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A high-intensity focused ultrasound device specific for the treatment of breast cancer

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Noninvasive treatment of cancers has been implemented using high-intensity focused ultrasound (HIFU). Ultrasound waves are generated by a non-imaging transducer outside the body, propagated via ultrasonic medium and various tissues, and converged on a small region at the focus of the transducer. In short time, HIFU and induced hot spot are formed within the focal region. The hot spot targets the cancer cells under imaging guidance to cause coagulative necrosis. Consequently, HIFU can achieve local and precise ablation of cancers without incision. Breast cancer is the most common cancer in women worldwide. Image-guided HIFU has been applied to treat breast cancer. However, two clinical issues were encountered due to the design of HIFU transducers. A spherical bowl transducer was designed to emit ultrasound beams into the breast from the anterior to the posterior when the patient lay prone, which resulted in that the HIFU burned the chest bone and muscles behind the breast cancer. The other problem is skin burn in the period of HIFU ablating cancer. The acoustic window of the present HIFU transducer on the skin is so small that the heat per unit area is highly sufficient to burn the skin. Therefore, we have developed a HIFU device dedicated for breast cancer treatment in this investigation. The HIFU device consisted of sixteen identical piezoelectrical resonators and the resonators were placed to form a ring with a diameter of 20 cm. The acoustic path of the ring-shape HIFU transducer was more parallel to the chest wall as compared with current transducers, which may prevent chest bone and muscles from thermal damage. The design of ring shape can also increase the acoustic window on the skin to avoid skin burn when HIFU ablates the cancer near the skin. The ring HIFU prototype was fabricated and characterized. The pork ablation of the self-developed HIFU device was performed to verify the feasibility of our concept.

Biography

Gin-Shin Chen has completed his Ph.D. at the age of 28 years from National Cheng-Kung University and postdoctoral studies from National Health Research Institutes (NHRI) in Taiwan. He is the associate investigator of the institute of Biomedical Engineering and Nanomedicine of NHRI. His research interests include therapeutic ultrasound, ultrasonic transducers, and medical devices. He has published 17 papers in reputed journals.

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