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Development of ultrasound technology to realize highly accurate, simple and painless breast cancer screening

Successful detection of canine 5 mm tumor using 360° full-angle ultrasound measurement

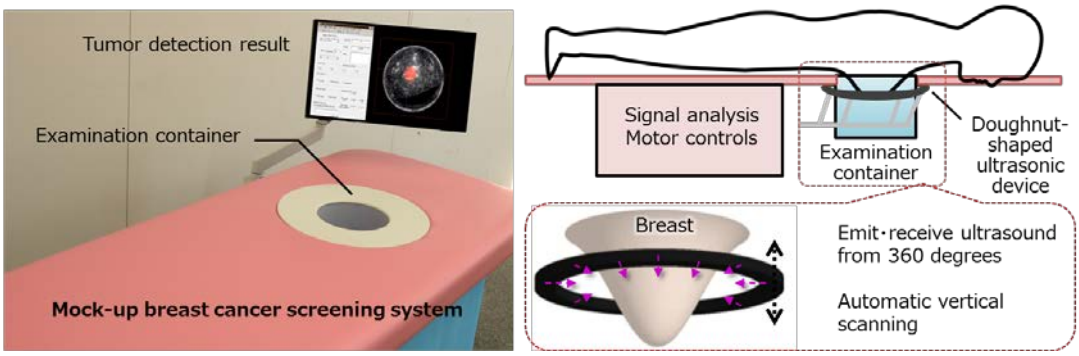


Fig. 1 Breast cancer screening system mock-up and prototype configuration

Tokyo, May 24, 2017 --- Hitachi, Ltd. (TSE: 6501, Hitachi) today announced the development of ultrasound measurement technology that realizes highly accurate, simple and painless breast cancer screening. The examination that does not rely on examiner skill-level is made possible as the technology employs a doughnut-shaped ultrasonic device that emits and collects ultrasonic waves from 360 degrees to automatically conduct scans. It is safe and painless as the person undergoing the medical exam is only required to lie face down with one breast in a vessel filled with water. (Figure 1) Based on the velocity of the ultrasonic waves and other information collected, it is possible to measure not only characteristics of a tumor (such as hardness, viscosity, and surface roughness) but also to visualize any micro-calcification in the mammary glands, therefore contributing to higher screening accuracy. Tests using this technology were performed on surgically resected diseased tissue from dogs, and naturally-occurring canine tumors as small as 5 mm were successfully detected (Figure 2). Hitachi has begun clinical tests using human tissue in collaboration with Hokkaido University Hospital from April 2017, with the aim of developing commercially viable breast cancer screening equipment based on this technology.

Breast cancer has become the most common form of cancer in women worldwide (1) in recent years, and early detection is considered key to successful treatment. Currently, breast cancer screening is conducted by mammography or conventional ultrasound however issues exist with both methods. In mammography, there is the

pain induced by having to compress the breast, irradiation as well as low tumor detection accuracy in high density mammary glands common in younger age groups and people of Asian ethnic background. With conventional ultrasound, detection sensitivity is heavily dependent on the examiners' level of skill.

To overcome these issues and to realize highly accurate, simple and painless breast cancer screening, Hitachi has used ultrasonic waves which do not involve irradiation or pain, to develop ultrasound measurement technology capable of detecting very small tumors without relying on examiner skill level. Features of the technology developed are as follows.

