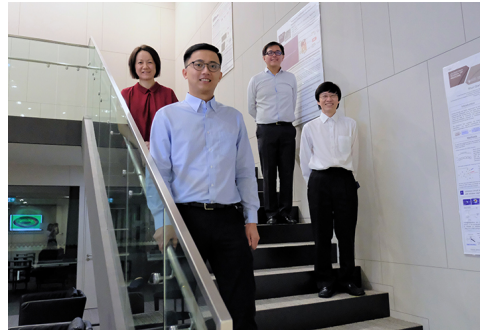


NTU Singapore scientists and KKH clinicians dev urine test that identifies pregnancy outcome aft threatened



Researchers at Nanyang Technological University, Singapore (NTU Singapore) and clinicians at KK Women's and Children's Hospital (KKH) have developed a urine test that within 30 minutes, can gauge outcomes for women presenting with signs of threatened miscarriage.

Threatened miscarriage – characterised by abdominal pain with vaginal bleeding – is one of the most gynaecological emergencies worldwide.

According to a separate study by Duke-NUS, NTU and KKH[1], one in five pregnancies in Singapore end in threatened miscarriage within the first trimester. Among pregnant women with such symptoms, 20% end up losing their baby within two weeks.

Clinicians do not currently have a way of predicting their risk of miscarriage that is non-invasive. The current method assesses a pregnant woman's miscarriage risk through a blood test (serum progesterone levels) that measures progesterone levels and can take a few hours.

The new test developed by NTU scientists in collaboration with doctors from KKH uses an innovative enhanced Raman scattering (SERS) chip that requires a droplet of urine to screen for urine molecules with miscarriage risk. It does this through the chemical 4-mercaptophenylboronic acid (MPBA) which binds to the chip. MPBA probes and selectively captures the miscarriage-related molecules pregnane and tetrahydrocortisone (THC) from the urine.

In a case-control study of 40 pregnant women who attended the Urgent O&G Centre at KKH with signs of threatened miscarriage, the test retrospectively identified accurately the pregnancy outcomes of all.

Led by Associate Professor Ling Xing Yi and Associate Professor Tan Nguan Soon from NTU, in collaboration with KKH's Dr Ku Chee Wai, the study findings were published in the peer-reviewed journal *ACS Nano* in 2020.

The researchers believe their initial success points the way towards a non-invasive, fast, and accurate method for triaging pregnant women with a threatened miscarriage, identifying those who are at higher risk of spontaneous miscarriage.

Assoc Prof Ling, of NTU's School of Physical and Mathematical Sciences, said, "Usually molecules associated with miscarriage risk are simply too dilute within the body's fluids and challenging to detect. To solve this problem, our group developed an innovative SERS 'confine and capture' approach and used a 'targeting agent' to isolate miscarriage-related biomarkers from urine, resulting in speedy detection of miscarriage risk."

Assoc Prof Tan, a metabolic disorder expert at NTU's Lee Kong Chian School of Medicine, explained the unparalleled sensitivity offered by the SERS test and the small sample volume required to make it a practical clinical use.

"This is even more so for cases where large amounts of sample are hard to obtain, such as tear samples or breath vapour for lung diseases. Our diagnostic platform could revolutionise metabolic

for medical conditions that are normally challenging to detect and bring testing for them out of the clinic," said Assoc Prof Tan,

Fast detection removes undue anxiety for patients presenting with threatened miscarriage in the r

When a woman presents with threatened miscarriage, a reliable and non-invasive diagnostic test w invaluable for miscarriage risk management say the researchers. However, there is currently no po test with quick turnaround time.

Dr Ku Chee Wai, Division of Obstetrics and Gynaecology, KKH, said, "This non-invasive toolkit will en clinicians to predict the risk of a spontaneous miscarriage in women who presents with a threatene miscarriage. Early detection will also allow these pregnant women to receive counselling, medical in or be under close medical management for adverse pregnancy outcomes throughout the rest of th pregnancy. It can also allay the fears and worries of pregnant women who are at low risk of miscarr improve their pregnancy experience".

Associate Professor Tan Hak Koon, Chairman, Division of Obstetrics and Gynaecology, KKH, said, "A academic medical centre specialising in women's and children's health in Singapore, KKH has been progesterone and miscarriage-related studies for over a decade. Our research into SERS steered us collaboration with NTU, advancing both KKH and NTU towards the goal of improving the health out pregnant women and their babies everywhere in the world."

The NTU team has patented the innovation and is now looking to evaluate the performance of the t hospital settings, with the aim of commercialising the product in future.

The researchers are also working on adapting the toolkit for use in other types of health conditions