

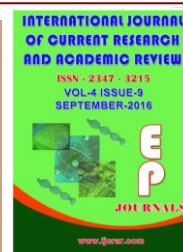


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Impact of Preeclampsia on Birth Weight by Gestational Age

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KEYWORDS

Preeclampsia, fetal birth weight, preterm and term labor

A B S T R A C T

Early diagnosis and treatment of preeclampsia could have a substantial impact on maternal, fetal and infant health. The aim of this study is to carry out an overall study of preeclampsia and its complications on the birth weight and gestational age in the case and control groups. 400 pregnant mothers referring to Imam Khomeini Hospital of Ahvaz are investigated. The study is conducted as retrospective review of patient's records with a focus on the goals and variables. The obtained data are analyzed by the descriptive statistics and statistical tests. There is a significant relationship between preeclampsia and birth weight in term and preterm labor ($P < 0.0001$). There is no significant relationship between preeclampsia and birth weight and term labor but this relationship has been significant in preterm labor ($P < 0.0001$). Preeclampsia is a heterogeneous disorder that limits the fetal growth and could also be followed by normal fetal growth. Therefore patients with restricted fetal growth will have preterm labor and the presence of preeclampsia is an exacerbating factor in this process. In cases of term labor of preeclampsia patients the fetal growth is more appropriate and the birth weight is relatively higher and closer to the normal range.

Introduction

Preeclampsia is a disease associated with hypertension, proteinuria and edema that appears in the mild and severe forms mainly after the 20th week of pregnancy the clinical severity of which depends on the degree of oxidative stress (Fallahian *et al.*, 2008).

Preeclampsia appears in 5 to 8 percent of all pregnancies and has many complications for the mother and the fetus so that 50,000 women around the world die as a result of preeclampsia and its complications (Bennette *et al.*, 1999). Maternal complications of preeclampsia include:

eclampsia, placental abruption and hematologic abnormalities that lead to damage to the vital organs and fetal complications include: low birth weight, hypoxia, fetal death and preterm labor leading to the premature birth (Cunningham *et al.*, 2005). Preeclampsia is a heterogeneous disorder that appears in at least two forms: Preeclampsia with fetal growth restriction and preeclampsia with normal fetal growth. On the other hand the birth weight is determined by both gestational age and fetal growth (Friedman *et al.*, 1991). Preeclampsia with an early onset (less than 37 weeks) may be more severe and have more harmful effects on fetal growth and it is likely to lead to iatrogenic preterm labor. However preeclampsia with a late onset (after 37 weeks) it is less likely to present these complications. So it seems that preterm labor is considered as a marker of a disease severity and fetal growth restriction (van Beek *et al.*, 1998). Patients with preeclampsia and fetal growth restriction often have preterm labor that these preeclampsia patients could follow the ischemic model. However the preeclampsia patients with the normal growth of the fetus usually have term labor and the possibility of preeclampsia pathogenesis following the ischemic model is lower in these patients. Therefore based on the results of the studied it is hard to say that the reduced uterine blood flow is the only pathologic process of preeclampsia. Therefore the ischemic model is discussed as the sole cause of preeclampsia and it has always hard to discuss whether the reduced uterine-placental blood flow is the reason of the disease or the result of the disease as a result of disease followed by the clinical symptoms. Although preeclampsia increases the risk of low birth weight and SGA (the left amplitude of the birth weight curve), it also increases the risk of high birth weight

and LGA (the right amplitude of the birth weight curve) (Friedman *et al.*, 1999). In studies conducted on the high birth weight and LGA in women with severe preeclampsia (3.7%), preeclampsia (4.3%) and gestational hypertension (3.8%) were higher than the normal blood pressure (3.1%). It was also observed that the group of preeclampsia patients that had LGA infants often had after 37 weeks labor. However, this increased growth in infants with high birth weight and LGA born by preeclampsia mothers could be caused by increased uterine placental blood flow that leads to higher blood pressure while preeclampsia in advanced stages that is associated with severe reduction in uterine placental blood flow is associated with higher prevalence of SGA and low birth weight (Altman *et al.*, 1996). According to the studies preeclampsia is associated with 5% reduction in birth weight and 4 times increase in SGA especially in severe preeclampsia and the early onset (before the 24th week of pregnancy) that this value is increased into 12 and 23%. According to research results the point that should always be noted is that preeclampsia and severe preeclampsia do not increase the risk of preterm labor. But the risk of low birth weight and reduced fetal growth is increased; thus the preeclampsia and treatment for termination of pregnancy complications are among the reasons of most preterm deliveries in preeclampsia. The bottom line is that despite numerous studies the reason of preeclampsia remains unknown and epidemiological studies have not yet proved the relationship between preeclampsia and average fetal weight based on the pregnancy week (van Beek *et al.*, 1998). However, much of the complications and some risk factors of this disorder could be identified and prevented. In addition, due to the high prevalence and maternal and fetal complications especially on the birth weight, it could be said that paying attention

