

## Timing And Manner Of Delivery In Hypertensive Disorders Of Pregnancy

Fatimata Kane<sup>1,2</sup>, Gao Na<sup>1,2</sup>, Lu Ruihui<sup>1,2</sup>, Zhou Xinxin<sup>1,2</sup>, Tang Haiyang<sup>1,2</sup>,  
Lan Xiangxin<sup>1,2</sup>, Li Guiyang<sup>1,2</sup>, Xiao Yuxin<sup>1,2</sup>, Chen Yuefen<sup>1,2</sup>, Xun Zhang<sup>1,2</sup>,  
Yuyan Ma<sup>2</sup>

<sup>1</sup>School of Medicine, Shandong University, 44 Wen Hua Xi Road, Jinan City, Shandong Province, China

<sup>2</sup>Department of Obstetrics and Gynaecology, Qilu Hospital of Shandong University, 107 Wen Hua Xi Road  
Jinan, Shandong Province, 250012, China

### Abstract:

**Objectives:** To evaluate the delivery method for pregnant women with hypertensive disorders. Additionally, to determine the timing of the delivery in association with the manner of delivery to understand the termination of pregnancy with one of the leading causes of maternal death worldwide.

**Methods:** In this retrospective study, we collected data from 290 patients with hypertensive disorders from Qilu Hospital of Shandong University. The patients were divided into six groups: 43 with gestational hypertension, 39 with preeclampsia, 170 with severe eclampsia, 2 with eclampsia, 18 with chronic hypertension, 28 with chronic hypertension with superimposed preeclampsia. Data analysis was done using SPSS software.  $P \leq 0.5$  was considered statistically significant.

**Results:** We found that the eclampsia and severe eclampsia group had the highest rate of c-section (100% and 95.9%) and gestational hypertension and chronic hypertension group the lowest rate of c-section 55.8% and 66.7% respectively. Except for chronic hypertension group, where most deliveries occurred at early term (38.9%), most babies in 5 groups were born between 32 and 37 weeks of gestation with a rate of 39.5% to 100%. Placenta abruption was found in around 10% of pregnant women with chronic hypertension with superimposed preeclampsia and in lower rates for other groups. Less than 5% of patients of each group had a pregnancy complicated by HELLP syndrome. We could notice significantly lower birth weight for severe eclampsia group ( $2.091 \pm 0.76$ ) and higher birth weight for gestational hypertension ( $3.203 \pm 0.66$ ) group compared to the others ( $P < 0.001$ ). However, there was no significant difference for gestational age at delivery among groups.

**Conclusion:** Pregnant women with hypertensive disorders have higher possibility to deliver with c-section than vaginally. This study shows, from the highest to the lowest rate of c-section: eclampsia, chronic hypertension with superimposed preeclampsia, severe preeclampsia, preeclampsia, chronic hypertension and gestational hypertension. Late preterm delivery was higher among groups except for chronic hypertension patients. Furthermore, the rate of c-section is associated to the severity of the disease and higher gestational age with early management. An extended time of gestation can be beneficial for neonatal outcomes, including neonatal weight. These discoveries should help to advise practitioner for early routine diagnosis and treatment to prevent complications related to hypertensive disorders of pregnancy.

**Key words:** hypertension, timing, mode, delivery, pregnancy-induced hypertension.

Date of Submission: 28-02-2020

Date of Acceptance: 13-03-2020

### I. Introduction

Hypertensive disorders of pregnancy represent the second-highest leading cause of maternal death worldwide after hemorrhage(1-3). They complicate near 10% of all pregnancies(4-6). History of pregnancy-induced hypertension is associated with the augmented possibility of hypertension and cardiovascular disorders(7-9). They are considered to be a multifactorial disease involving placental abnormality and maternal factors which include cardiovascular disorders, metabolic factors, immune factors, angiogenic factors, anti-angiogenic factors and positive family history of pregnancy hypertensive disorders(5). Moreover, hypertensive disorders are linked to severe outcomes, including obstetrical complications, stroke, and morbidity(10). Obstetrical complications, including c-section, have increased over vaginal delivery in the past few years in many countries(11). C-section is performed by the practitioner in pregnancy-induced hypertension to decrease the risk associated with fetal distress and pregnancy related complications(12). Additionally,

according to the mode of delivery, some studies have stated the higher risk of perinatal complications, mortality and morbidity correlated with c-section than vaginal delivery(13).

