

Hypertension in Pregnancy

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Article's Information

Received: 26.02.2024

Accepted: 05.06.2024

Published: 15.09.2024

Keywords:

Hypertension;

Pregnancy;

Childbirth;

Treatment

Abstract

Hypertensive disorders during pregnancy are an important global health problem and a leading cause of maternal death in underdeveloped countries. While therapeutic choices have remained mostly unchanged in recent years, there have been notable advancements in understanding the etiology of *preeclampsia*. on an accurate diagnosis, particularly by the emergency physician. The appropriate care for these patients relies significantly harm to the cardiovascular and other organ systems. This study has been providing the most recent information on the many hypertension diseases that occur during pregnancy and the available treatment choices.

<http://doi.org/10.22401/ANJS.27.3.08>

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1. Introduction

Hypertension is a prevalent medical condition during pregnancy, affecting over 10% of pregnancies and around 240,000 women in the United States annually. Physicians have known about preeclampsia for thousands of years [1], yet there is little understanding of its causes and how to avoid it. The main issue with high blood pressure is its possible negative impact on both the mother and the fetus. The possible side effects vary in intensity from minor to life-threatening. Hypertensive disorders of pregnancy are the second most prevalent direct cause of maternal mortality in the developed world. Hypertension is the most pervasive medical issue during pregnancy, affecting 5-10% of pregnancies. Black women, women over 45 years old, and women with diabetes had the most excellent rates. The reported rates may not accurately reflect the current occurrence of baseline hypertension, obesity, and diabetes in women of reproductive age due to their rising prevalence and the trend toward advanced maternal age [2]. There are four classifications of hypertension problems during pregnancy [3]:

1. Preeclampsia/eclampsia.
2. Chronic hypertension (occurring before a specific time).
3. Preeclampsia occurring on top of pre-existing chronic hypertension
4. Gestational hypertension refers to either temporary high blood pressure during pregnancy or the onset of persistent high blood pressure in the second part of pregnancy.

Recent years have seen significant progress in understanding preeclampsia's pathogenesis, prevention, and therapy. Research on the long-term effects of preeclampsia on several organs is currently ongoing [4]. Normal pregnancy involves elevated cardiac output and blood volume, widespread vasodilation, reduced blood pressure, and resistance to vasoconstrictor drugs like norepinephrine and angiotensin. Blood pressure reaches its lowest point during mid-pregnancy and then rebounds to pre-pregnancy values by the end of pregnancy. Systolic blood pressure (SBP) is less impacted than diastolic blood pressure (DBP) due to the heightened cardiac output counteracting the

vasodilation. An additional decrease occurs during sleeping, aligning with the typical circadian cycles seen in women who are not pregnant [1,5]. Pregnancy-induced hypertension has the following risks, such as reduced blood circulation to the placenta. Inadequate blood supply to the placenta may result in less oxygen and nutrients reaching the baby. This may result in sluggish development (intrauterine growth restriction), low birth weight, or early delivery. Premature infants may have respiratory issues, heightened susceptibility to infections, and other medical complexities [6].

Placental abruption: this disease refers to the premature detachment of the placenta from the uterine wall before birth. Preeclampsia and hypertension increase the likelihood of placental abruption [7].

Intrauterine growth limitation. Elevated blood pressure may lead to reduced fetal growth.

Damage to further organs. Inadequately managed hypertension may lead to damage in the brain, eyes, heart, lungs, kidneys, liver, and other vital organs. In extreme situations, it may be fatal.

Premature delivery. Early delivery may be necessary to avert life-threatening problems caused by excessive blood pressure during pregnancy [8].

Prospective cardiovascular illness: preeclampsia may elevate the likelihood of developing cardiovascular disease in the future. Having preeclampsia many times increases the likelihood of developing cardiovascular disease in the future [9].

High blood pressure: Elevated blood pressure is a systolic pressure between 120 and 129 millimeters of mercury (mm Hg) and a diastolic pressure below 80 mm Hg. High blood pressure often worsens if not managed well [10]. **First-stage hypertension:** Stage 1 hypertension is systolic pressure between 130 and 139 mm Hg or diastolic pressure between 80 and 89 mm Hg ¹¹. **Severe hypertension:** This level is more intense. A systolic pressure of 140 mm Hg or above or a diastolic pressure of 90 mm Hg or above [11]. **Gestational hypertension** is defined as blood pressure above 140/90 mm Hg after 20 weeks of pregnancy without associated organ damage. Blood pressure must be measured and recorded two or more times, with a minimum interval of four hours between each measurement [12-14]. Low-dose daily aspirin is often advised to reduce the likelihood of preeclampsia in those with a high risk. Research has shown that aspirin is safe to use throughout pregnancy [15].

