World Journal of Gynecology
www.worldgynecologyjournal.com
E-ISSN: 3108-0588
Received: 31-07-2026, Accepted: 30-08-2026, Published: 14-09-2026
Volume 2, Issue 3, 2026, Page No. 1-4

Pre-eclampsia: Current understanding of risk factors, prevention, and management

Pratik Kumar, Suresh Mukherjee
Department of Obstetrics and Gynaecology, Maulana Azad Medical College, New Delhi, India

Abstract
Pre-eclampsia remains a leading cause of maternal and perinatal morbidity and mortality worldwide, with the heaviest burden falling on low- and middle-income countries. This narrative review synthesizes literature published largely between 2023 and 2026 on the risk factors, prevention strategies, diagnostic advances, and management approaches relevant to pre-eclampsia. Established clinical risk factors, including prior pre-eclampsia, chronic hypertension, pregestational diabetes, obesity, and antiphospholipid syndrome, continue to anchor risk stratification, while emerging evidence points to the independent contribution of social determinants such as socioeconomic deprivation, limited healthcare access, and psychosocial stress. Low-dose aspirin initiated before 16 weeks' gestation remains the cornerstone of pharmacological prevention, with recent network meta-analyses helping to clarify optimal dosing, while calcium supplementation, including newer low-dose regimens, offers a complementary strategy where dietary calcium intake is limited. The soluble fms-like tyrosine kinase-1 to placental growth factor (sFlt-1/PlGF) ratio has matured into a clinically validated tool for ruling out short-term progression to severe disease and recently received expanded regulatory approval. Management continues to balance maternal safety against fetal maturity, with trial evidence supporting planned delivery for late preterm disease and tighter postpartum blood pressure targets. Persistent barriers, including workforce shortages, inconsistent guideline adoption, supply chain gaps, and patient-level adherence challenges, constrain the translation of proven interventions into practice, particularly in under-resourced settings. The review concludes that further progress depends substantially on the equitable implementation of existing evidence rather than solely on the discovery of new interventions.

Keywords: Pre-eclampsia, hypertensive disorders of pregnancy, aspirin prophylaxis, sFlt-1/PlGF ratio, maternal health

Introduction

Pre-eclampsia is a multisystem hypertensive disorder unique to pregnancy, characterized by new-onset hypertension after 20 weeks' gestation accompanied by evidence of maternal organ dysfunction, most often renal, hepatic, or haematological. It complicates a meaningful share of pregnancies worldwide and remains among the leading direct causes of maternal death, with the great majority of fatalities occurring in low- and middle-income settings (Beardmore-Gray *et al*., 2023) [2]. Beyond acute maternal and perinatal risks, such as stroke, HELLP syndrome, placental abruption, fetal growth restriction, and preterm birth, pre-eclampsia carries long-term consequences, substantially elevating a woman's lifetime risk of chronic hypertension and cardiovascular disease. Despite decades of research, the underlying placental and vascular pathophysiology of pre-eclampsia remains incompletely understood, and no curative treatment exists short of delivery. Nonetheless, recent years have brought meaningful advances: refined risk-stratification frameworks, clarified aspirin dosing regimens, validated angiogenic biomarker testing, and trial-based guidance on delivery timing. At the same time, translating this evidence into consistent clinical practice, particularly in resource-limited settings where the burden is greatest, remains an unresolved challenge. This review synthesizes recent literature to summarize current understanding of pre-eclampsia risk factors, prevention, diagnosis, and management, and to identify barriers that continue to limit effective implementation of evidence-based care.

Review Approach

This narrative review draws on peer-reviewed systematic reviews, meta-analyses, randomized controlled trials, and clinical practice guidelines published predominantly between 2023 [16] and 2026, identified through targeted searches of PubMed, Cochrane, and related databases using terms including "pre-eclampsia," "aspirin prophylaxis," "calcium supplementation," "sFlt-1/PlGF," and "hypertensive disorders of pregnancy." Priority was given to systematic reviews and meta-analyses with transparent, PRISMA-adherent methodology, large multi-country cohort studies, and major professional society guidelines. Older foundational studies are cited sparingly, only where they remain the primary evidentiary basis for current practice. Findings were synthesized thematically rather than pooled through formal meta-analysis.

