fortune Journals

Review Article

JOURNAL OF OPHTHALMOLOGY AND RESEARCH

ISSN: 2644-0024

Pregnancy as a Retinal Stress Test: The Retina as a Window into Mothers' Vascular and Immune Health

Marina Gad El Sayed[1*], Joanna Sung[1], Michael Zakhary[2], Maria Zakhary[2]

Abstract

Pregnancy represents a unique physiologic state characterized by dynamic vascular, immune, and hematologic adaptations that support maternal and fetal health. While these changes are often well tolerated, they may also unmask or exacerbate underlying systemic disease, contributing to maternal morbidity during pregnancy and the postpartum period. The retina, as a highly vascular and metabolically active tissue, offers a rare, noninvasive window into these systemic processes in vivo.

This editorial perspective frames pregnancy as a physiologic "stress test," highlighting how retinal findings can reflect broader maternal vascular, immune, and thrombotic dysfunction. Visual symptoms and retinal changes may serve as early indicators of hypertensive disorders of pregnancy, immune-mediated disease, and postpartum hypercoagulability. Despite this, ophthalmic manifestations are frequently underrecognized or attributed to benign physiologic changes, leading to missed opportunities for early diagnosis and intervention.

By integrating ophthalmologic evaluation into maternal care, clinicians may improve risk stratification and facilitate earlier identification of high-risk conditions. This perspective underscores the importance of interdisciplinary collaboration and proposes a clinical framework in which retinal findings are recognized as meaningful markers of systemic disease rather than isolated ocular phenomena. Future research is needed to further define the prognostic value of retinal changes and to establish evidence-based guidelines for incorporating ophthalmology into maternal health care

Keywords: Pregnancy; Fetal health; Postpartum; Maternal; Health care; Eye

Introduction

Pregnancy represents a period of profound physiologic change, marked by coordinated adaptations in vascular, immune, and hematologic systems to support maternal and fetal health. While these changes are typically well tolerated, they may also unmask or exacerbate underlying systemic disease, contributing to significant maternal morbidity during pregnancy and the postpartum period. Identifying early indicators of systemic dysfunction during this time remains a critical challenge in maternal health care.

The eye, and the retina in particular, offers a unique opportunity to observe these systemic processes in vivo. As a highly vascular and metabolically

Affiliation:

[1]University of California, Riverside School of Medicine, CA, USA.

[2]Chaffey College, Rancho Cucamonga, CA, USA.

***Corresponding author:**
Marina Gad El Sayed, University of California, Riverside School of Medicine, 900 University Avenue, Riverside, CA, 92521, USA

Citation: Joanna Sung, Marina Gad El Sayed, Michael Zakhary, Maria Zakhary. Pregnancy as a Retinal Stress Test: The Retina as a Window into Mothers' Vascular and Immune Health. Journal of Ophthalmology and Research. 9 (2026): 45-49.

Received: April 14, 2026
Accepted: April 21, 2026
Published: April 28, 2026

Gad El Sayed M, et al., J Opthalmol Res 2026
DOI:10.26502/fjor.2644-002400114

active tissue, the retina is especially sensitive to endothelial injury, immune-mediated inflammation, and microvascular compromise. Retinal findings may therefore serve as noninvasive indicators of broader systemic pathology, providing insight into disease severity that extends beyond ocular health alone.

This article explores pregnancy as a physiologic stress test viewed through a retinal lens, examining how visual symptoms and retinal findings reflect pregnancy-related vascular, immune, and thrombotic disease. By framing ophthalmic changes as clinically meaningful signals rather than isolated findings, this perspective highlights the role of ophthalmology in advancing interdisciplinary approaches to women's health.

A Clinical Framework for Ophthalmic Evaluation of Visual Changes in Pregnancy

Visual complaints are common during pregnancy and often reflect normal physiologic adaptations related to hormonal changes, fluid shifts, and altered vascular dynamics [1]. Mild refractive changes, dry eye symptoms, and contact lens intolerance may occur without underlying pathology and typically resolve in the postpartum period [2]. However, visual symptoms may also represent early manifestations of systemic disease, positioning the eye as a critical interface between obstetrics and medicine [3].

