Accurate diagnosis of prostate cancer with ultrasound

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Massimo Mischi, Ph.D., of Eindhoven University of Technology developed a new technology to accurately diagnose prostate cancer. Credit: Bart van Overbeeke

Prostate cancer is the most common type of cancer among men, but its diagnosis has up to now been inaccurate and unpleasant. Researchers at Eindhoven University of Technology, The Netherlands, in cooperation with AMC Amsterdam, have developed an imaging technology that can accurately identify tumors. The technology is based on ultrasound, and also has the potential to assess how aggressive tumors are. This can lead to better and more appropriate treatment, and to cost savings in health care.

About 11% of men who die of cancer in the western world do so as a result of prostate cancer. Each year 200,000 men are diagnosed with the

disease in the US alone. But diagnosis is still rudimentary. After determining the PSA (prostate-specific antigen) level in the blood-, biopsies are performed to see if there are tumors in the prostate. However the PSA level is not a very good indicator: two-thirds of all biopsies turn out to afterwards to have been unnecessary.

The biopsies also have disadvantages; for example they are not targeted, but instead tissue is sampled randomly using 6 to 12 needles. The chance that the needles will miss a tumor is high, causing a false negative result. In around one-third of cases with negative biopsies, tumors are later found to be present. Furthermore doctors often operate after a positive biopsy, but find a tumor so small that it would have been better not to operate.

The new technology uses the injection of microbubbles of a contrast agent with no side-effects. The response of the tiny bubbles to ultrasound is different from that of human tissue or blood. This makes the bubbles traceable from the outside, right into the smallest blood vessels. The pattern of blood vessels in tumors is different from that in healthy tissue. The researchers can recognize this pattern from advanced analysis of the bubble concentrations. And because tumors need blood – and hence new blood vessels – to grow, the researchers expect to be able to see how aggressive the cancer is from the pattern of the blood vessels.

The technology has been tested on four patients from whom the affected prostate was removed, dr.ir. Massimo Mischi of the TU/e department of Electrical Engineering explains. The location and size of the tumors turned out to match accurately with the images produced using the new technology. Mischi presented these first, promising results at a recent conference in Chicago.

Next year the research team will carry out a pilot with biopsies guided by images made using the new technology. This allows the biopsies to be

targeted, and therefore more effective. In a later phase the ultrasound technology will be used to decide whether biopsies are required, which will reduce the number of biopsies carried out. The researchers expect their technology to be available in hospitals within five years. The ultimate goal is for doctors to be able to determine if an operation is necessary, and if so what kind of operation, based on the images produced, without the need for biopsies.

All in all doctors will eventually be able to intervene much more accurately, expects prof.dr.ir. Hessel Wijkstra, head of urology research at AMC Amsterdam. Wijkstra was appointed part-time professor of Hemodynamic Contrast Sonography at TU/e last month. Furthermore he believes that there will be less unnecessary operations. In some cases doctors may decide to leave small, non-aggressive tumors untouched and monitor these tumors, in cases where a tumor is not causing any symptoms and is not impairing the health of the patient. In these cases the health effects of surgery are worse than those of the tumor itself. A further positive effect of this new approach is that the total costs will be reduced.

As well as TU/e and the AMC Amsterdam, the Catharina Hospital in Eindhoven and a number of ultrasound companies are also involved in the research. Dr.ir. Massimo Mischi received a Vidi grant worth eur 800,000 from the NWO (Netherlands Organisation for Scientific Research) last year for this research. The research also receives financial support from the Cure for Cancer Foundation.

Provided by Eindhoven University of Technology