A urine test to diagnose preeclampsia

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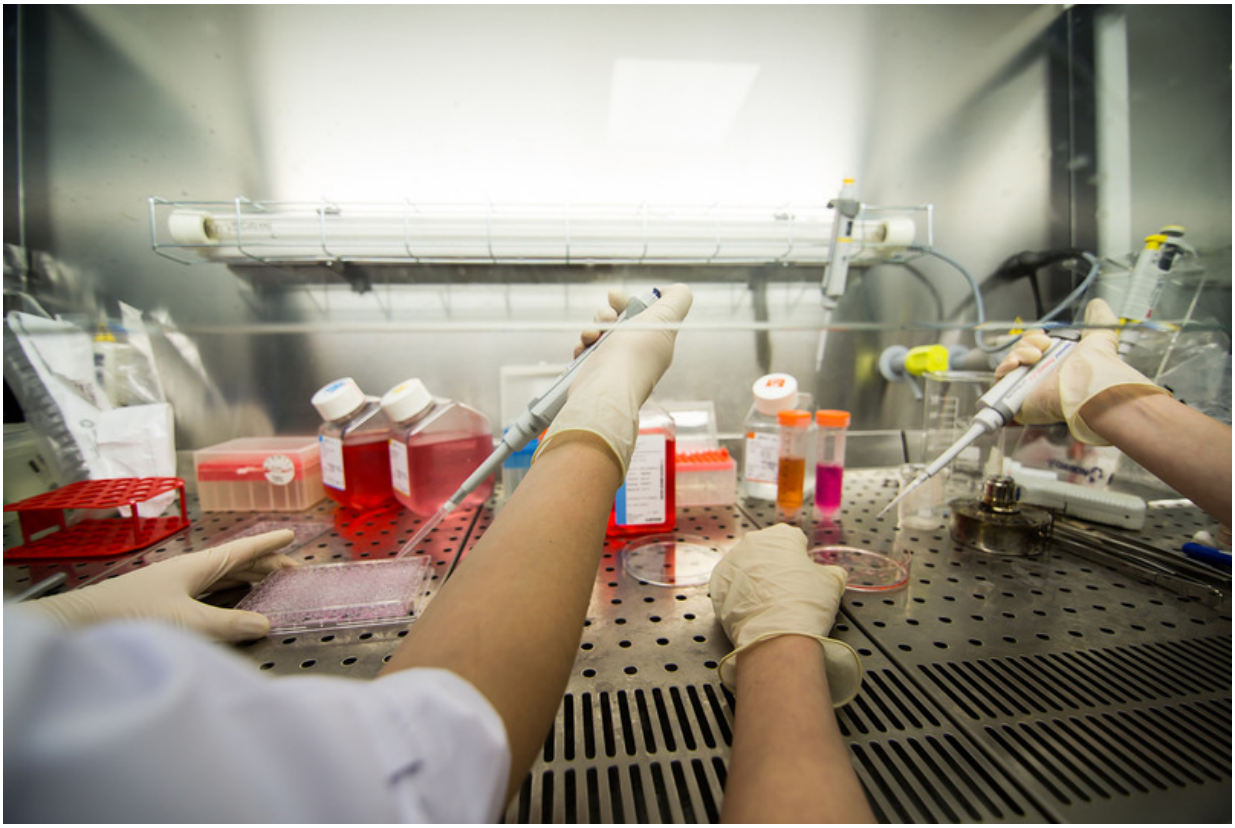

Scientists from MIPT in collaboration with researchers from a number of other institutes have developed a non-invasive method to diagnose preeclampsia -- a complex condition which occurs during pregnancy. Credit: MIPT

A team of scientists from the Moscow Institute of Physics and Technology and partners have developed a method of non-invasive testing for pregnant women with preeclampsia by detecting potential

biomarkers in the urine of pregnant women. In the future, this urine-based diagnostic method could enable specialists to detect the disease in its early stages. A paper detailing the results has been published in the *Journal of Proteomics*.

Preeclampsia and why it is dangerous

Preeclampsia is a multisystem disorder that occurs in the second half of pregnancy and is characterized by high blood pressure and proteinuria, a significant increase in the normal level of protein in the urine. Women with the condition suffer headaches, swelling, fainting, and other unpleasant and often dangerous symptoms. Ultimately, preeclampsia jeopardizes the health and life of an expectant mother and her baby. The symptoms of the condition are ambiguous, so doctors rarely diagnose "pure" preeclampsia. However, even if a diagnosis is made, its causes are still unknown. Therefore, it is not possible to control it effectively.

This means that doctors are only able to prescribe supportive care and treat the symptoms, while trying to delay the birth of the child—striking a balance between allowing enough time for full fetal growth and preserving the mother's health. This is difficult due to the improper development of the placenta resulting from the condition, which jeopardizes the fetus.

Clues from the body and a discovery for future diagnostics

If something is systemically wrong with a patient, it is logical to assume that the cause exists at the molecular level. Protein is found even in the urine of an absolutely healthy person, although only in very small concentrations. One of the main symptoms of preeclampsia is a marked increase in this concentration from the normal 0.03 g/l to the critical 0.3

g/l and above. The scientists wondered whether peptides, pieces of proteins, produced by women with preeclampsia could carry information about the disease. This approach is aligned with the current focus on non-invasive testing, i.e. the analysis of available biomaterials such as urine, saliva, or exhaled air.

To identify potential peptide biomarkers, the researchers compared samples of three groups of 10 women from the Research Center for Obstetrics, Gynecology and Perinatology: women with a normal pregnancy, and those with mild and severe preeclampsia. The researchers were not only interested in comparing healthy women and patients with preeclampsia; they also wanted to examine how certain biomarkers are associated with the severity of the condition. Following the experiments, 35 potential peptide biomarkers of preeclampsia were identified.

They included fragments of alpha-1-antitrypsin (14 peptides), collagen alpha-1(I) and alpha-1(III) chains (6 peptides), and uromodulin (7 peptides).

"In the Research Center for Obstetrics, Gynecology and Perinatology, we were able to confirm a number of markers previously proposed by our colleagues abroad, and also identify some new ones. We will obviously need to verify and confirm their significance. What is important is that this non-invasive method has proven effective—it can be used as a basis to develop a clinical method," said Evgeniy Nikolaev, one of the authors of the study, professor and head of MIPT's Laboratory of Ionic and Molecular Physics.

More information: A.S. Kononikhin et al, An untargeted approach for the analysis of the urine peptidome of women with preeclampsia, *Journal of Proteomics* (2016). DOI: 10.1016/j.jprot.2016.04.024

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