

Hypertensive disorders in pregnancy: current evidence, short-term and long-term outcomes

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Hypertensive disorders during pregnancy remain a leading cause of maternal and perinatal morbidity and mortality worldwide and represent a significant challenge in contemporary obstetrics. Despite advances in diagnostics, treatment, and screening programs, their prevalence continues to rise, driven by sociodemographic and medical factors such as higher maternal age and increasing rates of comorbidities.

Aim: to analyze current scientific literature on the prevalence short-term and long-term outcomes of hypertensive disorders during pregnancy, with a particular focus on preeclampsia, and to identify promising strategies for prevention and postpartum follow-up in women affected by these complications.

Materials and methods. A literature search was conducted in PubMed, Scopus, Web of Science, Medline, and UpToDate using the keywords: hypertensive disorders in pregnancy, gestational hypertension, preeclampsia, eclampsia, long-term outcomes, short-term outcomes, maternal cardiovascular risk, offspring, neurodevelopment, postpartum follow-up, cardiovascular prevention. Publications from 2020–2025 were prioritized. The review included systematic reviews, meta-analyses, cohort studies, and clinical guidelines. After exclusions, 70 publications meeting the criteria for relevance, evidence level, and clinical significance were analysed.

Results. The review summarizes the main clinical forms of hypertensive disorders during pregnancy – gestational hypertension, preeclampsia, and eclampsia – and highlights an upward trend in prevalence, particularly for gestational hypertension. The impact of the COVID-19 pandemic on incidence patterns is noted. Reported long-term maternal consequences – including cardiovascular, metabolic, and neurological disorders – as well as for their children, who may experience neurodevelopmental and psycho-emotional disturbances.

Conclusions. Hypertensive disorders during pregnancy carry substantial short- and long-term health risks for both mother and child. Women with a history of these conditions require structured postpartum follow-up and targeted preventive measures. Children born from such pregnancies may face elevated cardiovascular and neurodevelopmental risks, warranting ongoing monitoring. Implementation of early risk identification, patient education, and a multidisciplinary preventive approach is essential for reducing adverse outcomes.

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Гіпертензивні розлади під час вагітності: актуальні дані, короткострокові та віддалені наслідки

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Гіпертензивні розлади у вагітних – одна з найактуальніших проблем сучасного акушерства, оскільки вони залишаються однією з провідних причин материнської та перинатальної захворюваності й смертності у світі. Незважаючи на вдосконалення діагностики та лікування, оптимізації скринінгових програм, поширеність цих станів збільшується, що зумовлено соціально-демографічними змінами, підвищенням середнього віку вагітних, зростанням поширеності ожиріння, метаболічного синдрому та інших коморбідних станів.

Мета роботи – проаналізувати відомості сучасної наукової літератури щодо поширеності короткострокових і віддалених наслідків гіпертензивних розладів у вагітних, зокрема прееклампсії, а також визначити перспективні напрями профілактики та післяпологового спостереження.

Матеріали і методи. Пошук джерел здійснено у базах PubMed, Scopus, Web of Science, Medline та UpToDate за ключовими словами: hypertensive disorders in pregnancy, gestational hypertension, preeclampsia, eclampsia, long-term outcomes, short-term outcomes, maternal cardiovascular risk, offspring, neurodevelopment, postpartum follow-up, cardiovascular prevention. До аналізу включено 70 публікацій (2020–2025 pp.), серед них – систематичні огляди, метааналізи, когортні дослідження та клінічні рекомендації.

Результати. Розглянуто основні форми гіпертензивної патології під час вагітності, зокрема гестаційну гіпертензію, прееклампсію, еклампсію. В останнє десятиліття встановлено тенденцію до збільшення їхньої

поширеності, особливо гестаційної гіпертензії. Особливу увагу приділено впливу пандемії COVID-19 на динаміку гіпертензивних ускладнень. Узагальнено дані про віддалені наслідки для жінок, як-от про підвищення ризику хронічної артеріальної гіпертензії, ішемічної хвороби серця, інсульту, серцевої недостатності, метаболічних і неврологічних розладів. У дітей, народжених від таких вагітностей, встановлено більшу ймовірність виникнення серцево-судинної патології, порушень нейророзвитку та психоемоційного стану.

