



## Incidence Rate, Associated Risk Factor and Perinatal Outcome of Preeclampsia at Maternity Teaching Hospital

Aisha Mohammed Othman\* Shahla Kareem Alalaf\*\* Zhiyan Suwar Ismael\*\*\*

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### Abstract

**Background and objectives** Preeclampsia is a serious pregnancy complication with a significant maternal and perinatal morbidity and mortality. The aim of this study was to assess the incidence rate, associated risk factors and perinatal outcome of women with preeclampsia delivered in a tertiary maternity hospital.

**Methodology:** In the labor ward of Maternity Teaching hospital in Erbil city, Kurdistan region, Iraq a case control design was used to determine the risk variables and perinatal outcomes, and a cross-sectional design was used to estimate the incidence rate, from 1<sup>st</sup> of January, to 31<sup>st</sup> of December, 2023 on a sample of 218 pregnant women with preeclampsia and 440 pregnant women without preeclampsia was selected as controls. Associated risk factor and perinatal outcomes were compared between the 2 groups.

**Results:** Incidence rate of preeclampsia was (1.1%). Increased age (30% of cases vs. 12% of controls were  $\geq 35$  years), smoking (11.9% of cases vs. 0% of controls), preterm gestational age (3.2% of cases vs. 0% of controls), grand-multiparity (6.4% of cases vs. 3.2% of controls), multiple gestations (34.9% of cases vs. 24.1% of controls), previous preeclampsia (12.4% vs. 2.3%) were significantly related to preeclampsia ( $p < 0.050$ ). The common adverse outcomes of pregnant women with preeclampsia were fetal congenital anomalies (6.4%), elective cesarean section (46.8%), low Apgar scores at 1 (23.4%) & 5 (8.3%) minutes and early neonatal death (19.3%) ( $< 0.001$ ).

**Conclusions:** The study identifies common risk factors for preeclampsia, including advanced maternal age and smoking, and emphasizes routine blood pressure monitoring and management for high-risk pregnancies.

**Keywords:** Incidence, Preeclampsia, Risk factors

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\*M.B.Ch.B, Obstetrics and Gynecology at KHCMS, Maternity Teaching Hospital, Erbil E-mail: mhamadothman2015@gmail.com City, Kurdistan Region, Iraq. Corresponding author.

\*\*M.B.Ch.B, clinical MD in Obstetrics and Gynecology, Professor in Obstetrics and Gynecology department at medical college -Hawler Medical University, Kurdistan Region, Iraq. Email: shahla.alaf@yahoo.com

\*\*\*M.B.Ch.B, Obstetrics and gynecology, Fellow of the Iraqi commission for Medical Specialization. Email: zhiyan.suwar@gmail.com



## Introduction

Preeclampsia is a common medical disorder responsible for high death and co-morbidity rates in both mothers and fetuses. Globally, it is extending everywhere but with higher incidence rates in poor countries.<sup>1</sup> Preeclampsia is a new onset gestational hypertension accompanied by new onset proteinuria or organ failure or uteroplacental disorder at 20<sup>th</sup> week of pregnancy or after.<sup>2</sup> The incidence of preeclampsia in regard to World Health Organization (WHO) all over the world was in range of 2-10% of all gestations.<sup>3</sup> Common risk factors in regard to International Society for the Study of Hypertension in Pregnancy (ISSHP), American College of Obstetricians and Gynecologists (ACOG) and National Institute for Health and Care Excellence (NICE) guidelines are poor obstetrical and maternal factors. However, only ISSHP regarded obesity and assisted in vitro fertilization as risk factors of preeclampsia. Additionally, poor health infrastructures of developing countries are regarded as risk factor of preeclampsia.<sup>4</sup> Preeclampsia leads to high rates of perinatal mortality, stillbirths, low birth weight, low Apgar score and intensive care unit (NICU) admission among pregnant women with preeclampsia.<sup>5-7</sup> Some studies suggest that these poor perinatal outcomes can be explained by preterm gestational age alone, whereas others find persistent differences relative to uncomplicated pregnancies even when controlling for gestational age and birth weight.<sup>7-9</sup> Different perinatal co-morbidities are reported for preeclampsia like respiratory distress, intrauterine growth retardation asphyxia, prematurity, stillbirth and death in addition to future risks of mental diseases and cognitive dysfunctions of children.<sup>10,11</sup> Other authors categorized the perinatal outcomes according to onset (early or late) and severity of preeclampsia.<sup>12</sup> In preeclampsia, maternal and fetal outcomes are impacted by early

