A device capable of detecting cancer cells in one milliliter of blood

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Kumamoto University research group can easily and inexpensively separate and capture CTCs without any large equipment. The device is dynamically and three-dimensionally deformed by the fluid force when blood is pumped through it. It also utilizes nucleic acid aptamers, which bind specifically and firmly to target molecules. This enables both size-selective and affinity-selective separation and capture of tiny cancer cells.

While evaluating the device, researchers demonstrated that it could capture cancer cells even at a concentration of just five cancer cells in one mL of healthy blood. Since there are about five billion (red and white) blood cells in a mL of blood, the device proved to have a very high detection capability. Researchers also found that almost no blood cells were adsorbed by the microfilter, achieving a blood cell removal rate of more than 98%. It also had a high selective detection capability. Furthermore, in a comparative evaluation, they proved that the device was able to detect cancer cells with higher accuracy than existing devices.

When blood flows over the microfilter, cancer cells in the blood bind to the nucleic acid aptamer. The hydrodynamic force of the blood opens the slits of the filter and the blood cells flow away, leaving the cancer cells on the filter. Credit: Associate Professor Yuta Nakashima

"This work demonstrates that our micro-filter device can accurately detect trace amounts of cancer cells in blood," said Associate Professor Yuta Nakashima.
Nakashima, who led the study. "We expect it will be adopted for cancer diagnosis and treatment, including for early diagnosis of cancers that cannot be detected by imaging like CT and PET scans, postoperative follow-up, recurrence monitoring, and tailor-made treatments. In the future, we plan to use blood samples donated by cancer patients to verify the practical and clinical application of the method."


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