Furthermore, regarding the delivery, there is a high chance of future premature delivery in women with previous hypertensive disorders of pregnancy(3). Neonatal mortality is linked to preterm delivery(14). Because of the severity of these diseases and the high risks related to recurrent pregnancy, it is important to identify the average period of delivery among these pregnant women. Still, the timing of the delivery for each type of hypertensive disorders of pregnancy is not well identified. This study aimed to estimate the stage at which delivery occurs in hypertensive disorders of pregnancy.

Another important subject is to determine how the hypertensive disorders of the pregnancy affect the mode of delivery. Generally, all the pathological changes correlated with pregnancy-induced hypertension improve with suitable prenatal attention and delivery of the placenta(15, 16). The pregnancy can be terminated by a c-section or vaginal delivery except for complications related to the fetus or contraindications to vaginal delivery(17). Therefore, in this study, we asked whether there is a high difference in rate between c-section and vaginal delivery. To do so, we compared the method and delivery process of pregnant patients with hypertensive disorders who gave birth in Qilu hospital between 2017 and 2018. Therefore, we classified the collected data in 6 groups (gestational hypertension, preeclampsia, severe preeclampsia, eclampsia, chronic hypertension, chronic hypertension with superimposed preeclampsia) for the most accurate results for each type.

## **II. Material and Methods**

### ***Study population***

This retrospective study was done by routinely collected data for pregnant women that enrolled in the obstetrics department of Qilu Hospital of Shandong University from January 2018 to January 2019. For this study, 290 patients' data were assessed. Those patients were pregnant women with hypertensive disorders between 16 and 49 years old. To determine whether hypertensive disorders influence the timing and delivery methods during pregnancy. The subjects were divided into 6 groups: 43 for gestational hypertension, 39 for preeclampsia, 170 for severe preeclampsia, 2 for eclampsia, 18 for chronic hypertension, 28 for chronic hypertension with superimposed preeclampsia.

### ***Inclusion Criteria***

Patients with diabetes, twin gestation, previous pregnancy with hypertensive disorders and family history of hypertension were included in this study.

### ***Exclusion Criteria***

Women who didn't follow up or give birth in the hospital, pregnancy with fetal anomalies, miscarriage or abortion and with incomplete data were excluded.

### ***Data Collection***

Data analysed included age, BMI, height, weight, gravidity, parity, medical history (diabetes, renal disease, systemic lupus erythematosus, chronic hypertension, hypertension in previous pregnancy, family history of hypertension), Systolic blood pressure, Diastolic blood pressure, gestational age at the onset of hypertension, laboratory findings (urine protein, minimum albumin, serum creatinine, BUN, ALT, AST).

For gestational hypertensive patients, a follow-up was done to check if the blood pressure went back to normal after the pregnancy.

### ***Definitions***

*Gestational hypertension*: was defined as a presence of hypertension with systolic blood pressure  $\geq$  140mmHg and diastolic blood pressure  $\geq$  90mmHG after 20 weeks of gestation without proteinuria(18, 19).

*Preeclampsia*: was defined as elevated blood pressure (systolic blood pressure  $\geq$  140mmHg and diastolic blood pressure  $\geq$  90mmHg) after 20 weeks gestation with proteinuria(20).

*Severe preeclampsia*: was defined as (systolic blood pressure  $>$  160mmhg and diastolic blood pressure  $>$  110mmhg) with proteinuria, severe symptoms, organ damage and system dysfunction(20).

*Eclampsia*: was defined as a complicated severe preeclampsia syndrome with unexplained seizure(21).

*Chronic hypertension*: was defined as preexisting hypertensive disorders before conception(3).