Висновки. Гіпертензивні розлади під час вагітності асоціюються з високим рівнем ускладнень у коротко-строківій та віддаленій перспективі для матері та дитини. Післяпологове спостереження, раннє виявлення ризиків, інформування пацієнток і міждисциплінарний підхід до профілактики є ключовими для зниження негативних наслідків і покращення прогнозу.

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Hypertensive disorders (HDs) during pregnancy represent a significant challenge in modern obstetrics, remaining one of the leading causes of maternal and perinatal morbidity and mortality. This group includes gestational hypertension, preeclampsia (PE), eclampsia, chronic arterial hypertension, and HELLP (Hemolysis, Elevated Liver enzymes, and Low Platelet count) syndrome. Despite advances in medicine, the incidence of these conditions has been increasing over the past three decades, which may be associated with various factors, including the rising average maternal age, increased prevalence of obesity, metabolic syndrome, diabetes, and other endocrine disorders [1,2,3,4]. Adverse outcomes include maternal complications such as liver rupture, stroke, pulmonary edema, and acute kidney injury, as well as stillbirth, fetal growth restriction, and iatrogenic preterm birth [5].

HDs are diagnosed in approximately 5 % to 15 % of all pregnancies [6,7,8,9,10]. According to a global epidemiological analysis conducted within the framework of the Global Burden of Disease Study, the estimated number of HDs cases worldwide increased from 31.3 million in 1990 to 36.1 million in 2021, corresponding to a 15.2 % relative increase. The age-standardized incidence rate (ASIR) rose from 15662.9 to 18050.1 per 100 000 pregnancies over the same period. Particularly notable is the substantial rise in the prevalence of gestational hypertension, which grew from 6.15 million to 36.1 million cases over the past three decades. However, despite this significant increase in absolute numbers, the overall trend demonstrates an annual net decrease in the growth rate (net drift: 0.755 % per year) [11,12].

The geographic distribution of HDs shows considerable variation. In countries with a high Social Demographic Index (SDI), the prevalence of HDs is approximately 1200–1400 per 100,000 pregnancies, whereas in regions with a low SDI – such as South Asia, Sub-Saharan Africa, and Latin America – it can reach up to 13,000 cases. At the same time, many countries with medium to high SDI levels have demonstrated stabilization or even a slight decline in prevalence over recent decades, largely due to the implementation of screening programs and early intervention strategies [11].

A detailed analysis of trends in the prevalence of hypertensive complications in recent years is particularly noteworthy. According to a study conducted in the United States, the rate of HDs increased from 13.0 % in 2017 to 16.3 % in 2019, reaching 17.6 % by 2021. The authors attribute this rise to multiple factors, including increasing maternal age, more frequent detection of early forms of HDs, and the impact of the COVID-19 pandemic [13].

Undoubtedly, the COVID-19 pandemic has had a significant impact on the dynamics of HDs prevalence. While large prospective studies (e. g., an analysis of 22,438 pregnancies in

2021) did not confirm a direct increase in the risk of HDs among pregnant women with SARS-CoV-2 infection [14], several other studies point to an association between severe COVID-19 and an elevated risk of developing PE and HELLP syndrome. Inflammatory changes, hypercoagulation, and endothelial dysfunction are considered key pathophysiological links between COVID-19 and hypertensive complications [15,16].

The group of HDs encompasses several clinically distinct conditions. One of these is gestational hypertension, defined as elevated blood pressure diagnosed after 20 weeks of gestation in the absence of pathological proteinuria or other signs of organ dysfunction characteristic of preeclampsia. Its prevalence in the general population is approximately 2.7 %, but among primiparous women it can reach as high as 18.6 % [17,18,19].

