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# Prevalence, Risk Factors, and Fetal and Maternal Outcomes of Hypertensive Disorders of Pregnancy: A Retrospective Study in Western Saudi Arabia

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**ABSTRACT**

***Objectives:*** We sought to estimate the prevalence of hypertensive disorders of pregnancy (HDP) in Saudi Arabia as well as the risk factors of HDP, and maternal and fetal outcomes. ***Methods***: We retrospectively evaluated the medical records of 9493 women who delivered at King Abdulaziz University Hospital, a tertiary care center, between January 2015 and June 2017. All cases of HDP were included. ***Results:*** We identified 224 pregnant women with HDP in our patient cohort, giving a prevalence of 2.4%. Their mean age was 31.3±6.7 years, with an average gravidity of 4.0 and average parity of 3.0. The most prevalent subtype of HDP was preeclampsia (54.9%) while 29.5% of the women had gestational hypertension, and 8.0% had eclampsia. The prevalence of subtypes of HDP differed significantly with gravidity, and mean age differed significantly with HDP subtype. Personal and family histories of preeclampsia and the presence of diabetes were more prevalent in women with preeclampsia and gestational hypertension; however, only the difference in diabetes prevalence was significant. The overall prevalence of maternal complications was 9.4% and the prevalence of maternal mortality was 1.3%. Multigravid women and women with chronic hypertension were at increased risk of prematurity compared to other pregnant women, but not significantly. ***Conclusions:*** The prevalence of HDP was relatively low in our cohort. However, to prevent harmful impacts on both the mother and fetus, screening for this disorder is recommended early in pregnancy.

Hypertensive disorders of pregnancy (HDP) are frequently encountered,[1] complicating up to 10% of gestations.[2,3] The rate of HDP is likely to increase along with obesity and metabolic syndrome in women of reproductive age.[1] As effective treatments are currently limited, prevention and identification of the causes and risk factors are of importance. HDP include chronic hypertension, gestational hypertension, preeclampsia (PE), and chronic hypertension with superimposed PE.[4] Hypertension in pregnancy is defined as a systolic pressure ≥ 140 mmHg and/or a diastolic pressure ≥ 90 mmHg,[5] and it predisposes pregnant women to obstetric morbidities leading to 10–15% of maternal deaths, particularly in developing countries.[6] PE has been linked to adverse perinatal outcomes for the mother and fetus as well as increased maternal blood pressure and other cardiovascular risks later in life.[7] Women with a history of preterm PE have a seven- to eight-times increased risk of coronary heart disease morbidity and mortality.[8] A lack of healthcare-worker training in the early detection and emergency management of suspected PE contributes to its morbidity and mortality.[9] The overall prevalence of gestational hypertension and PE are estimated as 1.8–4.4% and 0.2–9.2%, respectively.[10] The prevalence of maternal and fetal complications associated with HDP vary by region and healthcare facility type.[11] The worst outcomes of maternal and fetal eclampsia and chronic hypertension superimposed on PE have been reported in tertiary care hospitals.[12] Few data are available on the prevalence of HDP and their subtypes, the risk

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factors for this disorder, and the maternal and fetal outcomes in Saudi Arabia.

This study aimed to estimate the prevalence of HDP, risk factors, and maternal and fetal outcomes, as well as any differences in primigravid and multigravid women.

## METHODS

This retrospective study was conducted at King Abdulaziz University Hospital from January 2015 to June 2017. King Abdulaziz University Hospital is a teaching hospital and tertiary health center located in the city of Jeddah in the western province of Saudi Arabia.

All patients diagnosed with HDP at King Abdulaziz University Hospital between January 2015 and June 2017 were eligible for inclusion. There were no specific exclusion criteria. The population size estimation was based on the prevalence of HDP reported in the literature and was calculated as,

$$SS = \frac{Z^{2*}(p)*(1-p)}{c^2}$$

where Z = Z value (e.g., 1.96 for 95% confidence level), p = percentage expressed as decimal, and c = the 95% confidence interval (CI) expressed as decimal.

The average estimated worldwide prevalence of HDP ranges from 8% to 10%.[13] For a Z value of 1.96 and a CI of 95%, the required sample size was estimated at 114–139 patients. A cohort of 224 patients with HDP attended the health facility during the study period, which gave an adequate sample.