*Chronic hypertension with superimposed preeclampsia*: was defined as the onset of proteinuria and preeclampsia features at 20 weeks gestation in a pregnant woman with a history of chronic hypertension(18, 22).

### ***Data analysis***

Statistical analysis was performed using IBM SPSS Statistics Version 23 (Release 23.0.0.0).

Qualitative variables were compared using the Chi-square test and quantitative variables with One-way Anova. The Data for categorical variables was presented using a frequency table, number and percentage (%) and for the continuous variable by the mean and standard deviation. P-value  $\leq$  0.05 was considered statistically significant.

III. Result

There was a history of chronic hypertension in 3 groups, for eclampsia (5%), and it was higher for chronic hypertension (83.3%) and chronic hypertension with superimposed preeclampsia (82.1%). History of hypertension in previous hypertension was present in all groups except the eclampsia group. Family history of hypertension wasn't present in preeclampsia and eclampsia group, it was lower in gestational hypertension group and higher in chronic hypertension (44.4%) and chronic hypertension with superimposed preeclampsia (35.7%). In this study, mean maternal age differed significantly across groups ( $p < 0.001$ ) and were highest in chronic hypertension with superimposed preeclampsia group ( $35.22 \pm 4.72$ ) and lower for eclampsia group ( $24.5 \pm 0.70$ ). History of Diabetes was present in all groups except the eclampsia group and chronic hypertension group (Table 1).

Table no 1: Baseline Maternal Characteristics

	Gestational Hypertension	Preeclampsia	SeverePreeclampsia	Eclampsia	Chronic Hypertension	Chronic Hypertension With Superimposed Preeclampsia	P-Value
	N=43	N=39	N=170	N=2	n=18	n=28	
Maternaldemographiccharacteristics							
Maternalage	32 ±6.62	31.74 ±4.90	32.34 ±5.34	24.5 ±0.70	36.17 ±4.63	35.11 ±4.72	0.001
BMI	32.42±7.29	31.04±4.84	30.85 ±4.28	23.62±0.87	31.71 ±4.98	32.79 ±4.79	0.054
Height(cm)	163.61 ±5.43	163.05 ±6.29	161.25 ±4.79	160.5 ±6.36	161.83 ±4.86	162.07 ±4.79	0.098
MaternalWeight(Kg)	86.61 ±20.45	82.61 ±14.19	80.27 ±12.94	61 ±7.07	83.14 ±14.27	86.62 ±16.28	0.018
Gravidity	2.26 ±1.09	2.08 ±1.17	2.77 ±1.30	1.5 ±0.70	2.78 ±1.43	3.14 ±1.20	0.002
Parity	0.65 ±0.75	0.46 ±0.60	0.76 ±0.67	0 ±0.00	0.78 ±0.42	1 ±0.54	0.012
History							
Diabetes	9 (20.9%)	5 (12.8%)	19 (11.2%)	0 (0%)	0 (0%)	5 (17.9%)	<0.001
RenalDisease	0 (0%)	0 (0%)	2 (1.2%)	0 (0%)	0 (0%)	0 (0%)	0.908
Systemic Lupus Erythematous	0(0%)	2(5.1%)	4(2.4%)	0(0%)	0(0%)	0(0%)	0.562
Chronic Hypertension	0(0%)	0(0%)	10(5.9%)	0(0%)	15(83.3%)	23(82.1%)	<0.001
Hypertension in previouspregnancy	3(7.0%)	3(7.7%)	23(13.5%)	0(0%)	3(16.7%)	4(14.3%)	0.72
FamilyHistory of Hypertension	2(4.7%)	0(0%)	24(14.1%)	0(0%)	8(44.4%)	22(35.7%)	<0.001
BookingCharacteristics							
Systolic Blood Pressure	156.19 ±13.64	151.78 ±7.87	169.18 ±18.84	158 ±9.89	159.83 ±11.96	181.14 ±13.92	<0.001
Diastolic Blood Pressure	95.67 ±11.26	95.41 ±8.52	107.23 ±13.08	96 ±4.24	102.78 ±12.21	124.79 ±60.87	<0.001
Gestational Age at Onset of Hypertension	33.61±5.88	32.36 ±5.52	30.82 ±5.37	35.5 ±0.70	15.2 ±3.34	24.6 ±11.21	0.981
Highest urine protein	0.04±0.21	1.61±1.18	2.18±1.10	2.50±0.70	0.05±0.23	1.46±1.17	<0.001
Minimum albumin	34.42±3.50	31.83±3.69	31.49±24.93	26±4.24	35.82±2.46	31.05±3.26	0.887
Serumcreatinine	52.29±11.62	54.68±9.84	63.06±17.28	66.5±14.84	50±6.031	60.96±18.11	<0.001
BUN	41±3.8	37±4.28	167±5.15	4.5±1.41	3.81±0.90	4.77±1.90	0.007
ALT	34.92±112.93	16.70±8.44	35.23±83.90	26.5±3.53	26.29±22.98	37.85±36.94	0.844
AST	30.78±69.47	19.78±6.04	36.49±72.90	35.5±3.53	22.76±12.21	35.64±29.17	0.736

