationship between other obstetrical complications or pregestational conditions and the formation of FGR in preeclampsia.

Conclusion

The mean gestational age at delivery is 34 weeks and 6 days, indicating that most cases have experienced preterm delivery. Most patients diagnosed with preeclampsia (78.8%) have no other pregestational conditions or obstetrical complications. Among other obstetrical complications, placental abruption and oligohydramnios are the most common (8.8% and 8.0, respectively). Fetal growth abnormalities were detected in 86 cases (38.1%): FGR in 85 cases (37.6%) and macrosomia in only one case (0.44%) (P<0.0001) in a diabetic patient. A positive correlation between gestational age in PE and FGR indicates common pathophysiological mechanisms linking PE and FGR. Preeclampsia can have a direct adverse impact on the fetal growth.

Competing Interests

The authors declare that they have no competing interests.

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