Preeclampsia (PE) is a type of hypertensive disorder in pregnancy characterized by the combination of hypertension with proteinuria or signs of organ dysfunction. According to various estimates, it occurs in 2 % to 8 % of pregnancies, although in certain populations – particularly among adolescent mothers – its frequency can reach 6.7 %. Eclampsia, a severe complication of PE accompanied by generalized seizures in the context of organ dysfunction, occurs in 0.1–0.3 % of pregnancies in countries with a high standard of medical care, whereas in regions with a low SDI, its prevalence can be as high as 1.4 % [20,21].

Currently, in addition to the distinction between PE, gestational hypertension, and superimposed PE (PE developing in the context of chronic hypertension), PE is also classified according to the presence or absence of severe features [22]. Depending on the gestational age at onset, PE is further categorized as early-onset (before 34 weeks of gestation) or late-onset (after 34 weeks) [23]. To date, PE remains a leading cause of both maternal and fetal morbidity and mortality [24,25,26].

Aim

To analyse current scientific literature on the prevalence, short-term and long-term outcomes of hypertensive disorders during pregnancy, with a particular focus on preeclampsia, and to identify promising strategies for prevention and postpartum follow-up in women affected by these complications.

Materials and methods

This literature review involved a comprehensive search and analysis of publications indexed in major scientific databases:

PubMed, Scopus, Web of Science, Medline, and UpToDate. The search strategy involved the use of combined queries with logical operators "AND" and "OR". The following keywords were included in the search: hypertensive disorders in pregnancy, gestational hypertension, preeclampsia, eclampsia, long-term outcomes, short-term outcomes, maternal cardiovascular risk, chronic hypertension, offspring, neurodevelopment, postpartum follow-up, cardiovascular prevention, placental dysfunction, endothelial dysfunction, pathogenesis of preeclampsia. The search was conducted between April and May 2025. No language restrictions were applied; however, preference was given to publications in English.

The analysis included articles published primarily between 2020 and 2025 that addressed the epidemiology, pathogenesis, and clinical outcomes (including long-term consequences) of HDs during pregnancy, as well as approaches to their prevention and postpartum management. Eligible sources comprised systematic reviews, meta-analyses, prospective and retrospective cohort studies, and clinical guidelines issued by leading international professional organizations, including the International Society for the Study of Hypertension in Pregnancy (ISSHP), the International Federation of Gynecology and Obstetrics (FIGO), the American College of Obstetricians and Gynecologists (ACOG), and the World Health Organization (WHO).

During the selection process, consideration was given to the year of publication, study design, methodology, sample size, objectivity of the reported findings, and their clinical relevance. Particular attention was paid to high-quality evidence sources, including multicenter studies and meta-analyses. Publications lacking a clearly defined methodology or consisting solely of narrative overviews without a scientific evidence base were excluded from the final analysis.

As a result of the search, a total of 743 scientific publications were identified that matched the predefined keywords and thematic criteria. After preliminary screening of titles and abstracts to remove duplicates, irrelevant topics, and studies not meeting the inclusion criteria (such as editorials, case reports, and narrative reviews lacking evidence synthesis), 264 publications remained for full-text review.

During the full-text analysis, additional exclusions were made for studies focused exclusively on laboratory or experimental models without a clinical component, as well as for articles discussing pregnancy complications unrelated to arterial hypertension.

Ultimately, 70 scientific sources were included in the final review. These sources met the established criteria for quality, relevance, and level of evidence, and consisted primarily of systematic reviews, meta-analyses, prospective cohort studies, and clinical guidelines published over the past decade.

Results

The relevance of addressing HDs is further underscored by the fact that cardiovascular diseases (CVDs) are among the three leading causes of mortality worldwide. CVDs are the primary cause of death among women, accounting for approximately one-third of all female deaths [27,28,29]. Hypertension, as the leading risk factor for CVD-related mortality, affects more than 1.1 billion adults globally [27,28,29,30].

Globally, hypertension remains a major cause of maternal and fetal morbidity and mortality, both in the short and long term [4]. Regarding short-term outcomes in women with hypertensive disorders, it has been established that blood pressure in the postpartum period is often higher than during pregnancy, which creates a sustained risk of cerebrovascular hemorrhage. Poorly controlled hypertension is a common cause of postpartum readmission [31,32]. HDs during pregnancy can worsen or newly develop in the postpartum period and account for up to 44 % of pregnancy-related deaths within the first six days after delivery [33].