Data were manually extracted and recorded on a structured and piloted Google form. We recorded the patient's medical record number, demographic characteristics, gravidity, parity, abortion history, body mass index (BMI), gestational age, blood pressure measurements, hypertension type and treatment, presenting symptoms, mode of delivery, maternal complications, and mortality. Other data included risk factors, previous history of PE and diabetes mellitus, smoking history, and family history. The determinants of fetal outcomes recorded included fetal presentation, weight, head circumference, and Apgar scores at one and five minutes. Patients were stratified into four groups following the American Academy of Obstetrics and Gynecology criteria. These were PE-eclampsia, chronic hypertension of any cause, chronic hypertension with superimposed PE, and gestational hypertension.

The values of categorical variables were reported as frequencies and absolute numbers. Values of continuous variables were reported as mean±standard deviation (SD). Associations of two categorical variables were assessed with the chi-squared test. Logistic regression models were constructed to adjust for potential confounding variables. For all the statistical tests, a *p*-value < 0.050 was considered significant. We used SPSS Statistics (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp) for all analysis.

The Institutional Review Board of King Abdulaziz University Hospital and the Research Ethics Committee of King Abdulaziz University in Jeddah approved this study.

**Table 1:** Characteristics of women with hypertension disorders.

| Variables | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|
| Age, years | 15 | 48 | 31.3 | 6.7 |
| Gravidity | 1 | 15 | 4.0 | 2.8 |
| Parity | 0 | 12 | 3.0 | 2.0 |
| Number of abortions | 0 | 7 | 0.7 | 1.1 |
| Gestational age, weeks | 25 | 41 | 33.8 | 3.9 |
| BMI, kg/m$^2$ | 20 | 42 | 28.0 | 6.1 |
| Systolic BP, mmHg | 125 | 230 | 157.6 | 15.4 |
| Diastolic BP, mmHg | 67 | 128 | 92.6 | 11.4 |
| Fetal weight, g | 900 | 4600 | 2683.0 | 847.0 |
| Apgar score at 1 minute | 6 | 10 | 7.4 | 1.8 |
| Apgar score at 5 minutes | 8 | 10 | 8.7 | 0.9 |
| Fetal head circumference, cm | 22 | 37 | 30.6 | 3.5 |

*BP: blood pressure; BMI: body mass index; SD: standard deviation.*

**Table 2:** Distribution of hypertension disorders of pregnancy according to gravidity.

| Type | PE | E | G-HPN | C-HPN | PE + C-HPN | Total | *p*-value |
|---|---|---|---|---|---|---|---|
| Primigravida | 53 | 13 | 23 | 5 | 3 | 97 | 0.040 |
| Multigravida | 70 | 5 | 43 | 3 | 6 | 127 | |
| Total | 123 (54.9%) | 18 (8.0%) | 66 (29.5%) | 8 (3.6%) | 9 (4.0%) | 224 (100%) | |

*PE: preeclampsia; E: eclampsia; G-HPN: gestational hypertension; C-HPN: chronic hypertension; PE + C-HPN: preeclampsia superimposed on chronic hypertension.*

## RESULTS

Among the 9493 deliveries performed between January 2015 and June 2017, 224 women had HDP giving a prevalence of 2.4% [Table 1]. The mean age of the patients was 31.3±6.7 years, the average gravidity was 4.0, and the average parity was 3.0. Ninety-seven women (43.3%) were primigravid, and 127 (56.7%) were multigravid. The most prevalent hypertensive disorder was PE (54.9%), 29.5% of women had gestational hypertension, and 8.0% had eclampsia [Table 2]. The prevalence of the subtypes of HDP differed significantly with gravidity, and the mean patient age differed significantly with the type of hypertension disorder. Women with gestational hypertension were older (32.1±5.7 years) than those with eclampsia (25.8±6.5 years). Personal and family histories of PE were more prevalent in women with PE, gestational hypertension, or diabetes; however, the association was significant only in women with diabetes in pregnancy [Table 3]. The prevalence of obesity and smoking did not differ significantly with the type of hypertension disorder. Maternal outcomes [Table 3] included both a significantly greater occurrence of seizures and more intensive care unit