interventions like corticosteroids for fetal lung maturity and magnesium sulfate for neuroprotection and seizure prevention. Preeclampsia increases the risk of low Apgar scores, low birth weight due to restricted fetal growth, and intrauterine fetal demise. Proper management, including the timing of delivery, is critical to improve outcomes for both mother and baby in cases of preeclampsia.<sup>13-16</sup> The aims of present study were to assess the incidence rate, associated risk factor and perinatal outcome of women with preeclampsia delivered in a tertiary maternity hospital.

## Patients and methods

A cross-sectional design was conducted to estimate the incidence rate of PE and case-control design was conducted to identify the risk factors and perinatal outcomes of PE in Labor ward of Maternity Teaching Hospital in Erbil city, Kurdistan region-Iraq. Study duration was one year from 1st of January, to 31st of December, 2023. Inclusion criteria involved age group 18-45 years, any parity, gestational age of 24 weeks and more, delivered within the period of the study and accepted to participate in the study. The exclusion criteria were gestational age less than 24 weeks, pregnancy induced hypertension, eclamptic fits and women refused to participate. For the case-control study the sample size included 218 pregnant women with preeclampsia delivered at the hospital within one-year duration were regarded as the case group, four hundred and forty pregnant women who delivered at the hospital and did not have preeclampsia were selected as controls. Information of participants was collected directly from enrolled women and filled in a prepared questionnaire designed by researchers. The questionnaire contained with basic characteristics of women, obstetric history of participants, medical history of participants and gestational outcomes of participants. Preeclampsia was diagnosed by senior





Obstetrician in regard to gestational age of more than 20 weeks with systolic blood pressure of  $\geq 140$  mmHg and diastolic blood pressure of  $\geq 90$  mmHg and proteinuria (1+ or more).<sup>1</sup> The age of enrolled women was categorized into five groups (<20 years, 20-24 years, 25-29 years, 30-34 years and  $\geq 35$  years). Occupation of women was classified into (housewife, office work and manual work), while the residency was categorized into (urban or rural). Gestational age was classified according to ACOG guidelines into very or early preterm (<33 weeks), late preterm (33-36 weeks) and term ( $\geq 37$  weeks).<sup>13</sup> Parity history was categorized into nulliparous (para 0), primiparous (para 1), multiparous (para 2-4) and grand-multiparous (para  $\geq 5$ ). Fetal congenital anomalies were assessed by yes or no, while the delivery modes were classified into (spontaneous vaginal delivery, induction of labor, elective cesarean section and emergency cesarean section). The Apgar scores after delivery of newborns were distributed to (reassuring 7-10, moderately abnormal 4-6 and low 0-3) in regard to American academy of pediatrics.<sup>14</sup> While the birth weights were classified into very 1000-1499 g, 1500-2499 g, 2500-3999 g and  $\geq 4000$  g in regard to WHO classification of birth weight.<sup>15</sup> Macerated still birth is defined as birth of baby with skin and soft tissue changes (prepartum stillbirth), while fresh stillbirth is defined as baby birth without skin changes (intrapartum stillbirth).<sup>16</sup> Perinatal outcomes of pregnant women with preeclampsia were assessed by researchers with help of Pediatrician. The women's information was entered and interpreted statistically by SPSS program-26. Suitable table were implemented accordingly. The chi square and fisher's exact tests were used for statistical relationships. A p value of  $\leq 0.05$  was regarded as significant. Ethics approval was granted by the Research Protocol Ethics

Committee of Kurdistan Higher Council of Medical Specialties No. 55, 8 Jan. 2023. Each woman who consented to participate in the study at the time of the initial interview provided written, informed consent. Every participant received an assurance that the information they provided would be kept private and used exclusively for research. The Declaration of Helsinki for Ethical Principles for Medical Research Involving Human Subjects was followed in conducting all of the interviews.