Adverse pregnancy outcomes, including hypertensive disorders during pregnancy, gestational diabetes, preterm birth, and low birth weight – which affect up to 30 % of pregnant women – increase the risk of developing cardiovascular disease [29]. The consequences of HDs for both the mother and her offspring are well documented. These include an increased risk of recurrent PE or eclampsia, stroke, heart failure, pulmonary edema, acute kidney injury, placental abruption, and maternal death, as well as a heightened risk of preterm birth, fetal growth restriction, and perinatal fetal death [34,35].

Women with a history of HDs have an increased risk of developing CVDs compared to women with normotensive pregnancies. Specifically, these patients face a higher future risk of hypertension, ischemic heart disease, heart failure, peripheral vascular disease, stroke, and CVD-related mortality. The elevated long-term risk of CVD among women who experienced HDs during pregnancy has been confirmed by multiple meta-analyses. Notably, the relative risk is highest within the first year postpartum, and cardiovascular risks in this population persist for decades after pregnancy [32,36,37,38].

Women with HDs have a significantly higher likelihood of developing hypertension, ischemic heart disease, heart failure in later life, and mortality compared to women with uncomplicated pregnancies. The risk of future hypertension is greatest within the first five years postpartum [6,39,40]. In addition, during the months or even years following delivery, women who experienced gestational hypertension, PE, or eclampsia are at increased risk of neurological disorders, including migraine, headache, epilepsy, and sleep disturbances. It is worth noting that women with a history of eclampsia have a fivefold higher risk of developing epilepsy [41].

To date, three main hypotheses have been proposed to explain the increased risk of CVD in women with a history of PE: a positive family genetic history, epigenetic changes during pregnancy, and placental development abnormalities [4]. The correlation between the history of PE and premature CVD appears to be strongest in cases of early-onset or severe PE and subsequent long-term CVD. Thus, PE, as a common pregnancy complication worldwide, is now recognized as a novel risk factor for CVD. Key concerns related to CVD risk associated with PE include early onset and more severe cardiovascular manifestations in women with a history of PE and in their offspring, especially male offspring [42].

PE has been associated with an approximately 75 % higher risk of CVD-related mortality compared to women without a history of PE [43]. Complicated pregnancies, including PE, are also

linked to an increased risk of developing chronic kidney disease later in life. A similar risk exists for gestational hypertension, although the association is less pronounced than that observed with PE [44,45,46]. Numerous studies have demonstrated an elevated risk of future cardiovascular or cerebrovascular events, diabetes, and dyslipidemia in women diagnosed with PE [47,48,49,50,51,52].

One question that remains under discussion is whether HDs during pregnancy, including PE, contribute to developmental disorders in offspring. Clearly, well-designed multicenter studies are needed to examine the complex interrelationships between preconception and early pregnancy factors, fetal and placental characteristics, maternal factors, and other variables [24]. Epidemiological research increasingly recognizes the importance of the Developmental Origins of Health and Disease (DOHaD) paradigm and suggests that early-life exposures may be transmitted across generations [53]. Numerous studies have indicated an association between complicated pregnancies, particularly HDs, and the risk of disease in offspring [54,55,56,57,58,59,60].

Children born to mothers with HDs, especially those with a maternal history of CVD or diabetes, have an increased risk of general and certain type-specific CVDs with early onset in the first decades of life [61]. Preclinical data have highlighted several pathways through which early-life exposures alter physiology and influence blood pressure. PE, gestational diabetes, maternal undernutrition, and antenatal corticosteroid exposure – among others – have all been shown to exert physiological effects on fetal growth, development, and function, ultimately impacting blood pressure [59]. Evidence from systematic reviews and meta-analyses supports an association between HDs and elevated blood pressure levels in offspring [62]. Moreover, exposure to HDs during pregnancy may be linked to an increased risk of congenital heart defects in children [60]. A systematic review and meta-analysis of observational studies, along with multiple individual studies, indicate that in utero exposure to HDs during pregnancy may be a risk factor for autism spectrum disorder and attention-deficit/hyperactivity disorder in offspring [63].

