

OUTCOMES OF PREGNANT WOMEN WITH DIFFERENT TYPES OF HYPERTENSION.

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ABSTRACT. Arterial hypertension is the most common somatic disorder during pregnancy, complicating 5–10% of all pregnancies. Hypertensive disorders of pregnancy (HDP) pose a serious risk to maternal and fetal health. Chronic arterial hypertension is defined as elevated blood pressure that existed prior to pregnancy. Gestational hypertension is characterized by elevated blood pressure after 20 weeks of gestation (commonly after 37 weeks) and usually normalizes within 6 weeks postpartum. It should be noted that, despite unified principles for the management of HDP worldwide, disproportionately high rates of adverse pregnancy outcomes in resource-limited settings are primarily due to difficulties in organizing healthcare and its quality under these conditions.

Objective: The aim of this study was to determine adverse perinatal and neonatal outcomes in pregnant women with hypertensive disorders of pregnancy.

Methods: An analytical cross-sectional study was conducted among women hospitalized with hypertensive disorders of pregnancy at the Bukhara City Maternity Complex from August 2022 to August 2025. Variables associated with adverse maternal and perinatal outcomes were compared using multivariable binomial regression analysis.

Results: Among 400 pregnant women, 2%, 35%, 14%, and 49% had eclampsia, preeclampsia, chronic arterial hypertension, and gestational hypertension, respectively. Women with preeclampsia/eclampsia had a significantly higher risk of cesarean section (79.4% vs. 65%; adjusted relative risk (RR) = 2.139; 95% CI: 1.386–3.302; $p=0.001$) and preterm birth before 34 weeks of gestation (20.5% vs. 6%; adjusted RR = 2.5; 95% CI: 1.19–5.25; $p=0.01$) compared to women with chronic/gestational hypertension. Risks of prolonged maternal hospitalization (43.9% vs. 27.1%), neonatal intensive care unit (NICU) admission (30.7% vs. 19.8%), and perinatal mortality (23.5% vs. 11.2%) were also higher among women with preeclampsia/eclampsia. All fetal biometric parameters in women with preeclampsia/eclampsia were lower compared to fetuses of women with chronic hypertension. All types of hypertensive disorders were associated with a significantly increased risk of neonatal complications such as sepsis, low birth weight, respiratory distress syndrome (RDS), and preterm birth, except for gestational hypertension, where the elevated risk was observed only for RDS (but not for sepsis or low birth weight).

Conclusions: Women with preeclampsia/eclampsia have higher risks of adverse maternal, perinatal, and neonatal outcomes compared to women with chronic or

gestational hypertension. Our findings indicate the need for strategies for the prevention and management of hypertensive disorders during pregnancy to improve pregnancy outcomes.

Keywords: Arterial hypertension, Preeclampsia, Eclampsia, Neonatal outcomes

ИСХОДЫ БЕРЕМЕННОСТИ У ЖЕНЩИН С РАЗЛИЧНЫМИ ТИПАМИ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ.

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Аннотация

Артериальная гипертензия является самым распространённым соматическим заболеванием во время беременности и осложняет около 5–10% всех беременностей. Гипертензивные расстройства беременности (ГРБ) представляют серьёзную угрозу для здоровья матери и плода. Хроническая артериальная гипертензия определяется как повышение артериального давления, существовавшее до наступления беременности, тогда как гестационная гипертензия характеризуется повышением артериального давления после 20 недель гестации (чаще после 37 недель) и, как правило, нормализуется в течение 6 недель после родов. Следует отметить, что, несмотря на единые мировые принципы ведения ГРБ, непропорционально высокая частота неблагоприятных исходов беременности в условиях ограниченных ресурсов в основном обусловлена трудностями в организации и качестве медицинской помощи.

Цель: Оценить неблагоприятные перинатальные и неонатальные исходы у беременных женщин с гипертензивными расстройствами беременности.

Методы: Проведено аналитическое поперечное исследование среди беременных женщин, госпитализированных с гипертензивными расстройствами беременности в Бухарском городском родильном комплексе в период с августа 2022 по август 2025 года. Связь между типами гипертензивных расстройств и неблагоприятными материнскими и перинатальными исходами оценивалась с использованием многовариантного биномиального регрессионного анализа.