## Results

The number of deliveries in the maternity teaching hospital during 2023 was 19795, and the number of deliveries with preeclampsia (PE) was 218. Accordingly, the incidence of PE was 1.1%. In the case-control study 218 patients with PE and 440 patients without PE were included. The mean age (SD) of the women of the whole sample was 27.5 (6.9) years, the median was 26 years, and the age range was 16-48 years. It is evident in Table 1 that 30.3% of the cases were aged  $\geq 35$  years, compared with 12.5% of the controls ( $p < 0.001$ ). The majority (81.6%) of the women were housewives, but there was no significant difference between the two groups ( $p = 0.065$ ). Around two-thirds (64.3%) of the women were living in urban areas, again the difference was not significant ( $p = 0.126$ ). The proportion of smoking among cases (11.9%) was significantly higher than the proportion (0%) among the controls ( $p < 0.001$ ) as presented in Table (1).



**Table (1):** Basic characteristics

	Case	Control	Total	p value
Age (years)				
<20	25 (11.5)	29 (6.6)	54 (8.2)	
20-24	41 (18.8)	163 (37.0)	204 (31.0)	
25-29	40 (18.3)	96 (21.8)	136 (20.7)	
30-34	46 (21.1)	97 (22.0)	143 (21.7)	
≥ 35	66 (30.3)	55 (12.5)	121 (18.4)	<0.001*
Occupation				
Housewife	167 (76.6)	370 (84.1)	537 (81.6)	
Office work	45 (20.6)	61 (13.9)	106 (16.1)	
Manual worker	6 (2.8)	9 (2.0)	15 (2.3)	0.065*
Residency				
Urban	149 (68.3)	274 (62.3)	423 (64.3)	
Rural	69 (31.7)	166 (37.7)	235 (35.7)	0.126*
Smoking				
Yes	26 (11.9)	0 (0.0)	26 (4.0)	
No	192 (88.1)	440 (100.0)	632 (96.0)	<0.001*
Total	218 (100.0)	440 (100.0)	658 (100.0)	

\*By Chi-square test.

Less than half (43.6%) of the cases were delivered at term, compared with 70.5% of the controls ( $p < 0.001$ ). The proportion of multiparous and grand multiparous women among cases was 32.1% and 6.4% respectively, compared with 17.5% and 3.2% among the controls ( $p < 0.001$ ). Around one-third (34.9%) of cases had a history of

multiple gestations, compared with 24.1% of the controls ( $p = 0.004$ ). The proportion of cases with a history of preeclampsia (12.4%) was significantly higher than that of the controls (2.3%). No significant ( $p = 0.312$ ) difference was detected between cases and controls regarding the history of IVF Table (2).

**Table (2):** Obstetric history of the study groups

	Case	Control	Total	p value
Gestational age (weeks)				
Very preterm	7 (3.2)	0 (0.0)	7 (1.1)	
Moderate to late preterm	116 (53.2)	130 (29.5)	246 (37.4)	
Term	95 (43.6)	310 (70.5)	405 (61.6)	<0.001**
Parity				
Nulliparous	51 (23.4)	122 (27.7)	173 (26.3)	
Primiparous	83 (38.1)	227 (51.6)	310 (47.1)	





Multiparous	70 (32.1)	77 (17.5)	147 (22.3)	
Grand multiparous	14 (6.4)	14 (3.2)	28 (4.3)	<0.001*
Multiple gestations				
Yes	76 (34.9)	106 (24.1)	182 (27.7)	
No	142 (65.1)	334 (75.9)	476 (72.3)	0.004*
Previous preeclampsia				
Yes	27 (12.4)	10 (2.3)	37 (5.6)	
No	191 (87.6)	430 (97.7)	621 (94.4)	<0.001*
IVF				
Yes	5 (2.3)	5 (1.1)	10 (1.5)	
No	213 (97.7)	435 (98.9)	648 (98.5)	0.312**
Total	218 (100.0)	440 (100.0)	658 (100.0)	

\*By Chi-square test. \*\*By Fisher's exact test.

