Screening detects ovarian cancer using neighboring cells

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Pioneering biophotonics technology developed at Northwestern University is the first screening method to detect the early presence of ovarian cancer in humans by examining cells easily brushed from the neighboring cervix or uterus, not the ovaries themselves.

A research team from Northwestern and NorthShore University HealthSystem (NorthShore) conducted an ovarian cancer clinical study at NorthShore. Using partial wave spectroscopic (PWS) microscopy, they saw diagnostic changes in cells taken from the cervix or uterus of patients with ovarian cancer even though the cells looked normal under a microscope.

The results have the potential to translate into a minimally invasive early detection method using cells collected by a swab, exactly like a Pap smear. No reliable early detection method for ovarian cancer currently exists.

In previous Northwestern-NorthShore studies, the PWS technique has shown promising results in the early detection of colon, pancreatic and lung cancers using cells from neighboring organs. If commercialized, PWS could be in clinical use for one or more cancers in approximately five years.

The ovarian cancer study was published this month by the *International Journal of Cancer*.

PWS uses light scattering to examine the architecture of cells at the nanoscale and can detect profound changes that are the earliest known signs of carcinogenesis. These changes can be seen in cells far from the tumor site or even before a tumor forms.

"We were surprised to discover we could see diagnostic changes in cells taken from the endocervix in patients who had ovarian cancer," said Vadim Backman, who developed PWS at Northwestern. "The advantage of nanocytology—and why we are so excited about it—is we don't need to wait for a tumor to develop to detect cancer."

Backman is a professor of biomedical engineering at the McCormick School of Engineering and Applied Science. He and his longtime collaborator, Hemant K. Roy, M.D., formerly of NorthShore, have been working together for more than a decade and conducting clinical trials of PWS at NorthShore for four years. Backman and Roy both are authors of the paper.

"The changes we have seen in cells have been identical, no matter which organ we are studying," Backman said. "We have stumbled upon a universal cell physiology that can help us detect difficult cancers early. If the changes are so universal, they must be very important."

Ovarian cancer, which ranks fifth in cancer fatalities among American women, usually goes undetected until it has spread elsewhere. The cancer is difficult to treat at this late stage and often is fatal.

"This intriguing finding may represent a breakthrough that would allow personalization of screening strategies for ovarian cancer via a minimally intrusive test that could be coupled to the Pap smear," Roy said.

At the time of the ovarian cancer study, Roy was director of gastroenterology research at NorthShore and worked with Jean A.

Hurteau, M.D., a gynecological oncologist at NorthShore. (Hurteau is an author of the paper.) Roy is now chief of the section of gastroenterology at Boston University School of Medicine and Boston Medical Center.

The study included a total of 26 individuals. For cells taken from the endometrium (part of the uterus), there were 26 patients (11 with ovarian cancer and 15 controls); for cells taken from the endocervix, there were 23 patients (10 with ovarian cancer and 13 controls). The small size of the study reflects the difficulty in recruiting ovarian cancer patients.

Cells were placed on slides and then examined using PWS. The results showed a significant increase in the disorder of the nanoarchitecture of epithelial cells obtained from cancer patients compared to controls for both the endometrium and endocervix studies.

The cells for the ovarian cancer study were taken from the cervix and uterus. For the earlier lung cancer study, cells were brushed from the cheek. For the colon, cells came from the rectum, and for the pancreas, cells came from the duodenum. Cells from these neighboring organs showed changes at the nanoscale when cancer was present.

PWS can detect cell features as small as 20 nanometers, uncovering differences in cells that appear normal using standard microscopy techniques. PWS measures the disorder strength of the nanoscale organization of the cell, which is a strong marker for the presence of cancer in the organ or in a nearby organ.

The PWS-based test makes use of the "field effect," a biological phenomenon in which cells located some distance from the malignant or pre-malignant tumor undergo molecular and other changes.

More information: The paper is titled "Insights into the field

carcinogenesis of ovarian cancer based on the nanocytology of endocervical and endometrial epithelial cells." The paper is available at onlinelibrary.wiley.com/doi/10 … 2/ijc.28122/abstract

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