IMAGING TUMOR XENOGRAFT

Application Note

Abstract

An important step in understanding cancer metastasis in humans is first studying the disease in mice. By infecting a mouse using a subcutaneous injection of the BT-474 cell line, a human breast carcinoma, the resulting metastatic tumor's growth can be tracked using photoacoustic imaging (PAI). PAI is a non-invasive imaging modality that can generate volumetric data that details the depth and dimensions of anatomical objects like tumors. An old, 2 years, Nu/Nu nude mouse is infected with a BT-474 xenograft and imaged *in vivo* using PAI with the PhotoSound TriTom system at a laser wavelength of 800 nm and 532 nm.

Weylan Thompson
wt@pst-inc.com

PhotoSound Technologies, Inc.
Houston, TX USA

Introduction

Photoacoustic imaging (PAI) can best resolve blood-rich deep anatomical structures. A tumor-bearing mouse is scanned using PAI with the TriTom system at 800 nm and 532 nm. The acquired PA data is reconstructed into 3D volumes that are used to estimate the volume of the primary tumor.

Materials and Methods

Mouse Model

A two-year-old, live, tumor-bearing female Nu/Nu nude mouse (Charles River Laboratories, Wilmington, MA) was scanned. There are two large tumors visible from the mouse's exterior (Figure 1). The focus of the PAI imaging is the tumor labeled Figure 1:1.

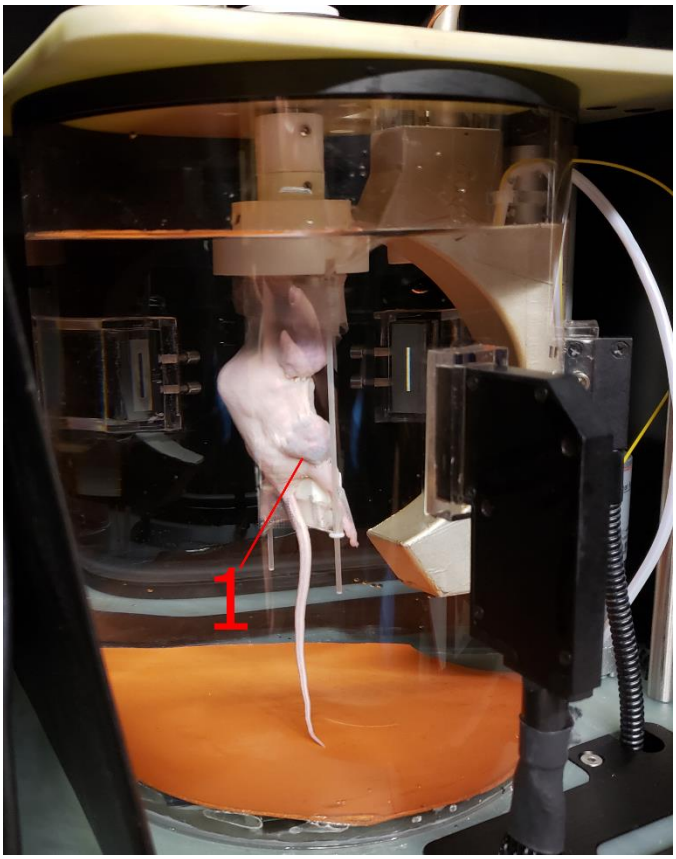

Figure 1: BT-474 tumor-bearing mouse (1) mounted inside a TriTom imaging system.

Imaging

The TriTom imaging platform was prepared with the water in the imaging chamber at temperature $T = 37.0 \pm 0.5\ °C$. The mouse subject was placed into a mouse restrainer. The mouse holder is then mounted onto the rotational stage of the TriTom. Several 3D PA tomography (PAT) scans were initiated, each rotating the mouse 360° while acquiring 360±5 frames of PA data at the excitation wavelength of 800 nm and 532 nm.

PAT Reconstruction

The acquired PA data were reconstructed into 40x40x30 mm volumes with a voxel size of 0.1 mm using a filtered back-projection method [1].