BMI: Body Mass Index

BUN: Blood Urea Nitrogen

AST: Aspartate Transaminase

ALT: Alanine Aminotransferase

Late preterm was the highest for five different groups with eclampsia (100%), preeclampsia (56.4%), severe preeclampsia (47.9%), gestational hypertension (39.5%), chronic hypertension with superimposed preeclampsia (38.9%). For the chronic hypertension group, the highest rate of delivery was at early term with 38.9%—the rate of extremely preterm of the lowest in all groups. We had compared the gestational age for the six different groups respectively and represented them in table 2. Less than 25% of pregnant women in each

group gave birth at full term. More than 50% of all babies for chronic hypertension and chronic hypertension with superimposed preeclampsia were born after 37weeks of gestation.

**Table no 2:** Relation between gestational age and hypertensive disorders

	Gestational Hypertension	Preeclampsia	Severe Preeclampsia	Eclampsia	Chronic Hypertension	Chronic Hypertension With Superimposed Preeclampsia
Extremely Preterm <28(%)	1(2.30%)	0(0.00%)	1(0.70%)	0(0.00%)	2(11.10%)	0(0.00%)
Very Preterm 28-32(%)	4(9.30%)	4(10.30%)	15(10.60%)	0(0.00%)	2(11.10%)	2(11.10%)
Late Preterm 32-37(%)	17(39.50%)	22(56.40%)	68(47.90%)	2(100.00%)	3(16.70%)	7(38.90%)
Early Term 37-39(%)	11(25.60%)	11(28.20%)	37(26.10%)	0(0.00%)	7(38.90%)	6(33.30%)
Term 39-41(%)	10(23.30%)	2(5.10%)	21(14.80%)	0(0.00%)	4(22.20%)	3(16.70%)

**Table no 3:** Relation between delivery mode and hypertensive disorders

Delivery mode	Gestational Hypertension	Preeclampsia	SeverePreeclampsia	Eclampsia	Chronic Hypertension	Chronic Hypertension With Superimposed Preeclampsia
C-section	55.80%	82.10%	95.90%	100.0%	66.7%	96.4%
Vaginal Delivery	44.2%	17.9%	4.1%	0	33.3%	3.6%

According to the type of hypertensive disorders, the rate of c-section is higher in all groups. For the eclampsia group, all babies were born through c-section. Followed by chronic hypertension with superimposed eclampsia and severe preeclampsia groups, respectively 96.4% and 95.9%. For preeclampsia patients 82.1% had c-section and 17.9% vaginal delivery. Rate of c-section was lowest among all groups in chronic hypertension and gestational hypertension groups, 66.7% and 55.8% respectively (Table 3).

There were significant differences detected for placenta Abruption across groups. Placenta Abruption was existing in less than 10% in all groups except for chronic hypertension with superimposed preeclampsia (10.7%). Another important maternal complication was HELLP syndrome. 8((4.7%) of severe preeclampsia patients had developed HELLP syndrome and 1(3.6%) patient in chronic hypertension superimposed with the preeclampsia group (Table4).

