Photoacoustic Ultrasonography And Its Potential Application In Mammography

Yuncai R. Fang, Robert A. Kruger Dept. of Radiology, Indiana Univ. Medical Center, Indianapolis, Indiana

This paper investigated photoacoustic ultrasonography (PAUS) and its applicability in breast cancer detection. PAUS employs a short pulse of electromagnetic energy, at either near infrared or microwave frequency, to heat breast tissue. Rapid heating, resulting from inhomogeneous absorption of the energy pulse, generates ultrasonic waves. The energy absorption patterns can be reconstructed from these pressure waves recorded at a plurality of locations external to the biologic tissue. The principle of the photoacoustic signal generation was analyzed, and the image reconstruction method was implemented and validated by imaging experiments. Extensive studies of microwave-induced PAUS demonstrated that an adequate absorption difference of microwaves at 434 MHz does exist between benign and malignant breast tissues. Experiments suggested that adequate ultrasonic signals can be detected using proper instrumentation, which allowed the microwave absorption patterns to be reconstructed. It was concluded that the microwave-induced PAUS is likely to be a useful imaging modality for breast screening.