**Table 3:** Prevalence of risk factors, symptoms, and fetal and maternal outcomes according to the type of hypertension disorder in pregnant women.

| | PE | E | G-HPN | C-HPN | PE + C-HPN | *p*-value |
|---|---|---|---|---|---|---|
| **Risk factors** | | | | | | |
| Age, mean ± SD, years | 31.5 ± 6.9 | 25.8 ± 6.5 | 32.1 ± 5.7 | 31.1 ± 8.5 | 31.7 ± 5.5 | 0.010 |
| BMI, mean ± SD | 27.9 ± 6.4 | 26.7 ± 4.9 | 28.4 ± 5.9 | 29.7 ± 5.8 | 27.5 ± 5.6 | > 0.050 |
| Personal history of preeclampsia | 49 (53.3) | 5 (5.4) | 31 (33.7) | 5 (5.4) | 2 (2.2) | > 0.050 |
| Family history of preeclampsia | 22 (47.8) | 4 (8.7) | 16 (34.8) | 3 (6.5) | 1 (2.2) | > 0.050 |
| Smoking | 13 (59.1) | 1 (4.5) | 5 (22.7) | 2 (9.1) | 1 (4.5) | > 0.050 |
| Associated DM | 23 (39.0) | 4 (6.8) | 28 (47.5) | 2 (3.4) | 2 (3.4) | 0.010 |
| **Maternal outcomes** | | | | | | |
| Eclamptic seizures | 7 (46.7) | 7 (46.7) | 1 (6.7) | 0 (0.0) | 0 (0.0) | < 0.001 |
| ICU admission | 9 (45.0) | 5 (25.0) | 3 (15.0) | 2 (10.0) | 1 (5.0) | 0.016 |
| Mode of delivery C/S | 100 (56.5) | 13 (7.3) | 50 (28.2) | 7 (4.0) | 7 (4.0) | > 0.050 |
| Maternal complications | 8 (38.1) | 2 (9.5) | 8 (38.1) | 1 (4.8) | 2 (9.5) | > 0.050 |
| Maternal mortality | 1 (33.3) | 0 (0) | 1 (33.3) | 1 (33.0) | 0 (0.0) | > 0.050 |
| **Fetal outcomes** | | | | | | |
| Gestational age, weeks | 33.5 ± 4 | 33.2 ± 3.4 | 34.5 ± 4.1 | 31.8 ± 3.5 | 34.5 ± 2.8 | > 0.050 |
| Fetal weight, mean ± SD, g | 2640.0 ± 844.0 | 2605.0 ± 800.0 | 2803.0 ± 909.0 | 2537.0 ± 578.0 | 2677.0 ± 754.0 | > 0.050 |
| **Apgar scores** | | | | | | |
| 1 minute | 7 | 7 | 8 | 7 | 6 | > 0.050 |
| 5 minutes | 9 | 9 | 9 | 9 | 8 | > 0.050 |
| **Head circumference, mean ± SD, cm** | 30.3 ± 3.3 | 30.3 ± 3.4 | 31.1 ± 3.6 | 29.5 ± 4.1 | 30.4 ± 3.6 | > 0.050 |

*Data presented as n (%) unless otherwise indicated.*
*PE: preeclampsia; E: eclampsia; G-HPN: gestational hypertension; C-HPN: chronic hypertension; PE + C-HPN: preeclampsia superimposed on chronic hypertension; SD: standard deviation; DM: diabetes mellitus; ICU: intensive care unit; C/S: cesarean section.*

**Table 4:** Prevalence of risk factors, symptoms, and fetal and maternal outcomes in women with hypertension disorders according to gravidity.