Mean neonatal weight was highest for the patients with gestational hypertension (3.2± 0.6) and lowest for severe preeclampsia patients (2.09±0.76). 21(75.0%) of babies from chronic hypertension with superimposed preeclampsia were transferred to NICU, 108(63%) for severe preeclampsia patients. Transfer to NICU for all others groups were less than 30% of the babies (Table5).

**Table no 4:** Maternal Outcomes

	Gestational Hypertension	Preeclampsia	SeverePreeclampsia	Eclampsia	Chronic Hypertension	Chronic Hypertension With Superimposed Preeclampsia	P-Value
PlacentalAbruption	2 (4.7%)	2 (5.1%)	10 (5.9%)	0 (0%)	0 (0%)	3 (10.7%)	<0.001
MaternalBethametasone	7(16.3%)	15 (38.5%)	119 (70.0%)	1 (50%)	3 (16.7%)	19 (67.9%)	0.106
HELLP	0 (0%)	0 (0%)	8 (4.7%)	0 (0%)	0 (0%)	1 (3.6%)	<0.001
abnormalblood flow	0 (0%)	1(2.6%)	4(2.40%)	0 (0%)	0 (0%)	1(3.60%)	0.875
S/D	3(7.00%)	5(12.80%)	27(15.90%)	0 (0%)	0 (0%)	2(7.10%)	0.249
Intracerebralhemorrhage	34(79.10%)	27(69.20%)	111(65.30%)	2(100.00%)	15(83.30%)	18(64.30%)	0.301
DIC	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
PulmonaryEdema	0 (0%)	0 (0%)	7(4.10%)	0 (0%)	0 (0%)	1(3.60%)	0.512

Acute renal failure	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Ascites	0 (0%)	2(5.10%)	0 (0%)	0 (0%)	0 (0%)	2(7.10%)	0.572
Hepatic Rupture	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

HELLP: Hemolysis, Elevated Liver Enzymes, and a Low Platelet count

DIC: Disseminated intravascular coagulation

#### IV. Discussion

The question addressed by this study was how the hypertensive disorders of pregnancy affect the delivery method and the stage at which the babies are delivered. In our study, we found that hypertensive disorders in pregnancy are associated with a high rate of c-section, the lowest for gestational hypertension and the highest rate for eclampsia group. We also have evidence that most of the babies are born late preterm for all the groups except for the chronic hypertension patients, which are at early term.

We found that gestational hypertension patients, with the lowest rate of c-section 55.8% had a mean gestational age of 37.42 ±2.16 and mean neonatal weight of 3.2 ±0.66 which are greater than those of the others groups of patients. Moreover, some studies mentioned a declined morbidity proportion for pregnant women with preeclampsia when induction of labor is done after 34 weeks of gestation (23). In our study, the mean gestational age for pregnant women with preeclampsia was 36.41±2.91 weeks, with 10% of babies born before 32 weeks of gestation. However, Labor Induction at 37 weeks is recommended for pregnant women with gestational hypertension and preeclampsia (24).

Table no 5: Neonatal Outcomes

	Gestational Hypertension	Preeclampsia	Severe Preeclampsia	Eclampsia	Chronic Hypertension	Chronic Hypertension With Superimposed Preeclampsia	P-Value
Gestational Age at deli	37.43±2.16	36.41±2.91	34.36±2.89	37 ±0,00	36.5±2.95	33.81±3.18	0.755
Neonatal Weight(g)	3203 ±665.41	2904.31±972.73	2091.26 ±766.59	2800 ±0,00	2865.88 ±710.74	2213.15 ±1032.25	<0.001
Small for gestational age(SGA)	2(4.70%)	3(7.70%)	39(22.90%)	0 (0%)	1(5.60%)	5(17.90%)	0.019
Fetal growth restriction(FGR)	3 (7.0%)	1 (2.6%)	14 (8.2%)	0 (0%)	1(5.6%)	2 (7.1%)	<0.001
Transfer to NICU	9 (20.9%)	11 (28.2%)	108 (63.5%)	0 (0%)	4 (22.2%)	21 (75.0%)	0.729
Neonatal Score 1min	9.76±0.86	9.79±0.92	8.77±2.39	10±0.00	9.16±2.40	8.35±2.62	0,008
Neonatal score 5min	9.93±0.33	9.89±0.50	9.38±1.73	10±0.00	9.94±0.23	9.5±0.83	0.075