Distinguishing physiologic visual changes from pathologic warning signs is essential in maternal care [4]. Sudden or persistent vision loss, visual field defects, scotomas, photopsias, diplopia, or visual obscurations should prompt consideration of pregnancy-related hypertensive disorders, immune-mediated disease, thrombotic events, or increased intracranial pressure. These symptoms often precede or parallel systemic findings, underscoring the diagnostic value of ophthalmologic assessment.

The retina, in particular, offers a uniquely accessible window into systemic vascular and immune processes. As a highly metabolically active and vascularized tissue, it is especially sensitive to endothelial dysfunction, inflammation, and microvascular compromise [5]. Retinal findings may therefore provide early insight into the severity and progression of systemic conditions that disproportionately affect pregnant and postpartum individuals.

Visual disturbances in pregnancy are frequently minimized or attributed to fatigue or benign physiologic change, leading to delayed evaluation and missed opportunities for early intervention [6,7]. Clear clinical thresholds for ophthalmologic referral are essential. Visual symptoms accompanied by hypertension, neurologic findings, autoimmune disease, or postpartum status warrant prompt ophthalmic assessment and interdisciplinary coordination.

By framing visual changes as potential indicators of systemic disease rather than isolated ocular complaints, clinicians can better integrate ophthalmology into maternal health care. The sections that follow explore how hypertensive disorders, immune dysregulation, and postpartum hypercoagulability manifest within the retina, reinforcing the concept of pregnancy as a physiologic stress test in which the eye serves as a noninvasive marker of maternal vascular and immune health.

Hypertensive Disorders of Pregnancy and Retinal Microvascular Disease

Among the systemic conditions that most clearly illustrate the diagnostic value of retinal findings in pregnancy are hypertensive disorders, including preeclampsia, eclampsia, and HELLP syndrome [8]. These conditions represent some of the leading causes of maternal and fetal morbidity and mortality worldwide and are characterized by widespread endothelial dysfunction, vasospasm, and microvascular injury. The retina, as an accessible microvascular bed, mirrors these systemic processes and offers a noninvasive means of assessing disease severity and progression. Retinal manifestations of hypertensive disorders of pregnancy may include arteriolar narrowing, increased vascular tortuosity, cotton wool spots, intraretinal hemorrhages, and, in severe cases, serous retinal detachment [9]. These findings reflect widespread endothelial injury and increased vascular permeability, mirroring placental and systemic vascular pathology. Importantly, the presence and severity of retinal changes have been shown to correlate with the clinical severity of preeclampsia, underscoring the retina's potential role as a marker of systemic disease burden [10,11].

Serous retinal detachment, though uncommon, represents a particularly striking ophthalmic complication associated with severe preeclampsia and HELLP syndrome [12]. Proposed mechanisms include choroidal ischemia and breakdown of the outer blood–retinal barrier, leading to subretinal fluid accumulation [13]. While visual symptoms may be transient and often improve following delivery and blood pressure control, these findings signal profound systemic vascular compromise and warrant close interdisciplinary management.

Despite the clinical relevance of these retinal findings, visual symptoms in pregnancy are frequently underrecognized or attributed to benign physiologic changes. Ophthalmologic evaluation is not routinely incorporated into the assessment of hypertensive disorders of pregnancy, potentially representing a missed opportunity for risk stratification and early intervention. Increased awareness of retinal microvascular changes among obstetric and primary care providers may aid in identifying patients at higher risk for severe disease and adverse outcomes.

Citation: Joanna Sung, Marina Gad El Sayed, Michael Zakhary, Maria Zakhary. Pregnancy as a Retinal Stress Test: The Retina as a Window into Mothers' Vascular and Immune Health. Journal of Ophthalmology and Research. 9 (2026): 45-49.

Gad El Sayed M, et al., J Opthalmol Res 2026
DOI:10.26502/fjor.2644-002400114

By reflecting the cumulative effects of systemic vascular injury, the retina serves as a valuable yet underutilized indicator of hypertensive disease severity in pregnancy. Integrating ophthalmic findings into maternal health assessment highlights the importance of interdisciplinary collaboration and reinforces the role of ophthalmology in the broader landscape of women's health.