(1) Technique to transmit and receive ultrasonic waves from 360° for measuring multiple tumor characteristics such as tumor surface roughness

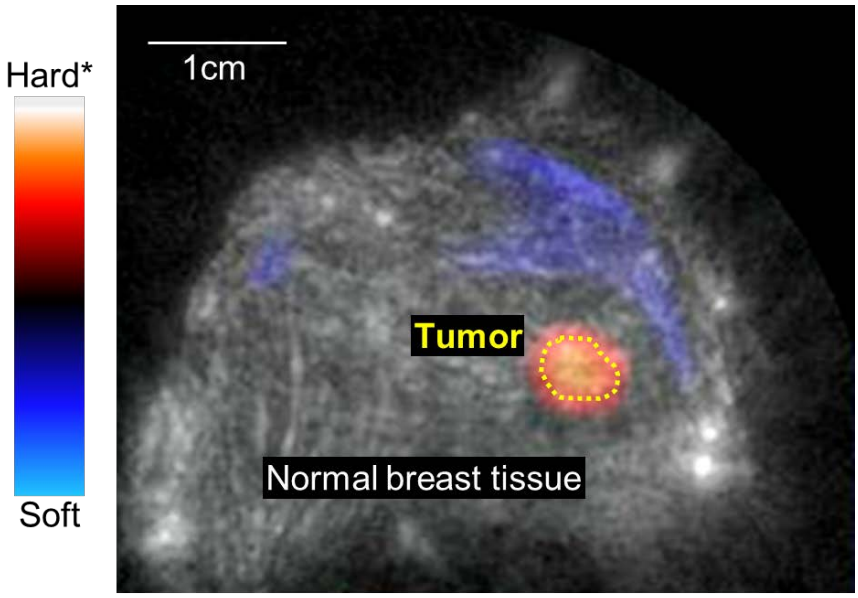
In conventional ultrasound, ultrasonic waves are transmitted from a single direction and back-scattered signals alone are received and utilized. In the technology developed, ultrasonic waves are transmitted and received from 360°, including the front and side, and analyzed. By analyzing the intensity and direction of the waves, it is possible to measure indexes on the stiffness, viscosity, and surface roughness of tumor boundaries, as well as visualize micro-calcification in the mammary glands, which was hitherto considered difficult with conventional ultrasound. Thus a comprehensive diagnosis can be achieved by understanding the various characteristics of the tumor such as the tendency for malignant tumors to have rough surfaces. This technology was combined with other Hitachi technology that speeds-up ultrasound analysis by seven-fold [(2)], to contribute to improving examination accuracy and reducing measurement time.

(2) Technique enabling accurate measurement even when the breast is distanced from the ultrasonic devices by a vessel

In conventional ultrasound, a jelly is applied to the ultrasonic device (probe) which is then pressed against the breast. In the technology developed, water is used to help the efficient propagation of ultrasonic waves between the doughnut-shaped ultrasonic device and the breast. To prevent virus infection between consecutive people undergoing examination, an exchangeable vessel was employed and the effect of the vessel on ultrasonic wave propagation is compensated in the measurements. This resulted in reducing sterilization time and ensured the provision of a safe and hygienic environment for medical examination.

Through collaborative research with Hokkaido University Hospital, Hitachi will work towards the development of clinically viable breast cancer screening equipment based on this technology.

A part of this research achievement will be presented at the 90th Academic Meeting of the Japan Society of Ultrasonic Medicine to be held from 26th to 28th May 2017 in Utsunomiya-shi, Tochigi, Japan.



*Using speed of sound as an indicator

Fig. 2 Detection of tumor detection in dog breast tissue using ultrasound

(1) GLOBOCAN 2012 (2012).

(2) Technology that quickly and accurate provides characteristics related to the hardness of a tumor by taking into consideration the effect of ultrasonic wave refraction within the body. This technology was presented at the 56th Annual Conference of the Japanese Society for Medical and Biological Engineering (JSMBE) in May 2017.

About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, delivers innovations that answer society's challenges. The company's consolidated revenues for fiscal 2016 (ended March 31, 2017) totaled 9,162.2 billion yen ($81.8 billion). The Hitachi Group is a global leader in the Social Innovation Business, and it has approximately 304,000 employees worldwide. Through collaborative creation, Hitachi is providing solutions to customers in a broad range of sectors, including Power / Energy, Industry / Distribution / Water, Urban Development, and Finance / Government & Public / Healthcare. For more information on Hitachi, please visit the company's website at http://www.hitachi.com.

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