Most babies delivered in the chronic hypertension group were born at early term and at term representing 61.1% of all patients diagnosed with chronic hypertension. A high percentage of patients were diagnosed with chronic hypertension before pregnancy, and some of the patients were diagnosed with hypertension in previous pregnancies. So, there was a treatment prescribed to most these patients before pregnancy and at all stage of the pregnancy for hypertensive disorders in contrary to most of the patients in other groups. For example, Easterling and colleagues (25), have reported that there was a decreased incidence of severe maternal hypertension and preterm delivery in women who had initial hypertensive treatment.

Otherwise, the delivery timing for the superimposed preeclampsia group was at 50% rate of babies born before and after 37 weeks of gestation. Even with the same rate of preterm and term babies, the mean neonatal weight was low 2.21±0.1 the rate of c-section was 96.4% of all delivery for superimposed preeclampsia. However, superimposed preeclampsia was associated with low neonatal, preterm delivery and high rate of c-section (26).

Previous studies have mentioned that due to elevated risk associated to vaginal delivery for hypertensive disorders patients, caesarean delivery is most often preferred (27, 28). That would explain the high rate of c-section in our study. However, immediate c-section was linked to high maternal and neonatal pulmonary complications in women with severe preeclampsia and presented no benefits (29). Suggestion for management for patients with severe preeclampsia is maternal stabilisation and pregnancy termination at or after 34 weeks of gestation (30). Induction of labor at or 34 weeks of gestation has exhibited effective results in pregnant women with severe preeclampsia (31).

This study presents several strengths. First, it is that the hypertensive disorders are classified by groups and analysed for every group to determine the differences between them and the specificity for each group. Second, we provide the correlation between the age of the delivery and the termination of the pregnancy

in full range for the hypertensive disorders in pregnancy. Third, we included eclampsia, one of the complications of hypertensive disorders of pregnancy, in our study as one group to understand the process, demographic and outcome better.

Although there are evident strengths to our study, it also contains certain limitations that need to be addressed. First, for the eclampsia group, there was a limited number of patients for this study. Only two patient's data were collected because it is one of the extreme complications of hypertensive disorders, and it doesn't occur as often as the other types of hypertensive disorders of pregnancy. Second, still in the same group of eclampsia patients, we can see that there is a large difference between the age of patients for eclampsia group and the other groups of approximately ten years. Last, all the data of this study were collected for one year, a larger size of patients and of distinctive years is important to fully make in evidence the differences across groups for a better understanding of the evolution of the diseases and treatment methods according to each type of hypertensive disorders.

## V. Conclusion

Pregnant women with hypertensive disorders have higher possibility to deliver with c-section than vaginal delivery. Among them, eclampsia and severe eclampsia patients represented the most favorable for c-section and gestational hypertension and chronic hypertension patients for vaginal delivery, but still, c-section remain the highest in all groups. Late preterm delivery was highest among groups except for chronic hypertension patients where the early term was more usual. Since hypertensive disorders of pregnancy represent one of the leading causes of maternal mortality and don't only affect the patient in the current pregnancy, but can also affect future pregnancies and health later in life. It is important to fully understand all parts of its process and termination to create better management options for pregnant women with different types of hypertensive disorders. Since the higher rate of c-section is related to the severity of the disease and the time of gestation with initial detection of hypertension. Early diagnosis and treatment are crucial to reduce complications associated with hypertensive disorders of pregnancy. Physicians should advise immediate investigation at the early stage of the pregnancy and adapted antenatal surveillance for women with a history or with a newly discovered hypertensive disorder to prevent complications and mortality.