Pregnancy, Autoimmune Disease, and Retinal Vasculitis

Beyond hypertensive disorders, pregnancy-related visual and retinal findings may also reflect underlying immune-mediated disease. Autoimmune conditions such as systemic lupus erythematosus, antiphospholipid syndrome, and other vasculitides disproportionately affect women of childbearing age and may be modified by the immunologic adaptations of pregnancy [14,15]. In this context, the retina serves as a sensitive indicator of immune-driven vascular injury with implications for both maternal and fetal health [16].

Retinal involvement in autoimmune disease can manifest as retinal vasculitis, vaso-occlusive disease, ischemic retinopathy, or optic neuropathy [17]. These findings often result from immune complex deposition, complement activation, and endothelial injury, mechanisms that may be amplified during pregnancy due to altered cytokine profiles and immune regulation [18]. In patients with systemic lupus erythematosus or antiphospholipid syndrome, retinal vascular occlusions may serve as early indicators of systemic disease activity or impending thrombotic events.

Pregnancy-associated immune modulation may further complicate the clinical course of autoimmune disease. Shifts toward a humoral immune response, fluctuations in disease activity across trimesters, and postpartum immune rebound can all influence vascular integrity. Retinal ischemia or vasculitis identified during pregnancy may therefore represent not only localized ocular pathology but also a broader reflection of systemic immune dysregulation with implications for maternal health [19].

Importantly, visual symptoms in pregnant patients with autoimmune disease may be subtle or attributed to nonpathologic changes, leading to delays in diagnosis. Retinal findings, when recognized, can prompt timely evaluation for systemic flare, thrombotic risk, or placental insufficiency. Ophthalmologic assessment thus offers a unique opportunity to identify high-risk patients who may benefit from closer multidisciplinary surveillance and tailored immunologic or anticoagulation management.

Recognizing retinal manifestations of autoimmune disease in pregnancy underscores the importance of integrating ophthalmology into maternal care for patients with known or suspected immune-mediated conditions. By serving as an accessible marker of vascular and immune activity, the retina provides valuable insight into disease severity and systemic risk, reinforcing its role as a critical interface between ophthalmology, rheumatology, and obstetrics in women's health.

Postpartum Hypercoagulability and Retinal Vascular Occlusions

In addition to vascular and immune-mediated changes during pregnancy, the postpartum period introduces a distinct physiologic vulnerability characterized by heightened thrombotic risk [20]. This hypercoagulable state, while protective against hemorrhage, may predispose individuals to microvascular occlusive events, including those affecting the retina [21]. Retinal vascular occlusions in the postpartum period therefore represent an important but underrecognized manifestation of systemic thrombotic risk [22].

Retinal vein and artery occlusions in the postpartum setting may occur in the absence of traditional cardiovascular risk factors, particularly in young women [23]. Proposed mechanisms include increased coagulation factor levels, reduced fibrinolytic activity, endothelial dysfunction, and interactions with coexisting conditions such as hypertensive disorders or autoimmune disease [24]. In some cases, retinal vascular occlusions may be the first clinical indication of an underlying thrombophilia or pregnancy-related vascular complication [25].

Visual symptoms associated with retinal vascular occlusions can range from transient visual disturbances to sudden, profound vision loss. These presentations are often unexpected in otherwise healthy postpartum individuals, leading to delays in diagnosis or attribution to benign postpartum changes. Recognition of retinal vascular occlusions as potential markers of systemic thrombotic risk is critical, as these findings may warrant further evaluation for hypercoagulable states, cardiovascular risk, or immune-mediated disease [26,27].

The postpartum period represents a particularly vulnerable window during which medical follow-up may be fragmented, and ophthalmic symptoms may go unreported or deprioritized. Integrating awareness of retinal vascular complications into postpartum care may facilitate earlier detection of systemic thrombosis and improve coordination between ophthalmology, obstetrics, and primary care. Retinal findings in this context should prompt consideration of broader vascular risk assessment rather than isolated ocular management.

By highlighting retinal vascular occlusions as potential indicators of postpartum hypercoagulability, ophthalmology can contribute to more comprehensive maternal risk stratification. The retina's sensitivity to microvascular compromise reinforces its role as a noninvasive indicator of

Gad El Sayed M, et al., J Opthalmol Res 2026
DOI:10.26502/fjor.2644-002400114

systemic thrombotic processes, further supporting the concept of pregnancy and the postpartum period as a physiologic stress test with lasting implications for women's health.