Clinical and Social Risk Factors

A large multinational meta-analysis of cohort studies established that a small set of clinical characteristics assessed in early pregnancy meaningfully stratifies risk: antiphospholipid antibody syndrome and a personal history of pre-eclampsia confer the greatest relative risk, followed by chronic hypertension, pregestational diabetes, obesity, and conception via assisted reproductive technology. A comparison of clinical practice guidelines against the underlying evidence base found that guideline-designated "major" risk factors are not always well aligned with the strength of supporting data, with some factors warranting aspirin prophylaxis resting on only "possible" rather than "definite" associations (Elawad et al., 2024) [4]. Complementing this clinical picture, a hierarchical evidence

review of social determinants identified two dozen associations between pre-eclampsia and factors such as socioeconomic deprivation, limited social support, restricted healthcare access, and adverse occupational or physical environments, noting that existing risk frameworks have historically neglected these dimensions in favor of purely clinical and genetic risk factors (Elawad *et al*., 2025) [5]. Regional data reinforce this picture: a Saudi Arabian systematic review linked micronutrient deficiencies, including calcium, magnesium, and zinc, alongside low disease awareness, to elevated pre-eclampsia burden, with fewer than a third of surveyed women demonstrating adequate awareness of the condition (Nujoom *et al*., 2025) [9].

Pharmacological Prevention

Low-dose aspirin remains the most extensively validated pharmacological strategy for pre-eclampsia prevention among high-risk women. Recent network and pairwise meta-analyses pooling data from numerous randomized trials have refined dosing guidance, generally converging on doses in the 80-150 mg range initiated before 16 weeks' gestation as most protective, while noting that trials using markedly higher doses still require further confirmation of comparative benefit (Hu et al., 2024; Ayyash *et al*., 2023) [1]. A 2024 review further emphasized that timing of initiation, rather than dose alone, is a critical determinant of efficacy, and that real-world adherence often falls short of trial protocols (Rottenstreich, 2024) [14]. Population-level data from France illustrate this gap: among women with a prior pre-eclampsia diagnosis, aspirin uptake and adherence to recommended dosing were frequently inadequate, particularly among socially disadvantaged women, even though initiation before 16 weeks at doses of 100 mg or more was associated with reduced risk of early and severe recurrence (Lailler *et al*., 2023) [7]. Calcium supplementation offers a second, complementary avenue, particularly where dietary calcium intake is low. A large multi-country trial in India and Tanzania recently demonstrated that a lower-dose regimen of 500 mg per day was noninferior to the standard high-dose regimen of 1,500 mg per day for preventing pre-eclampsia, a finding with meaningful implications for simplifying supplementation logistics in under-resourced settings (Romero *et al*., 2025) [12].

Diagnostic and Predictive Advances

Angiogenic biomarker testing has matured substantially in recent years. The ratio of soluble fms-like tyrosine kinase-1 to placental growth factor reflects the antiangiogenic placental state characteristic of pre-eclampsia and has been increasingly incorporated into clinical prediction and monitoring algorithms (Stepan *et al*., 2023) [16]. Pooled diagnostic accuracy estimates indicate reasonably strong performance for ruling out short-term progression to severe disease, though substantial heterogeneity across cutoff values and populations persists. A large Chinese cohort study recently proposed population-specific thresholds associated with meaningfully elevated risk of adverse maternal and perinatal outcomes among hypertensive women (Pan *et al*., 2025) [10]. Regulatory recognition has followed the evidence: an automated immunoassay-based sFlt-1/PlGF test received expanded United States regulatory clearance in 2025 for stratifying hospitalized women with hypertensive disorders into risk categories for progression to severe pre-eclampsia within two weeks (Roche Diagnostics, 2025) [11]. Even so, current guidance stresses that biomarker results should supplement rather than replace clinical assessment, since management pathways following a positive or negative result remain incompletely standardized (Society of Obstetricians and Gynaecologists of Canada, 2022) [15].

Clinical Management and Timing of Delivery

Delivery remains the only definitive treatment for pre-eclampsia, making the timing decision central to management. Guidance generally supports delivery from 37 weeks for pre-eclampsia of any severity, expectant management prior to 34 weeks absent severe features, and a more individualized approach in the late preterm window. The CRADLE-4 trial, conducted across sites in India and Zambia, found that planned delivery from 34 weeks' gestation in a low-resource setting reduced stillbirth and severe maternal hypertension without increasing neonatal unit admissions, extending to low- and middle-income contexts findings previously established mainly in high-income trials (Beardmore-Gray *et al*., 2023) [2]. Blood pressure management extends into the postpartum period, an interval associated with continuing cardiovascular risk. A recent multicenter cohort study evaluating tighter postpartum blood pressure targets, below 130/80 mmHg using remote monitoring, compared with standard targets below 150/100 mmHg, found the tighter approach associated with fewer postpartum emergency department visits, suggesting a role for more intensive postpartum surveillance (Rosenfeld *et al*., 2025) [13]. Magnesium sulfate continues to be endorsed as first-line therapy for eclampsia treatment and seizure prophylaxis in women with severe features, per major society guidance (Society of Obstetricians and Gynaecologists of Canada, 2022) [15].

