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COMMENT

How does the precise prediction of preeclampsia onset aid the overall management of preeclampsia?

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Preeclampsia (PE) is a highly heterogeneous syndrome in its presentation and pathophysiology. The condition can be life-threatening for both the mother and fetus, especially in cases of preterm birth (<37 weeks of gestation) or early onset (<34 weeks of gestation), which is known to become more severe. Historically and contemporarily, termination of pregnancy and delivery has remained the only efficacious remedy and is frequently employed in clinical settings. Therefore, at present, the fundamental strategy of PE management is to identify those at high risk of developing the condition, monitor high-risk individuals in a tertiary care facility with low-dose aspirin administration from an early stage of pregnancy [1], and terminate pregnancy at an appropriate time if they develop severe PE. Nonetheless, the precision of current predictions relying on checklist-based or multi-variable approaches is notably lacking, with these methods necessitating the measurement of maternal serum soluble fms-like tyrosine kinase 1, placental growth factor, or maternal uterine artery pulsatility index. These approaches are invasive, time-consuming, and entail considerable costs. Thus, there is a need to develop a simple, inexpensive, and accurate method to predict the onset of PE.

In recent years, there has been an accumulation of research findings aimed at assessing and predicting the onset or risk of various diseases, including diabetes [2], cardiovascular disease [3], Alzheimer's disease [4], and cancer [5] by utilizing vast amounts of real-world clinical data and machine learning. However, in obstetrics, machine learning has rarely been used to predict the onset of pregnancy complications or obstetric diseases. In the present investigation, Wang et al. developed, for the first time, an early screening model to predict the onset of PE by using a large amount of clinical real-world data, machine learning, and a data augmentation method [6]. Using robust data processing and statistical analysis, they identified 16 crucial predictors ranging from common clinical characteristics, such as pre-gestational body mass index (BMI) or previous PE, to previously unreported factors, such as nausea and vomiting during pregnancy and irregular menstrual cycles. This new screening model demonstrated an Area Under the Curve of 0.8008 and a sensitivity of 0.5190 at a false-positive rate of 10%. Notably, this result showed a 28–50% improvement in terms of sensitivity over the results of existing predictive models that use a checklist or multi-variable analysis.

To understand the present study, it should be emphasized that their research leads to the following two important perspectives. First, in the management of PE, it is crucial to implement a strategy that precisely identifies patients at risk of developing the disease and aims to prevent its onset. The distinctive difference between PE and other types of hypertension is that PE generally occurs for only a very short period during pregnancy. Therefore, unfortunately, it must be acknowledged that the possibility of developing innovative treatments for such temporary diseases is low in the near future, despite intensive research efforts. Furthermore, conducting clinical trials in pregnant women remains challenging. Meanwhile, a double-blind placebo-controlled trial showed that treatment with low-dose aspirin in women at high risk for preterm PE significantly reduced its development by 62% [1]. Given the effectiveness of this method in preventing the development of PE, it is a natural consequence that the central issue in the management of PE should be the accurate and cost-free identification of high-risk cases who are eligible for such a method.

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Second, their study highlights that PE, especially preterm or early onset PE, is predetermined early in pregnancy. According to their early screening model based on clinical features at <14 weeks of gestation, the sensitivity for all PE was 0.5190, with discernible enhancements observed in the sensitivity for preterm PE at 0.5323 and early onset PE at 0.5815 [6]. This is in line with the theory that impaired uterine spiral arteriole remodeling by extravillous trophoblasts at the site of villous implantation in the very early stages of pregnancy constitutes a principal etiological factor in PE, especially in preterm or early onset PE [7]. All these findings are consistent with the fact that prevention of preterm PE with low-dose aspirin requires the initiation of aspirin at less than 16 weeks of gestation [1].

The early screening model for PE proposed by Wang et al. raised several novel and compelling challenges for PE research and management. To date, this predictive model has only been examined retrospectively in the Chinese population. Therefore, we request the authors to release this prediction model at an appropriate time. It is also necessary to examine whether this model is equally accurate for other ethnic groups. Furthermore, a prospective study should be conducted to examine the effects of low-dose aspirin administration in pregnant women at high risk of PE extracted by this model. Moreover, within the 16 identified predictors, certain factors, such as BMI and irregular menstruation, were established before conception. If proactive improvements in these factors are accomplished, could the likelihood of PE be mitigated? Precise prediction of PE onset may play a role in the effective prevention of PE through behavioral changes aimed at enhancing these 16 factors.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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References

1. Rolnik DL, Wright D, Poon LC, O'Gorman N, Syngelaki A, de Paco Matallana C, et al. Aspirin versus Placebo in Pregnancies at High Risk for Preterm Preeclampsia. N Engl J Med. 2017;377:613–22.
2. Oikonomou EK, Khera R. Machine learning in precision diabetes care and cardiovascular risk prediction. Cardiovasc Diabetol. 2023;22:259.
3. Cuevas-Chavez A, Hernandez Y, Ortiz-Hernandez J, Sanchez-Jimenez E, Ochoa-Ruiz G, Perez J, et al. A Systematic Review of Machine Learning and IoT Applied to the Prediction and Monitoring of Cardiovascular Diseases. Healthcare. 2023;11:2240.
4. Ahmadzadeh M, Christie GJ, Cosco TD, Arab A, Mansouri M, Wagner KR, et al. Neuroimaging and machine learning for studying the pathways from mild cognitive impairment to alzheimer's disease: a systematic review. BMC Neurol. 2023;23:309.
5. Prelaj A, Miskovic V, Zanitti M, Trovo F, Genova C, Viscardi G, et al. Artificial intelligence for predictive biomarker discovery in immuno-oncology: a systematic review. Ann Oncol. 2024;35:29–65.
6. Wang L, Ma Y, Bi W, Meng C, Liang X, Wu H, et al. An Early Screening Model for Preeclampsia: Utilizing Zero-Cost Maternal Predictors Exclusively. Hypertens Res. 2024. https://doi.org/10.1038/s41440-023-01573-8
7. Chappell LC, Cluver CA, Kingdom J, Tong S. Pre-eclampsia. Lancet. 2021;398:341–54.