| | Primigravida (n = 97) | Multigravida (n = 127) | Total (N = 224) | *p*-value |
|---|---|---|---|---|
| **Risk factors** | | | | |
| BMI, mean ± SD | 27.6 ± 6.1 | 28.4 ± 6.5 | 28.04 ± 6.1 | > 0.050 |
| Personal history of eclampsia | 22 | 70 | 92 (41.1) | < 0.001 |
| Family history of eclampsia | 14 | 32 | 46 (20.5) | 0.034 |
| Smoking | 10 | 12 | 22 (9.8) | 0.502 |
| Associated DM | 18 | 41 | 59 (26.3) | 0.015 |
| **Patient symptoms** | | | | |
| Asymptomatic | 30 | 46 | 76 | > 0.050 |
| Mild hypertension | 3 | 8 | 11 | > 0.050 |
| Severe hypertension | 6 | 13 | 19 | > 0.050 |
| Oligohydramnios | 3 | 11 | 14 | > 0.050 |
| Peripheral edema | 16 | 12 | 28 | > 0.050 |
| Headache | 13 | 26 | 39 | > 0.050 |
| Epigastric pain | 16 | 25 | 41 | > 0.050 |
| Blurring of vision | 14 | 23 | 37 | > 0.050 |
| **Maternal outcomes** | | | | |
| Eclamptic seizures | 11 | 4 | 15 (6.7) | 0.015 |
| ICU admission | 9 | 11 | 20 (8.9) | > 0.050 |
| **Mode of delivery** | | | | |
| SVD | 17 | 30 | 47 (21.0) | > 0.050 |
| C/S | 80 | 97 | 177 (79.0) | |
| **Maternal complications** | 10 | 11 | 21 (9.4) | > 0.050 |
| **Maternal mortality** | 2 | 1 | 3 (1.3) | > 0.050 |
| **Fetal outcomes** | | | | |
| Gestational age in weeks | 34.2 ± 3.2 | 33.5 ± 4.1 | | > 0.050 |
| Fetal weight, mean ± SD, g | 2700.0 ± 800.0 | 2600.0 ± 880.0 | | > 0.050 |
| **Apgar scores** | | | | |
| 1 minute | 7 | 9 | | > 0.050 |
| 5 minutes | 9 | 9 | | |
| **Head circumference, mean ± SD, cm** | 31.2 ± 3.3 | 30.1 ± 0.0 | | 0.043 |

*BMI: body mass index; SD: standard deviation; DM: diabetes mellitus; SVD: spontaneous vaginal delivery; C/S: cesarean section; ICU: intensive care unit.*

(ICU) admissions in women with eclampsia than in those with other types of hypertension disorders. The prevalence of other maternal complications and mortality seen in the hypertension disorder types were not significantly different. Fetal outcomes [Table 4] were not significantly associated with type of hypertension disorder, fetal weight, Apgar score, or head circumference. The analysis of HDP risk factors, maternal, and fetal outcomes in primigravid women and multigravid women found that a personal or family history of eclampsia, and pregnancy-associated diabetes mellitus were significantly more frequent in multigravid women. Eclamptic seizures were significantly more frequent and fetal head circumference significantly larger in primigravid women. The frequencies of HDP symptoms in primigravid and multigravid women were not significantly different. Approximately 23.0% of women were treated with methyldopa [Table 5].

## DISCUSSION

Pregnancy-induced hypertension is a frequent cause of maternal and perinatal complications.[14] The prevalence of HDP and the maternal and fetal outcomes of each type of hypertension disorder were estimated in a group of 224 mothers and infants at a tertiary care hospital in Saudi Arabia.

**Table 5:** Type of medication used in pregnant women with hypertension disorders.

| | Medication | | | | |
|---|---|---|---|---|---|
| | Methyldopa | Nifedipine | Labetalol | Combination | Total |
| Primigravida | 19 | 7 | 8 | 63 | 97 |
| Multigravida | 32 | 12 | 6 | 77 | 127 |
| Total, n (%) | 51 (22.8) | 19 (8.5) | 14 (6.3) | 140 (62.5) | 224 |

Clinicopathological characteristics of primigravid and multigravid women were compared. The overall prevalence of HDP was 2.4%. PE was the most prevalent hypertension disorder (54.9%) followed by gestational hypertension (29.5%), eclampsia (8.0%), PE superimposed on chronic hypertension (4.0%), and chronic hypertension (3.6%). The overall prevalence of HDP was lower than previously reported estimates of 5.2–8.2%. Previous estimates of the prevalence of gestational hypertension and PE are 5.2–8.2%, 1.8–4.4%, and 0.2–9.2%.[10] HDP were more common in multigravid than primigravid women comprising 56.7% of cases. PE was also more prevalent in multigravid than primigravid women (56.9%). This result disagrees with a prospective randomized study done in India that found PE was more common in primigravid women,[14] but in line with another study that showed multigravida and multipara pregnancies were more strongly affected by hypertension than primigravida and primipara pregnancies.[15]