Результаты: Среди 400 беременных женщин 2% имели эклампсию, 35% — преэклампсию, 14% — хроническую артериальную гипертензию и 49% — гестационную гипертензию. У женщин с преэклампсией/эклампсией риск кесарева сечения был значительно выше по сравнению с женщинами с хронической или гестационной гипертензией (79,4% против 65%; скорректированный относительный риск (RR) = 2,139; 95% ДИ: 1,386–3,302; $p = 0,001$), а также риск преждевременных родов до 34 недель гестации (20,5% против 6%; скорректированный RR = 2,5; 95% ДИ: 1,19–5,25; $p = 0,01$). Также чаще отмечались пролонгированная госпитализация матери (43,9% против

27,1%), госпитализация новорождённых в отделение интенсивной терапии (30,7% против 19,8%) и перинатальная смертность (23,5% против 11,2%) в группе преэклампсии/эклампсии. Все фетометрические показатели были ниже у плодов женщин с преэклампсией/эклампсией по сравнению с плодами женщин с хронической артериальной гипертензией. Все типы гипертензивных расстройств были ассоциированы со значительным увеличением риска неонатальных осложнений, таких как сепсис, низкая масса тела при рождении, респираторный дистресс-синдром (РДС) и преждевременные роды. Однако при гестационной гипертензии повышенный риск был выявлен только для РДС, без значимой связи с сепсисом и низкой массой тела при рождении.

Выводы: Преэклампсия и эклампсия связаны с более высоким риском неблагоприятных материнских, перинатальных и неонатальных исходов по сравнению с хронической и гестационной гипертензией. Полученные данные указывают на необходимость совершенствования мер профилактики, ранней диагностики и ведения гипертензивных расстройств во время беременности с целью улучшения исходов беременности.

Ключевые слова: артериальная гипертензия, преэклампсия, эклампсия, перинатальные исходы, неонатальные исходы.

Introduction: Arterial hypertension is the most common somatic disorder during pregnancy, complicating 5–10% of all pregnancies. Hypertensive disorders of pregnancy (HDP) pose a serious risk to maternal and fetal health[3,14] Chronic arterial hypertension is defined as elevated blood pressure that existed prior to pregnancy. Gestational hypertension is characterized by elevated blood pressure after 20 weeks of gestation (commonly after 37 weeks) and usually normalizes within 6 weeks postpartum.

Preeclampsia is defined as the detection of hypertension in a previously normotensive pregnant woman after 20 weeks of gestation, with or without proteinuria. In the absence of proteinuria, preeclampsia is accompanied by systemic or target organ dysfunction, such as thrombocytopenia, liver involvement with or without pain in the right upper quadrant or epigastrium, renal failure, pulmonary edema, and neurological complications, including altered consciousness, blindness, stroke, clonus, severe headache, or persistent visual scotomas[15].

Eclampsia is defined as the occurrence of generalized tonic-clonic seizures or coma (eclampsia without seizures) in a woman with preeclampsia and represents a severe complication of the disorder[1,2]. HELLP syndrome is a form of preeclampsia characterized by endothelial dysfunction with activation of coagulation and liver dysfunction, detectable by laboratory testing. Clinically, HELLP syndrome may occur with normal blood pressure and without proteinuria. The acronym HELLP stands for Hemolysis (H), Elevated Liver Enzymes (EL), and Low Platelets (LP). HELLP syndrome develops in 10–20% of pregnant women with preeclampsia or severe eclampsia[7,10].

Almost all maternal deaths due to hypertensive syndromes occur in developing countries. According to one study, in more developed regions the prevalence of eclampsia is approximately 0.2% with a maternal mortality rate of 0.8%, while in less advantaged regions the prevalence reaches 8.1% with a maternal mortality rate of 22.0%. Therefore, hypertensive disorders of pregnancy are of significant scientific interest due to their frequency and serious maternal-fetal consequences[4].

