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Photoacoustic approach to breast cancer detection

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Scientists at the research Institute MIRA at the University of Twente have been working for some time on a new technique to detect breast cancer. The technique, based on the physical principle of photoacoustics, has been christened PAMmography. It uses short bursts of light that generate ultrasonic waves in places with high density of blood vessels, such as in the vicinity of malignant tumours. The scientists present an important scientific step that they have taken with a publication in the journal *Scientific Reports*. They show that breast tumours have specific manifestations and forms in images made using their technique.

Nearly 15 years ago, scientists at the University of Twente started research into a new method to detect breast cancer. This led to a first clinical prototype called the PAM (the Photoacoustic Mammoscope). The device uses short bursts of light to cause ultrasonic waves in places where a high density of blood vessels is presents, such as in the vicinity of malignant tumours. These ultrasonic signals then travel to the surface of the skin, where they can be measured.

With new research, published today in the journal *Scientific Reports*, the researchers demonstrate that their method does have the potential to reveal the presence of breast tumours in practice. The scientists investigated how various breast tumours appeared among a population of 32 patients using their method. In the publication, they compare the PAMmography images with MRI images and with microscope images after the tumour has been removed and then stained with dyes. The scientists were able to distinguish among three different manifestations

of the tumours. According to Associate Professor Srirang Manohar, who led the research, this is an important step in establishing diagnostic indicators - i.e., ways of recognising a tumour in a PAMmogram image.

Manohar says that PAMmography scored well in the research compared to MRI. The study shows that PAMmography definitely has the potential to be used in practice in the future. Certainly when one considers that the technique has a number of important advantages. For example, PAMmograms are relatively cheap, the tests are painless, no contrasting dye is required and, in principle, PAMmograms enable the detection of breast tumours in young breast tissue. At a certain point, PAMmography can play an important role in the area of detection (screening), diagnosis, monitoring tumours during chemotherapy and in the detection of breast cancer in young women, according to Manohar.

Despite the progress in the research, Manohar cautions against premature optimism. "Our method is relatively new, while MRIs and mammograms, for example, have undergone decades of development time. We still have lots of research to do to demonstrate the reliability of our technique. In an optimistic scenario, our method can be used in niche areas in approximately 5 to 10 years. But it could take longer before the method can be used regularly for screening and diagnosis."

More information: "Photoacoustic image patterns of breast carcinoma and comparisons with Magnetic Resonance Imaging and vascular stained histopathology," *Scientific Reports* 5, DOI: 10.1038/srep11778

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