The majority of the patients were middle-aged women with a mean age of 31.5 years as seen in studies in Turkey[16] and the UAE[17] where advanced maternal age was found to increase HDP risk.[18] Previously reported risk factors of HDP include a history of PE, increased maternal BMI before pregnancy, race (black women were at increased risk), multiple gestations, and underlying medical conditions (e.g., renal disease, diabetes mellitus).[18] In this study, only age and diabetes mellitus associated with pregnancy differed significantly with the type of hypertension disorder. Women with gestational hypertension were significantly older than women with other hypertensive disorders. A significant association of diabetes mellitus and the occurrence of gestational hypertension has been reported.[19,20]

Obesity increases the risk of both gestational diabetes and gestational hypertension.[21,22] Women who gain weight excessively during pregnancy are likely to be predisposed to PE.[23] In this study, the prevalence of obesity was not associated with the type of hypertension disorder or gravidity. Neither was smoking status associated with HDP subtypes. The association of smoking and PE varies substantially with the timing and intensity of exposure.[24]

In this study, the overall prevalence of maternal complications was 9.4%. Cesarean deliveries were more frequent in patients with HDP[25] and maternal complications. Additionally, in this study, cesarean deliveries were more prevalent in cases of PE or gestational hypertension, but that was not seen with the other HDP subtypes. These findings are consistent with a study conducted in Ethiopia between 2010 and 2013 which enrolled 130 women with HDP.[26] Eclamptic seizures and ICU admissions were significantly more frequent in women with PE and eclampsia than in those with other hypertension disorders. Maternal complications were more frequent in multigravid than primigravid women, which was also reported in a comparative study conducted in Turkey.[27] The overall prevalence of maternal mortality in this study was 1.3%, and was higher in primigravid than multigravid women; however, the difference was not significant. In this study, overall maternal outcomes were satisfactory and in line with another study, which reported 96% of patients had no maternal complications.[16] HDP are known to increase the risk of both early and late complications in the mother and fetus.[15] In this patient cohort, multigravid women and women with chronic hypertension were at increased risk of prematurity compared to other pregnant women, but this was not statistically significant. Prematurity is a common complication of HDP,[28] with an estimated prevalence of preterm delivery 31.6%.[29]

Although the average fetal weight was lower in women with chronic hypertension, the association was not significant. Apgar scores were not associated with the subtypes of HDP or gravidity. Most infants had satisfactory Apgar scores and normal fetal weight. A similar study reported that 59% of infants

born to mothers with HDP had an age-appropriate weight, and 66% had good Apgar scores.[17] The majority of patients with HDP were asymptomatic, which is in line with a previous report that PE is likely to be detected in antenatal clinics in asymptomatic women with hypertension.[30]

The American College of Obstetrics and Gynecology Practice Bulletin recommends methyldopa and labetalol as first-line agents for treating HDP.[31] In this study, combination therapy was the most frequent treatment followed by methyldopa, nifedipine, and labetalol.

The study was conducted at a tertiary healthcare center, which provides specialized consultative care. Consequently, the overall prevalence of maternal complications and mortality associated with HDP may have been underestimated and is a limitation of this study. It was also a monocenter study, which means that the results may not be representative of the general Saudi population. The strengths of the study are the inclusion of recent patients for a relatively long period and a sample size similar to previous studies. Few studies of the prevalence, risk factors, and maternal and fetal outcomes of HDP have been conducted in this region. The study addressed a topical issue, considering its impact on the public health of the regional populations, and intended to attract the interest of not only investigators but also health policymakers.

## CONCLUSION

The prevalence of HDP at the King Abdulaziz University Hospital, Saudi Arabia, from 2015 to 2017 was relatively low. PE was the most common hypertensive disorder, and the majority of women with the condition were asymptomatic. Maternal and fetal outcomes did not differ with the type of hypertension disorder or between primigravid and multigravid women. The prevalence of maternal complications and mortality were lower than those reported previously. HDP are a threat to the mother and fetus if not diagnosed early. It is important to screen pregnant women for this condition, and if hypertension is present, close and regular monitoring is required.

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