It should be noted that, despite unified principles for the management of HDP worldwide, disproportionately high rates of adverse pregnancy outcomes in resource-limited settings are primarily due to difficulties in organizing healthcare and its quality under these conditions[9].

Thus, even within a single country, pregnancy outcomes may vary due to socio-cultural factors and variability in the distribution and quality of medical care. Therefore, the objective of this study was to identify adverse maternal and perinatal outcomes in women admitted with hypertensive disorders of pregnancy and to directly compare outcomes between women with preeclampsia/eclampsia and those with chronic or gestational hypertension[14,17].

Materials and Methods

The study was conducted from August 2022 to August 2025 at the Bukhara City Maternity Complex. The study population included pregnant women aged over 18 years, with a gestational age of at least 20 weeks, who were admitted to the emergency department with a diagnosis of hypertensive disorders of pregnancy. Women with other concomitant diseases, smokers, and those using narcotic substances were excluded from the study.

Data analysis was performed using Stata software, version 11.0. Categorical variables were compared using the chi-square (χ^2) test or Fisher's exact test, as appropriate, while continuous variables were analyzed using Student's t-test. Risk factors associated with adverse maternal and perinatal outcomes were assessed using binomial regression with a logarithmic link function to calculate unadjusted and adjusted relative risks (RRs) with 95% confidence intervals (CIs). Variables included in the regression models were selected based on biological plausibility, published literature, and results of univariate analyses. Unadjusted and adjusted RRs were calculated to directly compare outcomes between women with preeclampsia/eclampsia and those with chronic or gestational hypertension. A p-value <0.05 was considered statistically significant.

Results

A total of 400 pregnant women with hypertensive disorders of pregnancy were included in the study: 286 with arterial hypertension and 114 with preeclampsia or eclampsia. The mean age (\pm standard deviation) was 32.19 ± 6.59 years in the hypertension group and 27.57 ± 6.72 years in the preeclampsia/eclampsia group.

Regarding educational level, 181 (57.3%) women in the hypertension group and 99 (53.5%) in the preeclampsia/eclampsia group had primary education. Concerning marital status, 181 (63.6%) women in the hypertension group and 91 (65.4%) in the preeclampsia/eclampsia group were married or living with a partner.

Most participants were multiparous: 107 (58.5%) women in the hypertension group and 65 (57.0%) in the preeclampsia/eclampsia group. In terms of parity, 159 (55.7%) women in the hypertension group had a history of 1–4 deliveries, compared with 62 (54.3%) women in the preeclampsia/eclampsia group. The estimated gestational age at the time of diagnosis exceeded 27 weeks in 280 (97.9%) women in the hypertension group and in 108 (94.7%) women in the preeclampsia/eclampsia group. No statistically significant differences were observed between the groups with respect to sociodemographic or reproductive characteristics.

In the preeclampsia/eclampsia group, HELLP syndrome developed in 7 women (6.1%). No statistically significant differences were found between the groups in the number of antenatal visits: the mean (\pm SD) was 6.7 ± 0.68 in the hypertension group and 6.5 ± 0.73 in the preeclampsia/eclampsia group.

Regarding adverse maternal outcomes, women with preeclampsia/eclampsia had a significantly higher risk of cesarean section (79.4% vs. 65%; adjusted RR = 2.139; 95% CI: 1.386–3.302; $p < 0.001$). The incidence of preterm birth before 34 weeks of gestation was also significantly higher among women with preeclampsia/eclampsia compared with those with chronic or gestational hypertension (20.5% vs. 6%; adjusted RR = 2.505; 95% CI: 1.194–5.257; $p = 0.015$) (Table 2).

With respect to adverse perinatal outcomes, the rate of neonatal intensive care unit (NICU) admission was significantly higher among women with preeclampsia/eclampsia (21.7% vs. 6.0%; adjusted RR = 2.567; 95% CI: 1.296–5.088; $p = 0.007$). Perinatal mortality was also higher in this group (5.2% vs. 2.0%); however, after adjustment for confounding factors, the difference was not statistically significant (adjusted RR = 0.423; 95% CI: 0.101–1.770; $p = 0.239$).