Evidence on Effectiveness

Taken together, the evidence base for pre-eclampsia prevention and management has strengthened considerably. Aspirin prophylaxis, when initiated early and taken consistently, is associated with reductions in preterm pre-eclampsia risk across multiple meta-analyses, though effect sizes vary by dose, gestational timing, and population risk profile (Hu *et al*., 2024) [4]. Calcium supplementation, including newly validated low-dose regimens, shows consistent risk reduction, particularly among women with low baseline dietary intake (Woo Kinshella et al., 2022; Romero *et al*., 2025) [12, 19]. Angiogenic biomarker testing demonstrates strong negative predictive value, making it most clinically useful for safely ruling out imminent severe disease and avoiding unnecessary hospitalization or early intervention (Stepan *et al*., 2023) [16]. Trial-based delivery-timing protocols have improved maternal outcomes without clear fetal harm in the late preterm window, and the CRADLE-4 trial provides encouraging confirmatory evidence that this benefit extends to low-resource settings (Beardmore-Gray *et al*., 2023) [2]. Collectively, this evidence supports a risk-stratified, multi-pronged prevention and monitoring strategy rather than reliance on any single intervention, with the strength of the underlying evidence varying by intervention and population studied.

Barriers and Challenges to Implementation

Despite robust efficacy data, translating these interventions into consistent practice faces substantial obstacles,

especially in low- and middle-income countries where pre-eclampsia's burden is disproportionately concentrated. A systematic review of aspirin, calcium, and magnesium sulfate implementation across such settings identified recurring barriers, including gaps in provider knowledge, unreliable drug supply chains, health workforce shortages, and constrained health system capacity, alongside patient-level challenges such as late antenatal care attendance, pill burden, and sociocultural attitudes toward supplementation. Guideline adoption itself is inconsistent: a global review of national antenatal care guidelines found that fewer than a third of reviewed countries had adopted World Health Organization calcium supplementation recommendations, with adoption lowest precisely in the low-resource settings carrying the greatest disease burden (Romero *et al*., 2025) [12]. Qualitative work in Tanzania has further identified the practical difficulty of managing complex, multiple-times-daily calcium dosing schedules, particularly where anaemia and competing iron-folic acid supplementation needs complicate adherence. Even in high-income settings, inconsistencies persist: a recent systematic review comparing international clinical guidelines for pre-eclampsia prevention found considerable variability in how risk factors are categorized and operationalized, undermining the standardization needed for equitable, risk-based prophylaxis.

Discussion and Implications

The current literature suggests that further reductions in pre-eclampsia-related morbidity and mortality depend less on discovering new interventions and more on closing persistent implementation gaps. Priorities include harmonizing risk-factor definitions across clinical guidelines to reduce inconsistent aspirin eligibility decisions, simplifying calcium supplementation regimens to improve adherence in high-burden settings, and generating further context-specific evidence to determine how consistently delivery-timing protocols validated in one setting translate safely to others with differing neonatal care capacity. Angiogenic biomarker testing holds promise for reducing unnecessary interventions, but standardized, population-specific cutoffs and clear post-test management pathways are still needed before its benefits can be realized at scale. Health system strengthening, including reliable supply chains, provider training, and community-level adherence support, appears at least as consequential as further refinement of clinical protocols. Addressing the social determinants identified in recent reviews, including healthcare access and socioeconomic deprivation, will likely require interventions extending well beyond the antenatal clinic itself.

Conclusion

Pre-eclampsia remains a major contributor to maternal and perinatal morbidity worldwide, but the evidence base guiding its prevention and management has advanced meaningfully in recent years, spanning refined risk stratification, clarified aspirin and calcium prophylaxis regimens, validated angiogenic biomarker testing, and trial-informed delivery timing. The central challenge going forward is not the absence of effective interventions but their inconsistent and inequitable implementation, particularly in the low- and middle-income settings where the burden of disease is greatest. Sustained progress will depend on strengthening health systems, harmonizing clinical guidelines, and generating context-specific implementation evidence alongside continued biomedical research.