1.1. Classification of Hypertensive Disorders in Pregnancy

Hypertension during pregnancy is characterized by a systolic blood pressure of 140mmHg or higher or a diastolic blood pressure of 90mmHg or higher [16]. Some medical specialists suggest that a sudden increase in blood pressure of 30mmHg systolic or 15mmHg diastolic is enough to diagnose preeclampsia. The women who experience this alteration are not considered preeclamptic yet but should be closely observed, particularly if proteinuria and hyperuricemia are also present [17].

1.2. Normal Pregnancy's Vascular Physiology

Pregnancy results in significant physiological alterations in systemic hemodynamics. It is crucial to recognize these variations from the non-pregnant condition when evaluating blood pressure in pregnancy. Simple Alterations in systemic blood pressure are accompanied by a corresponding shift in cardiac output, which experiences a significant rise. The peak occurs between the 16th and 20th weeks of pregnancy, and at its highest point, the increase is usually at least 40% higher than the starting level [18].

1.3. Normal Pregnancy and the Kidney

Pregnant women who are in good health have significant glomerular hyperfiltration. Studies in people carefully recorded a fast increase in renal blood flow. Glomerular filtration rate (GFR) rises during the first trimester of pregnancy and reaches its highest point in the latter half, exceeding normal, non-pregnant values by 40–60% [19]. Davison and his colleagues discovered renal hemodynamics enhancements occurred before cardiac output and increased plasma volume [20].

1.4. Changes in volume and blood flow in Preeclampsia

Studying completely untreated preeclampsia is challenging since it is often identified in individuals with preexisting chronic medical issues. Data obtained from preeclamptic individuals who have received treatment or had underlying renal illness, diabetes, or hypertension may not provide an accurate representation of uncomplicated preeclamptic patients [21].

1.5. Kidney Changes in Preeclampsia

Women enduring a normal pregnancy show a significant enhancement in renal function, which is reversed in women who develop preeclampsia. Glomerular filtration rate (GFR) and renal blood

flow decrease. The extent of the decline varies and is linked to the overall severity of the sickness. When proteinuria occurs and a kidney biopsy is performed, it usually reveals glomerular endotheliosis. This lesion is typical in women with preeclampsia; however, it may occur in other cases as well. This endothelial anomaly aligns with the idea that endothelial damage is a significant factor in the pathogenesis of this systemic illness, affecting the kidneys as well [22].

1.6. Preeclampsia Pathophysiology

The underlying mechanisms of new-onset hypertension and proteinuria in pregnancy, referred to as preeclampsia, are not yet fully understood. Over 30 years ago, hypertension during pregnancy was categorized as the most probable causal cause into four main groups: nutritional, renal, immunologic, and placental [21].

1.7. Preeclampsia

Preeclampsia Study of the disordered physiological processes that occur in disease or injury. The precise processes causing the development of high blood pressure and protein in the urine during pregnancy, known as preeclampsia, are not completely understood. Dr. Leon Chesley, a specialist in hypertension during pregnancy, classified the likely causes into four broad divisions over 30 years ago: dietary, renal, immunologic, and placental [23].

1.8. Chronic Hypertension (High Blood Pressure)

Blood pressure is the pressure exerted by the blood on the walls of the arteries. Force is produced throughout each beating as the heart pumps blood into the blood arteries: arterial wall dimensions and flexibility impact blood pressure. Pressure is generated within the arteries with each contraction and relaxation of the heart. The highest pressure occurs when blood is ejected from the heart into the arteries during systole. During diastole, when the heart is relaxed and not pumping blood, the pressure in the arteries decreases [24]. Two numerical values are taken during blood pressure measurement. The diastolic pressure is the bottom value, indicating the pressure in the artery when the heart is in a state of rest and is filling with blood. Both systolic and diastolic pressures are measured in millimeters of mercury (mm Hg). This recording indicates the level to which the mercury column is elevated due to blood pressure [5]. Healthcare providers measure blood pressure using a blood pressure cuff and stethoscope. An individual cannot measure their blood pressure without the

help of an electronic blood pressure monitoring gadget. Chronic hypertension is a condition. Elevated blood pressure, known as hypertension, significantly raises the likelihood of developing coronary cardiac disease (heart attack) and stroke (brain attack). High blood pressure may increase resistance in the arteries, forcing the heart to work harder to maintain blood circulation. High blood pressure often presents with no signs or symptoms. Regularly monitoring your blood pressure with the assistance of a healthcare professional may help determine whether it is above [25].