Current evidence indicates an association between PE and adverse health outcomes in offspring. Identified associations include increased risks of CVDs, renal dysfunction, general vascular disorders, endocrine diseases, immune dysregulation, and neurodevelopmental adverse outcomes. However, since HDs are often associated with preterm birth and fetal growth restriction, it may be challenging to determine the contribution of each condition to the increased risk observed in offspring [64].

In women with a history of pregnancy complications, CVDs tend to develop earlier than in women without such complications, further confirming the significance of pregnancy complications as a CVD risk factor [65]. Epidemiological studies have demonstrated that the history of HDs is associated with an increased risk of chronic conditions, particularly CVDs. Therefore, HDs should not be regarded solely as a maternal and perinatal health issue, but also as a long-term health issue with implications for later life [66]. According to a systematic review and meta-analysis, the risk of developing hypertension within two years postpartum is six times higher in women who have experienced preeclampsia [7].

Furthermore, a strong association has been established between the recurrence of PE in subsequent pregnancies and an additional increased risk of developing CVD and hypertension later in life, compared with women who had only one episode of PE [9]. Therefore, a complicated pregnancy course – particularly HDs during pregnancy – may serve as an early indicator of future metabolic and cardiovascular risks. This knowledge is crucial for developing targeted screening and preventive strategies [37].

International guidelines on the prevention, diagnosis, and management of hypertensive disorders during pregnancy recognize the significant complications associated with undiagnosed and untreated conditions. They also emphasize the potential for improved outcomes through a combination of preventive measures, timely diagnosis, prompt treatment, and delivery when indicated [67]. Given that the majority of CVD-related deaths and disabilities caused by modifiable risk factors can be reduced or prevented, preventive measures remain a key priority for global healthcare systems [27].

However, studies have shown that women often lack sufficient awareness of these risks and may miss necessary follow-up care [68]. Postpartum management of women with cardiovascular risks can be enhanced through active education and awareness campaigns, improved follow-up, and related measures [69]. The development of a structured screening tool for postpartum follow-up has the potential to improve long-term monitoring after preeclampsia, enhance the effectiveness of cardiovascular disease prevention, and contribute to improving population health outcomes [70]. Identifying risk factors for future CVD may encourage early lifestyle modifications and disease prevention. Furthermore, the development of CVD after pregnancy can contribute to increased perinatal morbidity in subsequent pregnancies [50].

Conclusions

1. Hypertensive disorders during pregnancy remain one of the most pressing challenges in modern obstetrics, as they continue to be a leading cause of maternal and perinatal morbidity and mortality worldwide. The increasing incidence of these conditions is associated with global demographic shifts, rising maternal age, and the growing prevalence of risk factors such as obesity, metabolic syndrome, and comorbid extragenital diseases.

2. Hypertensive disorders are accompanied by a high risk of severe complications for both the mother and the fetus, as well as long-term consequences that elevate the likelihood of developing cardiovascular, metabolic, and neurological disorders in mothers.

3. The established association between a history of hypertensive disorders during pregnancy and an increased risk of chronic hypertension, ischemic heart disease, and stroke underscores the need for implementing targeted postpartum follow-up and preventive programs.

4. Effective screening, timely diagnosis, and a multidisciplinary approach to managing patients with hypertensive disorders during pregnancy are essential prerequisites for minimizing potential adverse outcomes.

Prospects for further research. Promising directions for further research include an in-depth investigation of the pathophysiological mechanisms linking hypertensive disorders during pregnancy

to the development of cardiovascular and other chronic diseases later in life, with particular attention to the role of endothelial dysfunction and endotheliosis. Clarifying the significance of genetic and epigenetic factors remains highly relevant, as does improving strategies for the early identification of high-risk groups and the long-term follow-up of these women. In addition, further analysis of the impact of hypertensive disorders during pregnancy on the health of offspring across different stages of life is essential for building a robust evidence base to enhance preventive measures and to ensure comprehensive, high-quality interdisciplinary care.

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