Prevention, Clinical Implications, and Future Directions

The retinal manifestations of pregnancy-related vascular, immune, and thrombotic disease highlight an important opportunity for prevention through earlier recognition and interdisciplinary care. Visual symptoms during pregnancy and the postpartum period should not be reflexively attributed to benign physiologic changes, particularly when they occur in the setting of hypertension, autoimmune disease, or recent delivery. Incorporating ophthalmologic evaluation into maternal health pathways may allow for earlier identification of systemic disease severity and prompt escalation of care.

Preventive strategies should focus on improving awareness among obstetric, primary care, and emergency medicine providers regarding the significance of visual complaints in pregnant and postpartum patients. Clear referral thresholds for ophthalmologic assessment, particularly in individuals with hypertensive disorders of pregnancy, known autoimmune disease, or hypercoagulable risk factors, may help reduce delays in diagnosis and mitigate downstream morbidity. In high-risk populations, targeted retinal evaluation may serve as an adjunctive tool for systemic risk stratification [28].

From a systems perspective, pregnancy and the postpartum period represent critical windows for coordinated care. Improved communication between obstetrics, ophthalmology, rheumatology, neurology, and primary care may enhance detection of vascular and immune-mediated complications that extend beyond pregnancy itself. As maternal morbidity remains a persistent public health challenge, leveraging noninvasive markers such as retinal findings offers a practical and scalable approach to improving outcomes.

Future research should further clarify the prognostic value of retinal findings in pregnancy-related disease and explore whether early ophthalmic changes predict long-term cardiovascular, neurologic, or autoimmune risk. Prospective studies examining standardized ophthalmologic screening in high-risk pregnancies may help define best practices and inform evidence-based guidelines. As understanding evolves, the integration of ophthalmology into maternal health care has the potential to shift visual symptoms from being overlooked complaints to meaningful clinical signals.

Conclusion

Pregnancy imposes profound vascular, immune, and hematologic demands on the maternal body, functioning as a physiologic stress test with implications that extend into the postpartum period. The retina, as a uniquely accessible and sensitive microvascular tissue, reflects these systemic changes and offers valuable insight into maternal health. Retinal findings associated with hypertensive disorders, autoimmune disease, and postpartum hypercoagulability underscore the eye's role as more than an isolated organ, instead serving as a window into broader systemic pathology.

Recognizing visual symptoms as potential indicators of systemic disease reframes ophthalmology as an integral component of women's health rather than a downstream specialty consultation. By integrating ophthalmic assessment into maternal care, clinicians may improve early detection of high-risk conditions, facilitate interdisciplinary collaboration, and ultimately enhance maternal outcomes. Viewing pregnancy through a retinal lens reinforces the importance of looking beyond the expected and recognizing the eye as a noninvasive marker of maternal vascular and immune health.

References

1. Samra K. The eye and visual system in pregnancy, what to expect? An in-depth review. Oman Journal of Ophthalmology 6 (2013):87.
2. Naderan M. Ocular changes during pregnancy. Journal of Current Ophthalmology 30 (2018): 202-210.
3. Kumar MJ, Kotak PS, Acharya S, et al. A Comprehensive review of ocular manifestations in systemic diseases. Cureus 16 (2024): e65693.
4. Ocular changes in pregnancy. American Academy of Ophthalmology. Published January 1 (2022).
5. Ruan Y, Jiang S, Musayeva A, etc. Oxidative stress and vascular dysfunction in the retina: therapeutic strategies. Antioxidants 9 (2020): 761.
6. Kapelushnik N, Nemet M, Benjamin M, etc. Increased prevalence of transient visual disturbances with normal ocular exam findings in pregnancy - cross-sectional study. Scientific Reports 15 (2025): 18332.
7. Bessett D. Negotiating normalization: The perils of producing pregnancy symptoms in prenatal care. Social Science & Medicine 71 (2010): 370-377.
8. Zamaladi I, Ruvuma S, Mceniery CM, et al. Retinopathy among women with hypertensive disorders of pregnancy attending hospitals in Mbarara city, south-western Uganda: a cross-sectional study. BMJ Open 13 (2023): e076365.
9. Krishnakumar S, Chatterjee P. FUNDUS CHANGES IN PREECLAMPSIA. Journal of Evolution of Medical and Dental Sciences 5 (2016): 2159-2162.
10. He X, Ji Y, Yu M, et al. Chorioretinal alterations induced by preeclampsia. Journal of Ophthalmology (2021): 1-9.
11. Garg A, Wapner RJ, Ananth CV, et al. Choroidal and

Gad El Sayed M, et al., J Opthalmol Res 2026
DOI:10.26502/fjor.2644-002400114

retinal thickening in severe preeclampsia. Investigative Ophthalmology & Visual Science 55 (2014): 5723.