to this phenomenon and early diagnosis and treatment of preeclampsia could have a substantial impact on maternal, fetal and infant health. Thus according to the above mentioned factors this study is designed to generally analyze the preeclampsia and its complications and impact on birth weight and gestational age in the cases and control groups. This study could pave the way for further studies in this field and reduce the mortality and neonatal morbidity as one of the objectives in tokology and provide the authorities and health professionals with appropriate information to identify the aspects of a common problem during pregnancy so that by increasing the quality of prenatal care, quicker diagnosis and appropriate management of the disorder during pregnancy the associated complications for mother and fetus are prevented.

Material and Method

This study is a retrospective descriptive epidemiologic research that is conducted in Imam Khomeini Hospital, Ahvaz Jundishapur University of Medical Sciences in Ahvaz to investigate the relationship between preeclampsia and low birth weight in terms of gestational age in women with normal blood pressure in 2015.

In this study the study environment is Imam Khomeini Hospital, teaching hospital of Ahvaz Jundishapur University of Medical Sciences and the main center of Obstetrics, Gynecology and Infertility in the South West of the country. The research population of the study included mothers that referred to Imam Khomeini Hospital for action and follow-up as well as labor and they were diagnosed with preeclampsia. The case group included women diagnosed with preeclampsia as well as another group of women with normal blood pressure.

Accordingly, 200 subjects are randomly selected for each group.

Exclusion criteria: women with multiple pregnancies, history of hypertension, history of diabetes in any form, the use of antihypertensive drugs in the patient's medical records, specific cardiovascular disease and chronic kidney disease.

After obtaining permission from the university ethics committee all data are extracted from the profile of pregnant women who referred to Imam Khomeini hospital during the last five years (2009-2014). The main information included the blood pressure of the pregnant women, fetal birth weight and pre-term and term infants. The severity of preeclampsia is also classified as severe and non-severe based on the original pregnancy book of Williams (Cunningham *et al.*, 2005).

Results and Discussion

In the present study 400 pregnant women admitted to the maternity ward of Ahvaz Imam Khomeini Hospital are studied based on the sample size and duration. Among these subjects 200 patients with preeclampsia are selected as the case group and 200 pregnant women with normal blood pressure and without preeclampsia are selected as the control group and analyzed in terms of the research variables. Frequency of patients according to severity of preeclampsia Showed on Table 1.

The average fetal weight in pregnant women with preeclampsia is 2387.4 ± 784.4 g and it has been 3130 ± 625.3 g in normal pregnant women in terms of blood pressure. The average fetal weight in pregnant women with preeclampsia is less than this average in normal pregnant women in terms of blood

pressure and this difference is statistically significant ($P < 0.0001$) (Table 2).

In case group in women with preeclampsia the term labor is 72 cases (36%) and preterm labor is 128 cases (64%). In the group of mothers with normal blood pressure the term labor is 149 cases (74.5%) and preterm labor is 51 cases (25.5%). There is a significant relationship between the kind of pregnancy and preeclampsia in pregnant women ($P < 0.0001$).

The average fetal weight at term labor in pregnant women with preeclampsia is 2937 ± 651.2 g and is 3297.4 ± 521.4 g in normal pregnant women in terms of blood pressure. The average fetal weight in term labor in pregnant women with preeclampsia is less than this average in normal pregnant women in terms of blood pressure and this difference is statistically significant ($P < 0.0001$).

The average fetal weight at term labor in pregnant women with severe preeclampsia is 2780 ± 511.2 g and is 2997 ± 629.6 g in mothers with non-severe preeclampsia. The average fetal weight in term labor in pregnant women with severe preeclampsia is less than this average in pregnant women with non-severe preeclampsia and this difference is not statistically significant ($P = 0.2$).

The average fetal weight at preterm labor in pregnant women with preeclampsia is 2078.2 ± 677.9 g and is 2643.1 ± 625.6 g in normal pregnant women in terms of blood pressure. The average fetal weight in term labor in pregnant women with preeclampsia is less than this average in normal pregnant women in terms of blood pressure and this difference is statistically significant ($P < 0.0001$).

The average fetal weight at preterm labor in pregnant women with severe preeclampsia is 1867 ± 651.8 g and is 2269.1 ± 638.6 g in mothers with non-severe preeclampsia. The average fetal weight in preterm labor in pregnant women with severe preeclampsia is less than this average in pregnant women with non-severe preeclampsia and this difference is statistically significant ($P < 0.0001$).

In conclusion, a total of 400 pregnant women admitted to the maternity ward of Ahwaz Imam Khomeini Hospital within the years of 2004 -2014 are studied. 200 patients had preeclampsia and 200 pregnant women have normal blood pressure.