The proportion of cases with a history of heart disease (4.1%) was significantly ( $p = 0.047$ ) higher than that of the controls (1.6%). No significant association was detected

between preeclampsia and history of the following: diabetes ( $p = 0.186$ ), APLS ( $p = 0.193$ ), and chronic hypertension ( $p = 0.1930$ ), as presented in Table (3).

**Table (3):** Medical history of the study groups

	Case	Control	Total	p value
Diabetes				
Yes	0 (0.0)	6 (1.4)	6 (0.9)	
No	218 (100.0)	434 (98.6)	652 (99.1)	0.186**
APLS				
Yes	6 (2.8)	5 (1.1)	11 (1.7)	
No	212 (97.2)	435 (98.9)	647 (98.3)	0.193**
Heart disease				
Yes	9 (4.1)	7 (1.6)	16 (2.4)	
No	209 (95.9)	433 (98.4)	642 (97.6)	0.047*
Chronic hypertension				
Yes	6 (2.8)	5 (1.1)	11 (1.7)	
No	212 (97.2)	435 (98.9)	647 (98.3)	0.193**
Total	218 (100.0)	440 (100.0)	658 (100.0)	

\*By Chi-square test. \*\*By Fisher's exact test. APLS: Antiphospholipid antibody syndrome

Fourteen women in the case group (6.4%) gave birth to neonates with congenital anomalies, compared with 0% of women in the control group ( $p < 0.001$ ). Around half

(46.8%) of cases were delivered by elective Cesarean section, compared to 23.4% of the controls ( $p < 0.001$ ). The proportion of neonates with low Apgar scores in the first





and fifth minutes was significantly higher among cases than the controls ( $p < 0.001$ ). The rates of low birth weight of 1000-1499 g and 1500-2499 g among cases were 3.2% and 42.7% respectively, compared with 0% and

0.9% among the controls ( $p < 0.001$ ). The incidence of early neonatal death among cases (19.3%) was significantly ( $p < 0.001$ ) higher than that among the controls (0%), as presented in Table (4).

**Table (4):** Outcomes in each of the study groups

	Case	Control	Total	p value
Fetal congenital anomalies				
Yes	14 (6.4)	0 (0.0)	14 (2.1)	
No	204 (93.6)	440 (100.0)	644 (97.9)	<0.001**
Mode of delivery				
Spontaneous vaginal delivery	77 (35.3)	245 (55.7)	322 (48.9)	
Induction of labor	25 (11.5)	34 (7.7)	59 (9.0)	
Elective Cesarean section	102 (46.8)	103 (23.4)	205 (31.2)	
Emergency Cesarean section	14 (6.4)	58 (13.2)	72 (10.9)	<0.001*
Apgar score in 1 <sup>st</sup> minute				
Low (0-3)	51 (23.4)	8 (1.8)	59 (9.0)	
Moderately abnormal (4-6)	53 (24.3)	30 (6.8)	83 (12.6)	
Reassuring (7-10)	114 (52.3)	402 (91.4)	516 (78.4)	<0.001*
Apgar score in 5 <sup>th</sup> minute				
Low (0-3)	18 (8.3)	0 (0.0)	18 (2.7)	
Moderately abnormal (4-6)	36 (16.5)	8 (1.8)	44 (6.7)	
Reassuring (7-10)	164 (75.2)	432 (98.2)	596 (90.6)	<0.001*
Newborn weight (g)				
1000-1499	7 (3.2)	0 (0.0)	7 (1.1)	
1500-2499	93 (42.7)	4 (0.9)	97 (14.7)	
2500-3999	107 (49.1)	332 (75.5)	439 (66.7)	
≥ 4000	11 (5.0)	104 (23.6)	115 (17.5)	< 0.001**
Fetal outcome				
Fresh stillbirth	2 (0.9)	0 (0.0)	2 (0.3)	
Macerated stillbirth	2 (0.9)	0 (0.0)	2 (0.3)	
Alive, admission to NICU	130 (59.6)	13 (3.0)	143 (21.7)	
Early neonatal death	42 (19.3)	0 (0.0)	42 (6.4)	
Alive, no Admission to NICU	42 (19.3)	427 (97.0)	469 (71.3)	<0.001**
Total	218 (100.0)	440 (100.0)	658 (100.0)	