1.9. Pathophysiological Changes in Chronic Hypertension

Pathophysiological Alterations in Chronic Hypertension Chronic hypertensive pregnant women experience adaptations marked by consistently elevated vascular resistance, unlike typical pregnancies. Throughout the pregnancy, their blood vessel resistance index and pulse velocity remain persistently higher when compared with healthy pregnancies. Arterial stiffness, indicated by the ratio of stroke index to pulse level, is lower in individuals with chronic hypertension than in those with preeclampsia [15].

1.10. Chronic Hypertension Management

There is still a lack of agreement on pregnant women's optimal blood pressure values. The JNC 7 report indicates that cardiovascular disease risk increases gradually when systolic blood pressure is 115 mm Hg and diastolic blood pressure is 75 mm Hg. a new prehypertension classification for blood pressure levels between 120–139/80–89 mm Hg. The main goal of treating hypertension is to reduce cardiovascular consequences, with significant benefits seen in those who maintain lowered blood pressure levels for over a decade. Pregnant women with moderate hypertension have a less clear short-term advantage from antihypertensive medication compared to the possible adverse effects on the fetus. There is little data to support the idea that treating moderate hypertension in pregnancy improves the mother's prognosis. Using drugs for mild hypertension during pregnancy might cause a decrease in mean arterial pressure and raise the risk of restricted fetal development, independent of the specific antihypertensive medication used [26].

1.11. Treatment of Chronic Hypertension

Before Pregnancy Treatment

Adults considering pregnancy should ideally arrange pre-conception counseling meetings to

assess their health, medical history, medicines, and lifestyle behaviors that may impact pregnancy. Maternal Fetal Medicine specialist, general care physician, or cardiologist to address ways to minimize the risk of negative consequences [27].

1.12. Pregnancy Treatment

Consulting with a Maternal Fetal Medicine expert may determine whether therapy is necessary for high blood pressure during pregnancy and assess the safety of medication for use during pregnancy. Women have normal fluctuations in blood pressure throughout pregnancy. Several people are prescribed low-dose aspirin to reduce the likelihood of developing pre-eclampsia [28].

Vasospasm: In pregnancy-induced hypertension, a decrease in the vasodilator nitric oxide (NO) production and an increase in the generation of endothelin by the vascular endothelium may lead to vasospasm. Vasoconstriction leads to increased resistance and results in hypertension. Endothelial damage leads to interstitial leakage, allowing blood components like platelets and fibrinogen to accumulate beneath the endothelium due to impaired blood flow caused by uneven distribution [29].

Enhanced pressor responses: Pregnant women in a healthy state do not respond to administered vasopressors such as angiotensin II. This heightened sensitivity occurs before the development of hypertension. Autoantibodies are believed to stimulate AT1 receptors, leading to heightened sensitivity to angiotensin II. Increased expression of bradykinin receptors (B2) results in the formation of heterodimers with angiotensin II type I receptors (AT1). In laboratory studies, AT1/B2 receptors have demonstrated an enhanced sensitivity to angiotensin II [30].

Nitric oxide: Nitric oxide is a potent vasodilator produced by endothelial cells from L-arginine. Nitric oxide helps regulate the natural low-pressure vasodilated condition of the fetal-placental circulation in humans [31].

Circulating angiogenic factors: Vascular endothelial growth factors (VEGF) are particular growth factors that play a crucial role in inducing angiogenesis [31].

Proteinuria measurement: Proteinuria assessment is necessary for all pregnant women. Urinary

dipstick testing can be utilized to check for proteinuria when there is little indication of preeclampsia [32].