12. Varghese S, Koshy J, Avasthi K. Bilateral serous retinal detachment in a case of eclampsia. Health 04 (2012):13-14.

13. Hussain SA, O'Shea BJ, Thagard AS. Preeclamptic serous retinal detachment without hypertension: A case report. Case Reports in Women S Health 21 (2019): e00098.

14. Gad El Sayed M, Tsui E, Fouad Y. Retinal Vasculitis and Stroke Risk in Patients with Systemic Lupus Erythematosus. Ocular Immunology and Inflammation 33 (2025): 2115-2120.

15. Gad El Sayed M, Edrees ES, Tsui E, et al. The association between retinal vasculitis and cerebral infarction in systemic autoimmune disorders. Canadian Journal of Ophthalmology.

16. Palejwala NV, Walia HS, Yeh S. Ocular Manifestations of Systemic lupus erythematosus: A review of the literature. Autoimmune Diseases 2012 (2012): 1-9.

17. Read R. Clinical mini-review: systemic lupus erythematosus and the eye. Ocular Immunology and Inflammation 12 (2004): 87-99.

18. Koga K, Mor G. REVIEW ARTICLE: Toll-Like Receptors at the Maternal–Fetal Interface in Normal Pregnancy and Pregnancy Disorders. American Journal of Reproductive Immunology 63 (2010): 587-600.

19. El-Asrar AMA, Herbort CP, Tabbara KF. A clinical approach to the diagnosis of retinal vasculitis. International Ophthalmology 30 (2009): 149-173.

20. Didembourg M, Morimont L, De Gottal E, et al. The maternal hemostatic shift: Understanding VTE risk in pregnancy and postpartum. Thrombosis Research 257 (2025): 109561.

21. Maybury HJ, Waugh JJS, Gornall A, et al. There is a return to non-pregnant coagulation parameters after four not six weeks postpartum following spontaneous vaginal delivery. Obstetric Medicine 1 (2008): 92-94.

22. Kamel H, Navi BB, Sriram N, et al. Risk of a Thrombotic Event after the 6-Week Postpartum Period. New England Journal of Medicine 370 (2014): 1307-1315.

23. Bilateral Central Retinal Artery Occlusion in Pregnant Women with Severe Preeclampsia Post Caesarian Delivery. American Thoracic Society A6931 (2016).

24. Ayaki M, Yokoyama N, Furukawa Y. Postpartum central retinal artery occlusion simulating Purtscher's retinopathy. Ophthalmologica 209 (1995): 37-39.

25. Jürgens L, Yaici R, Schnitzler CM, et al. Retinal vascular occlusion in pregnancy: three case reports and a review of the literature. Journal of Medical Case Reports 16 (2022): 167.

26. Glueck C, Dixon S, Bruce C, et al. Retinal vascular occlusion: a window to diagnosis of familial and acquired thrombophilia and hypofibrinolysis, with important ramifications for pregnancy outcomes. Clinical Ophthalmology Volume 10 (2016): 1479-1486.

27. Glueck C, Kurtz W, Hutchins R, et al. Retinal artery and vein thrombotic occlusion during pregnancy: markers for familial thrombophilia and adverse pregnancy outcomes. Clinical Ophthalmology 10 (2016): 935.

28. Preeclampsia/Eclampsia Associated Retinopathy - EyeWiki. Published September 18 (2025).

Citation: Joanna Sung, Marina Gad El Sayed, Michael Zakhary, Maria Zakhary. Pregnancy as a Retinal Stress Test: The Retina as a Window into Mothers' Vascular and Immune Health. Journal of Ophthalmology and Research. 9 (2026): 45-49.