## References

- [1]. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *The Lancet Global Health*. 2014;2(6):e323-e33.
- [2]. Rath W, Fischer T. The diagnosis and treatment of hypertensive disorders of pregnancy: new findings for antenatal and inpatient care. *Dtsch Arztebl Int*. 2009;106(45):733-8.
- [3]. van Oostwaard MF, Langenveld J, Schuit E, Papatsonis DNM, Brown MA, Byaruhanga RN, et al. Recurrence of hypertensive disorders of pregnancy: an individual patient data metaanalysis. *American journal of obstetrics and gynecology*. 2015;212(5):624.e1-e17.
- [4]. Ukah UV, Hutcheon JA, Payne B, Haslam MD, Vatish M, Ansermino JM, et al. Placental Growth Factor as a Prognostic Tool in Women With Hypertensive Disorders of Pregnancy. 2017;70(6):1228-37.
- [5]. Kintiraki E, Papakatsika S, Kotronis G, Goulis DG, Kotsis V. Pregnancy-Induced hypertension. *Hormones (Athens, Greece)*. 2015;14(2):211-23.
- [6]. Barakat R, Pelaez M, Cordero Y, Perales M, Lopez C, Coteron J, et al. Exercise during pregnancy protects against hypertension and macrosomia: randomized clinical trial. *American Journal of Obstetrics and Gynecology*. 2016;214(5):649.e1-e8.
- [7]. Palmsten K, Buka SL, Michels KB. Maternal pregnancy-related hypertension and risk for hypertension in offspring later in life. *Obstet Gynecol*. 2010;116(4):858-64.
- [8]. Romundstad PR, Magnussen EB, Smith GD, Vatten LJ. Hypertension in Pregnancy and Later Cardiovascular Risk. 2010;122(6):579-84.
- [9]. Veerbeek JHW, Hermes W, Breimer AY, Rijn BBv, Koenen SV, Mol BW, et al. Cardiovascular Disease Risk Factors After Early-Onset Preeclampsia, Late-Onset Preeclampsia, and Pregnancy-Induced Hypertension. 2015;65(3):600-6.
- [10]. Kuklina EV, Ayala C, Callaghan WM. Hypertensive Disorders and Severe Obstetric Morbidity in the United States. *Obstetrics & Gynecology*. 2009;113(6):1299-306.
- [11]. Wu Y, Kataria Y, Wang Z, Ming W-K, Ellervik C. Factors associated with successful vaginal birth after a cesarean section: a systematic review and meta-analysis. *BMC pregnancy and childbirth*. 2019;19(1):360.
- [12]. Begum T, Rahman A, Nababan H, Hoque DME, Khan AF, Ali T, et al. Indications and determinants of caesarean section delivery: Evidence from a population-based study in Matlab, Bangladesh. *PLoS one*. 2017;12(11):e0188074-e.
- [13]. Katz L, Amorim MM, Souza A, Sr., Maia SB, França Neto AH, Leal NV, et al. [39-OR]: Cesarean section vs. vaginal delivery in severe preeclampsia: Perinatal outcomes. *Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health*. 2015;5(1):19.
- [14]. Hoffman MK, Goudar SS, Kodkany BS, Metgud M, Somannavar M, Okitawutshu J, et al. Low-dose aspirin for the prevention of preterm delivery in nulliparous women with a singleton pregnancy (ASPIRIN): a randomised, double-blind, placebo-controlled trial. *Lancet*. 2020;395(10220):285-93.
- [15]. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. *Obstet Gynecol*. 2013;122(5):1122-31.
- [16]. Poon LC, Galindo A, Surbek D, Chantraine F, Stepan H, Hyett J, et al. From first-trimester screening to risk stratification of evolving pre-eclampsia in the second and third trimesters of pregnancy: a comprehensive approach. *Ultrasound in obstetrics & gynecology : the official journal of the International Society of Ultrasound in Obstetrics and Gynecology*. 2019.
- [17]. Xiaobo Z, Qizhi H, Zhiping W, Tao D. Down-regulated miR-149-5p contributes to preeclampsia via modulating endoglin expression. *Pregnancy hypertension*. 2019;15:201-8.