In general, based on previous studies the birth weight among the infants born by mothers with preeclampsia is less than mothers with normal blood pressure significantly (Xiong *et al.*, 2000). In this study, 64 percent of infants of mothers with preeclampsia are born through preterm labor. Comparing the birth weight of infants of mothers with preeclampsia and normal mothers born as preterm and term, a significant relationship is obtained ($P < 0.0001$). Thus most of the infants born by mothers with preeclampsia both in term and preterm conditions do not have the expected weight for gestational age and the difference is associated with the lack of weight gain in preterm infants of mothers with preeclampsia which is significantly lower than that of the term infants of mothers with preeclampsia.

The study showed that the effect of preeclampsia and gestational hypertension on fetal weight can have functional differences based on gestational age such that the difference between severe and non-severe preeclampsia has not been significant in term labor (in fact it does not exist) while

this difference has been significant in preterm labor. So the effect of fetal weight loss existed in preterm labors. Some previous studies did not distinguish the preeclampsia effect on fetal weight in different gestational ages (Misra, 1996). However, in another study a significant decrease in birth weight is reported among infants born by mothers with preeclampsia compared with normal mothers also the proportionality of preterm infants was high in women with Preeclampsia (Misra, 1996).

The idea that most term infants born by mothers with preeclampsia have normal fetal development cannot be consistent with the reduction in uterine placental perfusion in patients with preeclampsia (Friedman *et al.*, 1991; van Beek *et al.*, 1998; Friedman *et al.*, 1999). Studies in preeclampsia pathophysiology showed that the increased

blood pressure in these patients is subject to the increase in cardiac output of mothers (Easterling *et al.*, 1990). Gantt argued that women who develop preeclampsia in the third trimester of pregnancy have higher uterine placental blood flow over their pregnancy than the women with normal blood pressure (Gant *et al.*, 1971).

The relative increase in blood pressure especially in the early stages is associated with increased risk in LGA (large for gestational age) infants which is due to the increase in uterine placental blood flow and as long as hypertensive reaches (14.9 and higher) and by reaching blood pressure to this level and higher the prevalence of effects of blood pressure and vasoconstriction of uterine placental blood flow is reduced and the area for the incidence of SGA and IUGR is provided.

Table.1

Table 1. Frequency of patients according to severity of preeclampsia		
The severity of preeclampsia	Frequency	%
Severe	85	42.5
Non-severe	115	57.5
Total	200	100.0

Table.2

Table 2.The average fetal weight			
	Term	Pre Term	Total
Preeclampsia	72	128	200
	36.0%	64.0%	100.0%
Normal	149	51	200
	74.5%	25.5%	100.0%
Total	221	179	400
	55.3%	44.8%	100.0%
Statistical Result	P<0.0001	Significant Difference	

Preeclampsia especially in advanced levels that is associated with uterine placental blood flow if followed by higher prevalence of SGA (small for gestational age) (Prakash *et al.*, 2006). In a study conducted by Giacomini it is indicated that the rate of LBW in patients with increase in blood pressure is more than people with normal blood pressure and it should be noted that blood pressure before 26th week of pregnancy has no effect on fetal weight.

From 26th week onward preeclampsia is involved with low birth weight while pregnancy hypertension induces the fetal weight within the weeks of 28-34 and has no effect before and after that. The added preeclampsia is effective in birth weight at weeks 32-34. Both increased and reduced fetal weights are observed in patients with pregnancy hypertension or preeclampsia at term labor (Jacquemyn *et al.*, 2006).

Another possible case for the findings in this study is that preeclampsia that has the early onset (less than 37 weeks) could be severer and have more adverse effects on fetal growth and lead to the premature birth. On the other hand preeclampsia that has later onset (over 37 weeks) could be non-severe and leads fewer infants to premature birth. Uterine placental perfusion reduction in a short period would also reduce the impact on the size of the fetus. In the study conducted by Yang it is indicated that the early onset of severe preeclampsia and thus pregnancy termination in 32nd week is associated with weak maternal and prenatal results and leads to the prevalence of fetal growth restriction and weight gain (Yang *et al.*, 2006). In fact, it seems that preterm labor is a sign of severity of the disease and fetal growth restriction. As a result, preeclampsia with early and late onset could have two different spectra of diseases. The data presented in this study lack the

information about the onset of preeclampsia but the data results based on the severity of preeclampsia and its impact on birth weight in severe and non-severe cases is totally reliable.

The results of this study are consistent with the theory that preeclampsia is a heterogeneous disorder that limits the fetal growth and could also be followed by normal fetal growth. Patients with restricted fetal growth will have preterm labor and the presence of preeclampsia is an exacerbating factor in this process. In cases of term labors of preeclampsia patients the fetal growth is more appropriate and the birth weight is relatively higher and closer to the normal range.

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