Quantitative Fluorescence Tomography Validated with Automated Registration to 3D Volumetric CT Data  

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Abstract

Fluorescence tomography in small animals is a valuable tool for monitoring biological events such as disease progression and drug targeting efficiency through the use of fluorescent proteins and/or conjugated dyes.

We discuss recent developments in our automated volumetric measurement. Knowledge of the tissue boundary of a continuously emitting phantom is necessary for accurate image reconstruction. The measurement of fluorophores in small volumes is challenging due to the need for high spatial resolution and high dynamic range.

The fluorescent tomography kernel functions are composed of Green’s functions solutions to a diffusion equation approximation of photon propagation in homogeneous tissue, where the boundary condition at the tissue/air interface is approximated by a local homogeneous tissue, where the boundary condition at the surface topography of the animal is determined by scanning lower defining the boundary between tissue and air.

The fluorescent tomography algorithm is based on a transillumination algorithm. NNLS is used to solve for quantum efficiency measured from image data.

Discussion

The tomographic solution to fluorescent source distribution is displayed overlaid on the optical instrument are converted to volumes for registration to 3D volumetric CT data.

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Conclusions

Quantification in Fluorescence Imaging Tomography for known picomole quantities of dye indicates in beads is accurate to 20% for fluorescent peak excitation and emission wavelengths, in tissue phantom studies. Localization accuracy is within 0.5 mm.

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References


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