Results

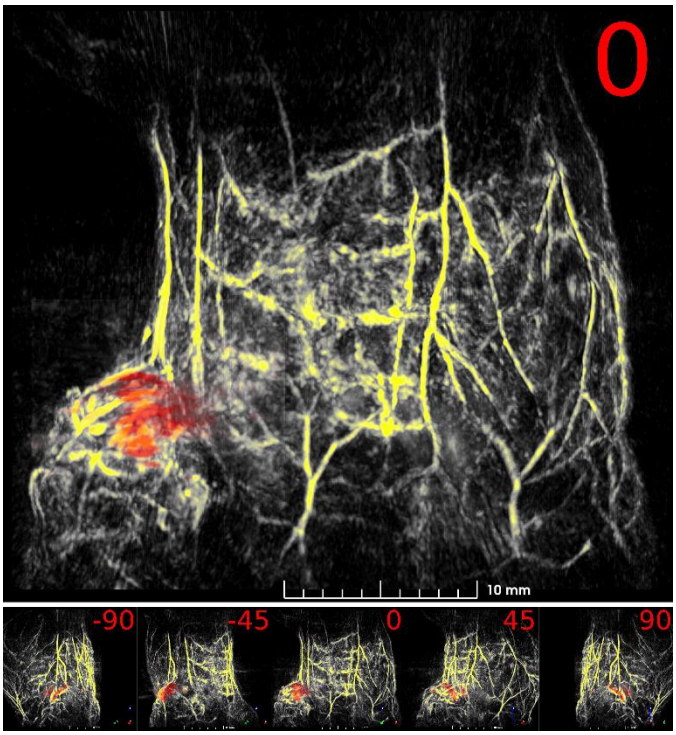

Figure 2: Maximum intensity projection volume render of the scanned mouse. 532 nm volume is colored yellow, 800 nm tumor volume is colored red. Angle of rotation is displayed in the top-right corner of each view.

Figure 2 shows the superimposed reconstruction volumes of the 800 nm scan, in red, and the 532 nm scan, in yellow. The lower tumor (Figure 1:1) is visible above the mouse's right hindleg. The tumor's internal bulk is shown in Figure 3:1 where the boundary between the tumor's mass and other internal anatomy of the mouse can be identified.

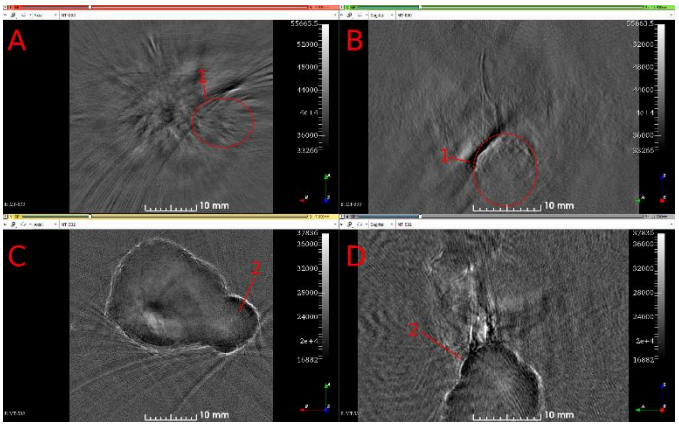

Figure 3: 2D slice reconstruction views of the mouse's tumor. Top row (A, B), 800 nm; bottom row (C, D), 532 nm. Left panels (A, C), axial views; right panels (B, D), sagittal views. The tumor's bulk is indicated by a dotted circle (1), the tumor's surface level can be seen in the 532 nm slices (2).

References

[1] Minghua Xu and L. V. Wang, "Time-domain reconstruction for thermoacoustic tomography in a spherical geometry," in *IEEE Transactions on Medical Imaging*, vol. 21, no. 7, pp. 814-822, July 2002, doi: 10.1109/TMI.2002.801176.