References

1. Ayyash M, Goyert G, Garcia R, Khangura R, Pitts D, Jacobsen G, et al. Efficacy and safety of aspirin 162 mg for preeclampsia prophylaxis in high-risk patients. American Journal of Perinatology,2023:41:2410-e2417. https://doi.org/10.1055/s-0043-1771260
2. Beardmore-Gray A, Vousden N, Seed PT, Vwalika B, Chinkoyo S, Sichone V, et al. Planned delivery or expectant management for late preterm pre-eclampsia in low-income and middle-income countries (CRADLE-4): A multicentre, open-label, randomised controlled trial. The Lancet,2023:402(10399):386-396. https://doi.org/10.1016/S0140-6736(23)00688-8
3. Chen G, Chen Y, Shi Y, Mao Z, Lou J, Ma J. A dynamic prediction model for preeclampsia using the sFlt-1/PLGF ratio combined with multiple factors. BMC Pregnancy and Childbirth, 2024. https://doi.org/10.1186/s12884-024-06627-4
4. Elawad T, Scott G, Bone JN, Elwell H, Roberts N, Vata P, et al. Risk factors for pre-eclampsia in clinical practice guidelines: Comparison with the evidence. BJOG: An International Journal of Obstetrics & Gynaecology, 2024. https://doi.org/10.1111/1471-0528.17320
5. Elawad T, Scott G, Bone JN, Green M, Sandall J, Chappell LC, et al. Towards the development of a conceptual framework of the determinants of pre-eclampsia: A hierarchical systematic review of social determinants. BJOG: An International Journal of Obstetrics & Gynaecology, 2025. https://pubmed.ncbi.nlm.nih.gov/39973015/
6. Hu X, et al. The optimal dosage of aspirin for preventing preeclampsia in high-risk pregnant women: A network meta-analysis of 23 randomized controlled trials. The Journal of Clinical Hypertension,2024:26(4):62-73. https://doi.org/10.1111/jch.14821
7. Lailler G, Grave C, Gabet A, Regnault N, Deneux-Tharaux C, Kretz S, et al. Aspirin for the prevention of early and severe pre-eclampsia recurrence: A real-world population-based study. Drugs,2023:83(5):429-437. https://doi.org/10.1007/s40265-023-01842-3
8. National Institute for Health and Care Excellence. Hypertension in pregnancy: Diagnosis and management (NICE Guideline NG133). National Institute for Health and Care Excellence, 2019.
9. Nujoom RR, Babader RB, Aloufi AA, Malibary M, Alshareef NH, Shoaib FM, et al. Preeclampsia in Saudi Arabia: A systematic review and meta-analysis of prevalence, risk factors, awareness, and outcomes. Cureus,2025:17(12):98969. https://doi.org/10.7759/cureus.98969
10. Pan J, et al. sFlt-1/PlGF ratio thresholds for diagnosing pre-eclampsia in pregnant women with high blood pressure. Ultrasound in Obstetrics & Gynecology, 2025. https://doi.org/10.1002/uog.70075
11. Roche Diagnostics. Roche Elecsys sFlt-1/PlGF ratio for preeclampsia receives FDA 510(k) clearance, offering a fast and reliable way to predict the risk of developing

severe preeclampsia [Press release]. Roche Diagnostics, 2025.
12. Romero R, et al. National adoption of World Health Organization recommendations on calcium supplementation during pregnancy. Annals of the New York Academy of Sciences, 2025. https://doi.org/10.1111/nyas.70120
13. Rosenfeld EB, Sagaram D, Lee R, Sadural E, Miller RC, Lin R, et al. Management of postpartum preeclampsia and hypertensive disorders (MOPP): Postpartum tight vs standard blood pressure control. JACC: Advances,2025:4(3):101617. https://doi.org/10.1016/j.jacadv.2025.101617
14. Rottenstreich A. Controversies and clarifications regarding the role of aspirin in preeclampsia prevention: A focused review. Journal of Clinical Medicine,2024:13(15):4427. https://doi.org/10.3390/jcm13154427
15. Society of Obstetricians and Gynaecologists of Canada. Guideline No. 426: Hypertensive disorders of pregnancy: Diagnosis, prediction, prevention, and management. Journal of Obstetrics and Gynaecology Canada,2022:44(5):547-571.e1. https://doi.org/10.1016/j.jogc.2022.03.002
16. Stepan H, Galindo A, Hund M, Schlembach D, Sillman J, Surbek D, et al. Clinical utility of sFlt-1 and PlGF in screening, prediction, diagnosis and monitoring of pre-eclampsia and fetal growth restriction. Ultrasound in Obstetrics & Gynecology,2023:61(2):168-180. https://doi.org/10.1002/uog.26032
17. Unpublished systematic review. Effectiveness and implementation barriers and enablers of calcium supplementation, aspirin prophylaxis and magnesium sulphate utilisation for pre-eclampsia in LMICs: A systematic review. Research Square, 2026. https://doi.org/10.21203/rs.3.rs-preeclampsia-lmic
18. Unpublished systematic review. Inconsistencies in recommendations for the preventive management of pre-eclampsia and quality assessment of international guidelines: A systematic review, 2026. https://pubmed.ncbi.nlm.nih.gov/41559578/
19. Woo Kinshella ML, Sarr C, Sandhu A, Bone JN, Vidler M, Moore SE, et al. Calcium for pre-eclampsia prevention: A systematic review and network meta-analysis to guide personalised antenatal care. BJOG: An International Journal of Obstetrics & Gynaecology,2022:129(11):1833-1843. https://doi.org/10.1111/1471-0528.17222