Table 1. Adverse perinatal outcomes in women with chronic arterial hypertension compared with women with preeclampsia/eclampsia.

Maternal outcomes	Chronic / gestational hypertension (n = 286), n (%)	Unadjusted RR	p-value	Preeclampsia / eclampsia (n = 114), n (%)	Adjusted RR	p-value
Premature labor	17 (6.0)	4.041	0.001	23(20.2)	2.505	0.015
Apgar score <7 at 1 minute of life	25(8.7)	1.835	0.033	26 (22.8)	1.967	0.020
Apgar score <7 at 5 minute of life	7(2.4)	2.909	0.020	8(7.0)	3.683	0.006

Admission to the neonatal intensive care unit (NICU)	17(6.0)	4.591	0.001	25(21.7)	2.567	0.007
Perinatal mortality	6(2.0)	2.522	0.065	6(5.2)	0.423	0.239

RR — relative risk ;

Apgar scores <7 at 1 minute (15.1% vs. 8.8%; adjusted RR = 1.967; 95% CI: 1.112–3.477; p=0.020) and at 5 minutes (7.0% vs. 2.5%; adjusted RR = 3.683; 95% CI: 1.500–9.356; p=0.006) were significantly more frequent among newborns born to mothers with preeclampsia/eclampsia (Table 1).

In the unadjusted analysis, prolonged maternal hospital stay was associated with preeclampsia/eclampsia (p=0.04). However, after adjustment for confounding factors, this association was no longer statistically significant (p=0.556).

Arterial hypertension during pregnancy is one of the leading causes of maternal and perinatal mortality [10,11]. In the present study, women with preeclampsia/eclampsia were found to have a higher risk of cesarean delivery. It is important to emphasize that preeclampsia itself is not an indication for operative delivery, except in cases of severe complications related to this condition. Nevertheless, despite the possibility of vaginal delivery in women with preeclampsia, the majority of patients undergo delivery by cesarean section [12,13].

Table 2. Adverse maternal outcomes in women with chronic arterial hypertension compared with women with preeclampsia/eclampsia.

Maternal outcomes	Chronic / gestational hypertension (n = 286), n (%)	Preeclampsia / eclampsia (n = 114), n (%)	Unadjusted RR	p-value	Adjusted RR	p-value
Premature labor	17 (6.0)	23 (20.17)	4.041	0.0001	2.505	0.015
Term labor	97 (33.9)	59 (51.7)	2.106	0.0001	1.152	0.061
Operative deliveries	186 (65.0)	90(78.9)	2.065	0.001	2.139	0.001
Prolonged maternal hospitalization	143(50.0)	68(59.6)	1.448	0.048	1.126	0.165

RR — relative risk ;

Preterm birth was more frequently observed among women with preeclampsia/eclampsia. Approximately 75% of preterm births were associated with spontaneous onset of labor and may be related to a history of pregnancy-induced hypertension. In addition, the risk of prolonged maternal hospitalization was significantly higher in the preeclampsia/eclampsia group.

Table 3. Comparison of fetal biometric parameters (mm) in the examined women

Gestation week	Parameters	Preeclampsia / eclampsia (n = 114), n (%)	Chronic / gestational hypertension (n = 286), n (%)
36	Biparietal diameter (BPD)	82,14±1,20	87,61±0,66
	Head circumference (HC)	309,9±2,65	320,48±2,02
	Abdominal circumference (AC)	289,13±5,73*	319,70±3,04
	Femur length (FL)	66,18±1,07*	69,87±0,58
40	Biparietal diameter (BPD)	87,03±0,86	90,55±0,88
	Head circumference (HC)	329,0±2,03	338,0±1,73
	Abdominal circumference (AC)	315,33±1,45**	343,27±2,90
	Femur length (FL)	71,0±1,15*	73,82±0,55

Note: * p<0,05, ** p<0,001 related to control group

Using ultrasound fetometry, fetal development was monitored and fetal measurements were assessed starting from 20 weeks of gestation. The data obtained from fetometric assessments are presented in Table 3.

As shown in Table 3, nearly all fetal biometric parameters in pregnant women with preeclampsia and eclampsia were lower compared with the corresponding parameters in fetuses of women with chronic hypertension.

