Novel Fibronectin and JMJD6 Signature in Circulating Placental Extracellular Vesicles as an Early Predictor of Preeclampsia

Sinai Health | Lunenfeld-Tanenbaum Research Institute

Quick Facts

Sector
Women's & Infant's Health
(Precision Diagnostics)

Product
ELISA -based detection assay using FN and JMJD6 for early prediction of PE

PE Diagnostic Market Size
$ 1.03 billion USD worldwide (2021)

Development Stage
Prototype

Inventors
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Lead Institution
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Opportunity Profile

Preeclampsia (PE) poses significant challenges in obstetric care, impacting 5% to 7% of all pregnancies and contributing to 10% of maternal morbidity and mortality globally. PE is traditionally categorized as Early-PE (<34 weeks) or Late-PE (>34 weeks), with clinical symptoms emerging in the latter part of the second trimester. The lack of a reliable early predictive test has been a critical limitation, impeding timely clinical prevention and intervention for PE, along with the associated risk of cardiovascular disease in affected women. The research team has developed a predictive test that can discriminate between the severity of hypertensive disorders: Early-PE vs Late-PE vs Gestational Hypertension (a mild form of PE)

In the intricate landscape of the placenta, Fibronectin (FN) plays a pivotal role in vascular establishment and trophoblast maintenance. Throughout pregnancy, the placenta releases extracellular vesicles (sEVs) laden with cellular cargo, including bioactive elements responsive to the tissue microenvironment, acting as sentinels for maternal and fetal health. As such it is postulated that FN in sEVs is a more reliable and accurate biomarker of maternal and fetal health.

The researchers have shown for the first time that *FN in placental sEVs in association with low levels of the oxygen sensor, JMJD6* may be an important signature of PE as early as the first trimester (12 – 14 weeks), before the onset of clinical symptoms in the pregnant mother. JMJD6 is a negative regulator of FN, and loss of JMJD6 results in significantly elevated FN release in sEVs. This suggests that JMJD6 is required for the maintenance of FN in trophoblast cells and in sEVs.

Application(s):

- Early prediction for hypertensive disorders of pregnancy (and potentially other pregnancy-related disorders) before clinical symptoms manifest.
- Facilitates early enrollment in clinical management of at-risk pregnant mothers
- Enables studies to better understand the pathophysiology and management of PE

Advantages:

- Elevated FN in sEVs coupled with reduced JMJD6 is a more accurate predictor of PE
- Early diagnosis of hypertensive disorders of pregnancy can significantly improve maternal and fetal outcomes by enabling timely intervention and management of the condition *before* clinical symptoms arise in the second trimester of pregnancy

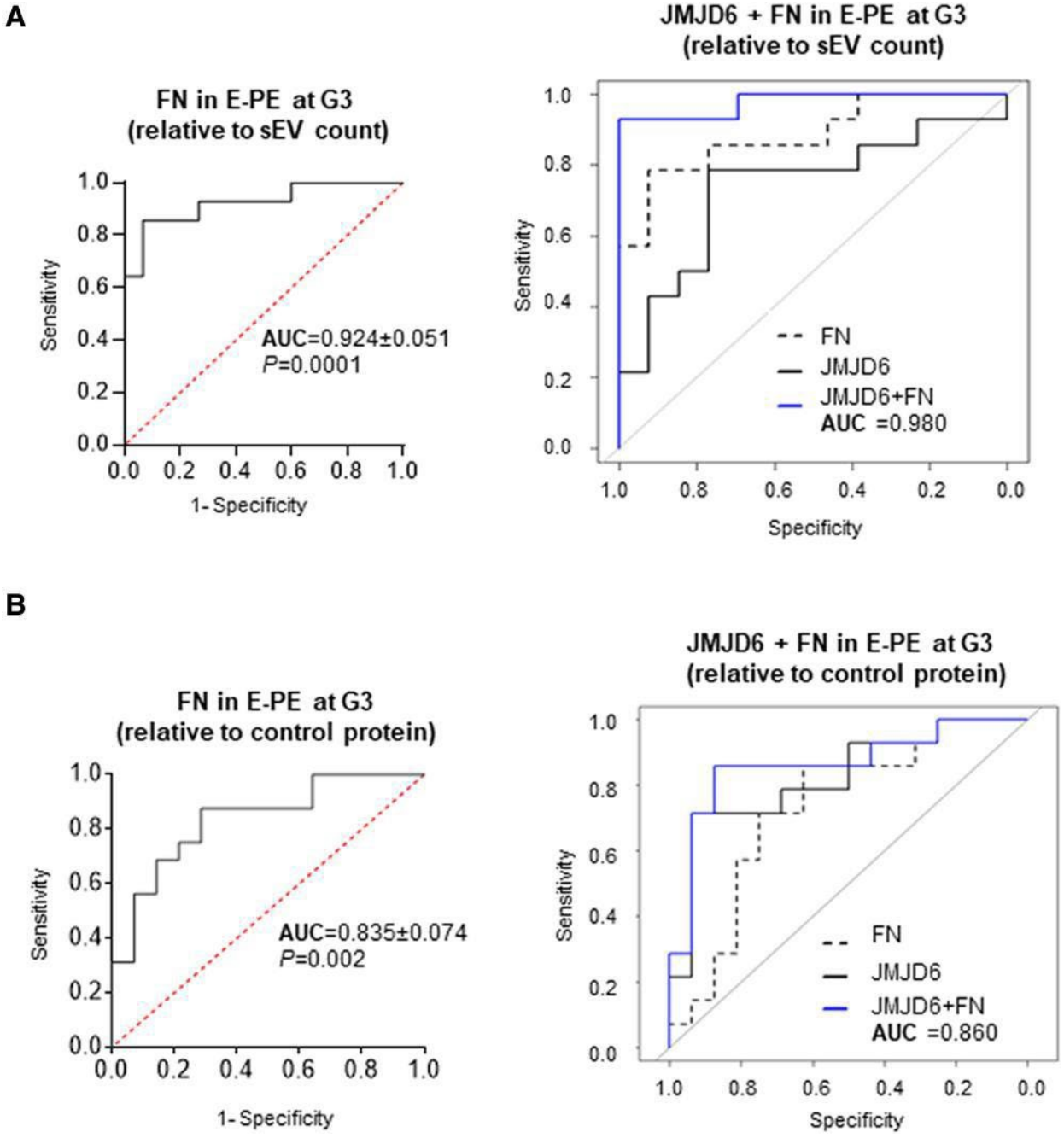
Technology:

- We have an ELISA-based detection assay and protocol for FN, JMJD6 and sEV isolation. Test can be optimized by industry partner to incorporate FN/ JMJD6 with the placental sEV biomarkers into a one-step or two-step ELISA test.

Intellectual Property & Commercial Opportunity

- A US provisional patent application has been filed; Available for licensing or partnership

DATA - OVERVIEW



JMJD6 depletion and FN overexpression in circulating placental sEVs define E-PE. (A) Single (left panel) and multi-parameter (right panel) ROC curves for FN and FN + JMJD6, respectively, in E-PE at G3, normalized to sEV number. (B) Single (left panel) and multi-parameter (right panel) ROC curves for FN and FN + JMJD6, respectively, in E-PE at G3, normalized to total protein. Corresponding AUC values are displayed on each graph.