\*By Chi-square test. \*\*By Fisher's exact test. NICU: Neonatal intensive care unit





## Discussion

Assessing incidence rate and risk factors of preeclampsia in our tertiary center is important in detecting the magnitude of preeclampsia and its burden on health institutes in order to design prevention programs and management plans.<sup>17</sup> Incidence rate of preeclampsia in our tertiary center was 1.1% of all deliveries in one year. This PE incidence rate was lower than the PE rate (3%) reported by recent Pakistani prospective study.<sup>18</sup> A Recent study conducted by Kadhim et al. in which they reported that incidence of PE in Iraqi pregnant women was ranged between 3-5% of deliveries.<sup>19</sup> Our study incidence rate of PE was lower than results of previous Iranian cross-sectional study which found that PE incidence rate was (7.51%) in tertiary center.<sup>20</sup> This study revealed that increased age of pregnant women was significantly related to preeclampsia. Consistently, Tyas et al. found that advanced maternal age related to preeclampsia.<sup>21</sup> In our study, the smoking status of pregnant women was related to preeclampsia. This finding coincided with results of Morisaki et al.'s meta-analysis.<sup>22</sup> However, a systematic review by Wang et al. and a meta-analysis by Rodriguez-Lopez et al., reported a protective effect of smoking for hypertensive disorders in pregnancy and preeclampsia.<sup>23,24</sup> Current study found a significant relationship between preterm gestational age and preeclampsia. Similarly, a large prospective cohort study implemented in China reported that preeclampsia was accompanied with high risk of preterm labour.<sup>21,25</sup> Our study showed high risk of multiparity and grand-multiparity among pregnant women with preeclampsia. Muniro et al stated that grand-multiparity is a common risk factor of many adverse obstetrical outcomes especially preeclampsia.<sup>26</sup> The multiple pregnancies were a significant risk factor of preeclampsia in our study. A population-based study

conducted in Norway found that multiple pregnancies had 3-4 folds risk of developing PE regardless of other risk factors.<sup>27</sup> In our study, women with previous preeclampsia had high risk of developing preeclampsia. This finding was parallel to results of Hernández-Díaz et al.'s prospective cohort study.<sup>28</sup> Our study also revealed that women with history of heart diseases had high risk of preeclampsia. It was also shown that women with preeclampsia had a high future risk of developing heart diseases.<sup>29</sup> Present study showed that common adverse outcomes of pregnant women with preeclampsia were fetal congenital anomalies, elective cesarean section, low Apgar scores at 1 & 5 minutes and early neonatal death. These findings were in agreement with different literatures carried out in Kurdistan region/Iraq by Akrawi et al. and other countries which reported many maternal and neonatal adverse outcomes of pregnancies complicated by preeclampsia.<sup>30-32</sup>

## Conclusion

The incidence rate of preeclampsia in tertiary center was (3.3%) that was acceptable and closes to national rate. The common associated risk factors of preeclampsia are increased maternal age, smoking, preterm gestational age, grand-multiparity, previous preeclampsia and heart disease. The common adverse outcomes of pregnant women with preeclampsia were fetal congenital anomalies, elective cesarean section, low Apgar scores at 1 & 5 minutes and early neonatal death. This study recommended routinely monitoring of blood pressure of pregnant women during antenatal care and further monitoring and management for high-risk group.

## Conflict of interest

The authors declare no conflict of interest.

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