Significant differences throughout the entire third trimester of pregnancy were identified for abdominal circumference (AC) and femur length (FL) among fetuses of women with hypertensive disorders. Specifically, AC values in fetuses of women with preeclampsia were lower than those in fetuses of women with chronic hypertension by 7% at 36 weeks and by 8% at 40 weeks of gestation.

Femur length values in fetuses of women with preeclampsia were also lower than those in fetuses of women with chronic/gestational hypertension by 3% at 36 weeks and by 4% at 40 weeks of gestation.

Table 4. Live-born neonates examined within 28 days after birth.

	Chronic / gestational hypertension (n = 286), n (%)		Preeclampsia / eclampsia (n = 114), n (%)	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Respiratory distress syndrome	1.05 (0.89-1.24)	0.56	2.39 (2.16–2.64)	<0.01
Low birth weight	1.39 (1.17–1.64)	<0.01	3.64 (3.29–4.02)	0.05
Severe congenital defects	1.14 (0.88–1.47)	0.32	1.05 (0.79–1.38)	0.75
sepsis	1.71 (1.29–2.32)	0.01	3.67 (2.41–5.59)	0.01

Neonatal Outcomes

According to the data presented in Table 4, among neonates born to mothers with chronic or gestational hypertension, a statistically significant increased risk of low birth weight was identified (OR = 1.39; 95% CI: 1.17–1.64; $p < 0.01$), as well as an increased risk of neonatal sepsis (OR = 1.71; 95% CI: 1.29–2.32; $p < 0.01$). No association was found between chronic/gestational hypertension and the development of major congenital malformations (OR = 1.14; 95% CI: 0.88–1.47; $p = 0.32$).

In the preeclampsia/eclampsia group, the risk of low birth weight was significantly higher, exceeding that of the chronic/gestational hypertension group by more than threefold (OR = 3.64; 95% CI: 3.29–4.02; $p = 0.05$). A significant increase in the risk of neonatal sepsis was also observed in this group (OR = 3.67; 95% CI: 2.41–5.59; $p = 0.01$). No association between preeclampsia/eclampsia and major congenital malformations was identified (OR = 1.05; 95% CI: 0.79–1.38; $p = 0.75$).

All types of hypertensive disorders were associated with a substantially increased risk of these neonatal conditions, except for gestational hypertension, in which an elevated risk was observed only for respiratory distress syndrome (but not for neonatal sepsis or low birth weight).

Conclusion

In women with chronic hypertension, the risk of several adverse outcomes—such as preterm birth, sepsis, respiratory distress syndrome, and low birth weight—was higher compared with women without hypertension; however, this risk was generally lower than that observed among mothers with preeclampsia and eclampsia.

At the same time, the risk of stillbirth was highest among women with chronic hypertension, followed by women with preeclampsia. This may be explained by the longer duration of hypertensive disease in mothers with chronic hypertension, which provides more time for stillbirth to occur compared with other hypertensive disorders, in which delivery may take place shortly after diagnosis. This is particularly relevant for preeclampsia and eclampsia, where labor induction is often indicated and delivery typically occurs soon after diagnosis. In addition, several previous studies have reported not only an association between chronic hypertension and stillbirth but have also identified chronic hypertension as one of the most common risk factors for stillbirth [5,6,16–18].

Women with hypertensive disorders of pregnancy (HDP) have a higher risk of adverse maternal and neonatal outcomes. Women with preeclampsia/eclampsia had higher risks of cesarean delivery and preterm birth compared with patients with chronic or gestational hypertension.

Strategies aimed at improving pregnancy outcomes in women with HDP are urgently needed, particularly for those with preeclampsia/eclampsia. We found that both mothers and neonates experienced a substantially greater number of adverse outcomes when preeclampsia or eclampsia was present. Infants born to mothers with chronic hypertension generally had a higher risk of several adverse outcomes compared with infants born to mothers who developed gestational hypertension during pregnancy; nevertheless, this risk remained lower than that observed among infants of mothers with preeclampsia and eclampsia.

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