- [18]. Brown MA, Lindheimer MD, de Swiet M, Van Assche A, Moutquin JM. The classification and diagnosis of the hypertensive disorders of pregnancy: statement from the International Society for the Study of Hypertension in Pregnancy (ISSHP). *Hypertension in pregnancy*. 2001;20(1):ix-xiv.
- [19]. Kumar N, Singh AK, Maini B. Impact of maternal serum uric acid on perinatal outcome in women with hypertensive disorders of pregnancy: A prospective study. *Pregnancy hypertension*. 2017;10:220-5.
- [20]. Dai D-M, Cao J, Yang H-M, Sun H-M, Su Y, Chen Y-Y, et al. Hematocrit and plasma albumin levels difference may be a potential biomarker to discriminate preeclampsia and eclampsia in patients with hypertensive disorders of pregnancy. *Clinica Chimica Acta*. 2017;464:218-22.
- [21]. Alonso-Ventura V, Li Y, Pasupuleti V, Roman YM, Hernandez AV, Pérez-López FR. Effects of preeclampsia and eclampsia on maternal metabolic and biochemical outcomes in later life: a systematic review and meta-analysis. *Metabolism - Clinical and Experimental*. 2020;102.
- [22]. Webster LM, Gill C, Seed PT, Bramham K, Wiesender C, Nelson-Piercy C, et al. Chronic hypertension in pregnancy: impact of ethnicity and superimposed preeclampsia on placental, endothelial, and renal biomarkers. *Am J Physiol Regul Integr Comp Physiol*. 2018;315(1):R36-r47.
- [23]. Coates D, Makris A, Catling C, Henry A, Scarf V, Watts N, et al. A systematic scoping review of clinical indications for induction of labour. *PLOS ONE*. 2020;15(1):e0228196.
- [24]. Leeman L, Dresang LT, Fontaine P. Hypertensive Disorders of Pregnancy. *Am Fam Physician*. 2016;93(2):121-7.
- [25]. Easterling TR, Carr DB, Brateng D, Diederichs C, Schmucker B. Treatment of hypertension in pregnancy: effect of atenolol on maternal disease, preterm delivery, and fetal growth. *Obstetrics & Gynecology*. 2001;98(3):427-33.
- [26]. Casagrande L, Rezende GP, J PG, Costa RS, Parpinelli MA, Surita FG, et al. Maternal and perinatal outcomes related to superimposed pre-eclampsia in a Brazilian cohort of women with chronic hypertension. *Int J Gynaecol Obstet*. 2020.
- [27]. Han B, Xu M. A comprehensive analysis of continuous epidural analgesia's effect on labor and neonates in maternal hypertensive disorder patients. *Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health*. 2017;7:33-8.
- [28]. Fatemeh T, Marziyeh G, Nayereh G, Anahita G, Samira T. Maternal and perinatal outcome in nulliparous women complicated with pregnancy hypertension. *JPMA The Journal of the Pakistan Medical Association*. 2010;60(9):707-10.
- [29]. Coppage KH, Polzin WJ. Severe preeclampsia and delivery outcomes: is immediate cesarean delivery beneficial? *Am J Obstet Gynecol*. 2002;186(5):921-3.
- [30]. Lambert G, Brichant JF, Hartstein G, Bonhomme V, Dewandre PY. Preeclampsia: an update. *Acta Anaesthesiol Belg*. 2014;65(4):137-49.
- [31]. Nassar AH, Adra AM, Chakhtoura N, Gómez-Marín O, Beydoun S. Severe preeclampsia remote from term: Labor induction or elective cesarean delivery? *American Journal of Obstetrics & Gynecology*. 1998;179(5):1210-3.

Fatimata Kane,etal. "Timing And Manner Of Delivery In Hypertensive Disorders Of Pregnancy." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(3), 2020, pp. 28-34.