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Acceleration of ultrasonic tissue heating by microbubble agent

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Ultrasound in the existence of microbubbles, whether they have been generated by acoustic cavitation or administered into the body, is known to induce bioeffects normally through mechanical or sonochemical mechanisms. Recently, it is reported that ultrasonic tissue heating can be accelerated several times by an administered microbubble agent. A microbubble, subjected to ultrasonic pressurein the frequency range of its resonanance converts the acoustic energy to heat through its volume oscillation. The acoustic power converted to heat by a microbubble through viscous heating was numerically calculated, and it was predicted that tissue ultrasonic absorption would be doubled if a microbubble agent is delivered to the tissue at a concentration in the order of 100 microbubbles /mg. Exteriorized murine kidneys were exposed to focused ultrasound at 3.2 MHz in degassed saline and the tissue temperature change was measured. Optison at a dose of 0.2 ml /kg multiplied the temperature elevation induced by ultrasonic exposure by several times. In order to use this effect to treat a deep-seated tumor, microbubbles should be somehow delivered to the tumor selectively. A novel method of selective delivery, in which nano liquid particles are administered and converted into microbubbles by ultrasonic stimulation, will also be discussed.