

A review of novel strategies used in the first trimester to predict pre-eclampsia

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Abstract

Preeclampsia is a pregnancy-related, multi-organ disorder mediated by endothelial injury; it is characterized by hypertension and is a major cause of maternal and fetal morbidity and mortality.(1) Cerebral complications and disruption of the blood-brain barrier resulting from this disease pose a serious threat to the mother's life (2). Early prediction during the first trimester of pregnancy enables focused monitoring and timely therapeutic intervention (1). Evidence indicates that initiating low-dose aspirin before the 16th week of pregnancy significantly reduces the incidence of early-onset preeclampsia (3).

Regarding early detection of preeclampsia using serum biomarkers, systematic studies have demonstrated that the assessment of placental growth factor (PlGF) and soluble fms-like tyrosine kinase-1 (sFlt-1), along with their ratio, plays a pivotal role in predictive models for this disorder (4). In serum proteomics analyses, markers such as fibrinogen beta chain (FGB) have been identified as potential biomarkers in regression models for early prediction (5). Furthermore, the proteomic profile of plasma extracellular vesicles (EVs) can distinguish molecular subtypes of preeclampsia prior to clinical onset (6). Additionally, alterations in sphingosine-1-phosphate (S1P) and vascular glycocalyx degradation products reflect the severity of endothelial involvement and injury (7).

Concerning non-invasive diagnostic methods, first-trimester screening—utilizing a combined assessment of maternal characteristics, mean arterial pressure (MAP), and uterine artery pulsatility index (UtA-PI) via the FMF algorithm—offers higher diagnostic accuracy than traditional clinical factors (3). Furthermore, ophthalmic artery Doppler ultrasonography and the analysis of peak systolic velocity ratios provide an efficient, non-invasive assessment of cerebrovascular changes,

thereby improving the prediction of preeclampsia (8). Integrating these clinical and imaging tools with biomarkers represents an optimal strategy for early prevention (1, 9).

Keywords:

Preeclampsia, gestational hypertension, early diagnosis

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