Prediction and Prevention of Preeclampsia: Many studies have assessed measures for predicting preeclampsia or differentiating it from less severe hypertension problems. They involve evaluating circulation or urine indicators and using imaging methods. A comprehensive literature evaluation found that screening procedures performed up to 2004 were not effective predictors of preeclampsia [33].

Hypertension treatment: Readers are directed to many publications that provide systematic analysis of trials and thorough discussions on the treatment of hypertension during pregnancy. Additionally, no strict animal testing criteria must be fulfilled before human trials commence. Due to fetal issues arising in the last two trimesters, some proposed using the drug from conception or during the first trimester in cases like chronic hypertensive conditions. Stopping the ACE inhibitor or receptor blocker could lead to severe challenges in regaining control, potentially resulting in early pregnancy loss [34]. It is increasingly clear that these medicines are linked to severe fetal abnormalities and should not be administered in the early stages of pregnancy. There is insufficient information available about the usage of antihypertensive drugs during breastfeeding. Medications having strong protein binding, such as labetalol or propranolol, are favored over atenolol and metoprolol. ACE inhibitors are crucial for managing protein uric and diabetic individuals and can be promptly resumed. Diuretics can reduce the production of breast milk and should not be used [35].

Aspirin: The National Institute for Health and Clinical Excellence recommends a daily intake of 75 mg of aspirin from the 12th week of pregnancy to the 36th or 37th week for women with one high-risk factor or more than two moderate-risk conditions [36].

Calcium: Providing calcium supplements to individuals with insufficient dietary calcium may reduce the incidence of preeclampsia. Because calcium deficiency is rare in developed nations, calcium supplementation is not recommended in the UK due to the low risk of harm [37].

Surgery of Bariatric: Being overweight is highly connected with hypertension difficulties in pregnancy. Research shows that weight loss surgery reduces the occurrence of hypertension in pregnant obese women by about 75 percent. It is uncertain whether weight loss via alternate methods may provide similar decreases in risk [38].

Vitamin B9: The Folic Acid Clinical Trial, defined as (FACT) is a stage 3 investigation that is double-blinded, randomly allocated, and placebo-controlled [39].

Analgesia: Most women with severe preeclampsia will experience positive effects from neuraxial analgesia during labor. This includes preventing the increase in blood pressure due to pain and the sympathetic block aiding in the overall antihypertensive approach. Furthermore, an indwelling epidural catheter allows for the administration of surgical anesthesia in case an operational birth is required⁴⁰. Contraindications for preeclampsia include thrombocytopenia, rapidly dropping platelet count, and, less commonly, disseminated intravascular coagulation. Complete blood count and coagulation investigations must be conducted within 6 hours in all instances and within 2 hours in extreme situations before the central neuraxial blockade. If central neuraxial blockade is contraindicated, intravenous opioids, particularly remifentanyl patient-controlled analgesia, are being used as a viable alternative [40].

Anesthesia: The central neuraxial blockade is the preferred anesthetic approach for most preeclamptic women who need surgical delivery. Spinal, epidural, and mixed spinal-epidural techniques are all effectively utilized, with no clear preference for one over the others. It may be utilized with caution owing to heightened sensitivity to certain medications. Monitoring blood pressure invasively is particularly beneficial when the mother already needs magnesium sulfate and intravenous antihypertensive medications. General anesthesia may be required if regional methods cannot be used owing to coagulation problems. It is crucial to properly control the hypertensive reaction to laryngoscopy as it has a clear correlation with maternal mortality. No medication has demonstrated superiority; hence, the anesthetist should select the one they are most accustomed to. Hypertension upon waking from anesthesia is frequent, and further doses of the above medications may be required. Preeclamptic patients with upper

airway swelling may need a smaller tracheal tube than expected, and careful extubating is necessary⁴¹. Magnesium sulfate does not impact the effectiveness of succinylcholine; however, it may decrease the occurrence of distinctive muscle twitches. Magnesium sulfate enhances the effects of non-depolarizing neuromuscular blocking medications, requiring a lower dose and careful monitoring to guarantee effective reversal during the postoperative period [41].

2. Conclusion

Hypertension means having high blood pressure before you get pregnant or before 20 weeks of pregnancy. We may have identified a set of factors that are both causative and indicative of pregnant. This is essential, especially given the increasing evidence of the significant impact of preeclampsia on the mother's long-term health. The current study has been provided the most recent information for hypertension in pregnancy.

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