Medical Xpress

Medical imaging improves cancer staging

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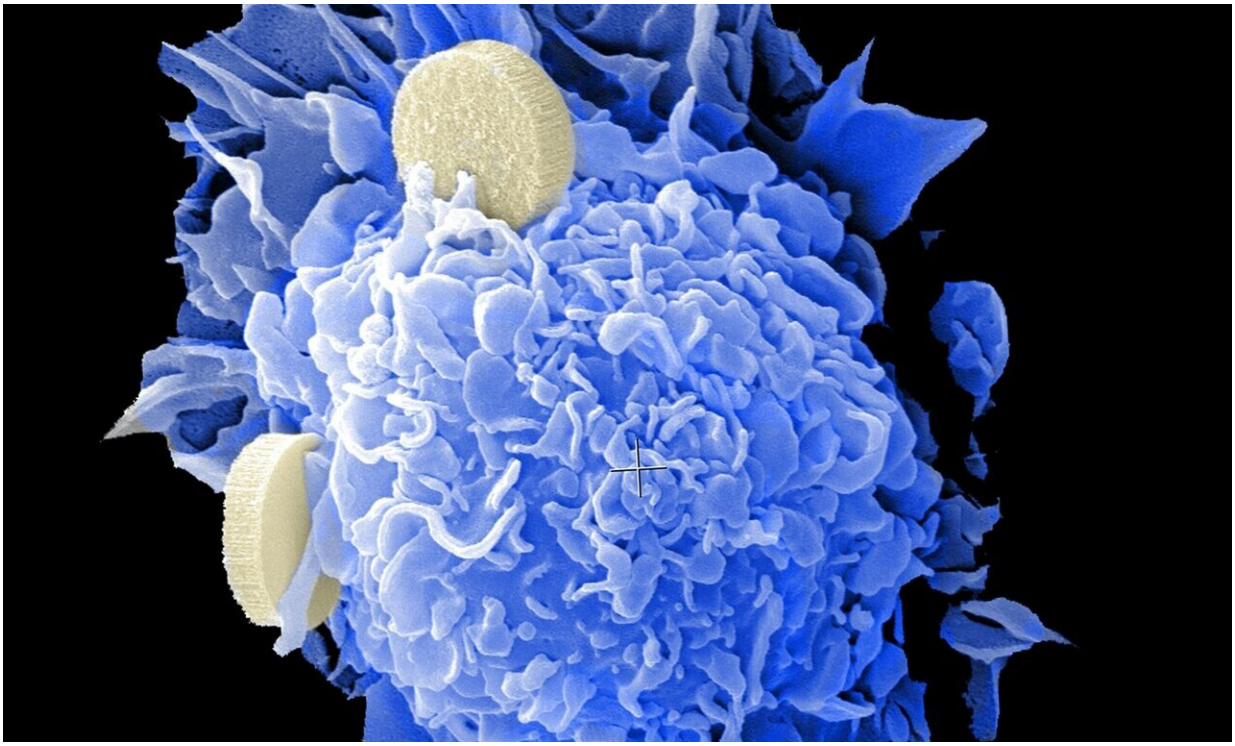

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Prof. Tian Chao's group from the Department of Precision Machinery and Instrumentation, University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS) has made progress on the photoacoustic imaging for medical science. They improved the imaging quality and 3-D construction of the photoacoustic imaging, and applied them to in vivo sentinel lymph node imaging. The studies were

published in *IEEE Transactions on Biomedical Engineering, Physical Review Applied* and *Journal of Biophotonics*.

Sentinel lymph node biopsy (SLN) is currently the standard method for breast cancer staging, which includes preoperative lymph node tracing and intraoperative lymph node biopsy image-guiding. However, existing image guidance techniques suffer from a variety of limitations, such as harmful ionizing radiation, high cost, and poor imaging depth.

To solve these problems, Prof. Tian's group proposed a contract-agent-enhanced photoacoustic imaging method, which used clinically-approved carbon nanoparticles as a contrast agent to trace SLN and guide fine needle aspiration biopsies, non-invasively and non-radioactively.

The researchers injected carbon nanoparticles (CNPs) into the forepaws of living rats to stain SLN. Subsequently, photoacoustic and ultrasound dual-modality imaging were performed simultaneously in real-time at the axillary area of the rats to trace the SLN and guide the biopsy.

Experiments showed that photoacoustics can image and display lymphatic vessel, lymph nodes, needles, etc. with high resolution and high signal-to-noise ratio, which can provide high-quality image guidance for lymph node biopsy.

In addition, spectroscopic analysis showed that CNPs are superior to indocyanine green, methylene blue and other contrast agents in optical absorption coefficient, photobleaching and photoacoustic conversion efficiency. It is an excellent tracer for identifying SLN by photoacoustic imaging and image-guided biopsies.

This study provides a practical approach for fine-needle aspiration biopsy in the SLN tracing and image guidance, and paves the way for clinical translation of photoacoustic SLN imaging.

More information: Songde Liu et al, In Vivo Photoacoustic Sentinel Lymph Node Imaging Using Clinically-Approved Carbon Nanoparticles, *IEEE Transactions on Biomedical Engineering* (2019). DOI: 10.1109/TBME.2019.2953743

Hang Wang et al. Three-dimensional interventional photoacoustic imaging for biopsy needle guidance with a linear array transducer, *Journal of Biophotonics* (2019). DOI: 10.1002/jbio.201900212

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