Fast multispectral optoacoustic tomography (MSOT) for dynamic imaging of pharmacokinetics and biodistribution in multiple organs.

Abstract:

The characterization of pharmacokinetic and biodistribution profiles is an essential step in the development process of new candidate drugs or imaging agents. Simultaneously, the assessment of organ function related to the uptake and clearance of drugs is of great importance. To this end, we demonstrate an imaging platform capable of high-rate characterization of the dynamics of fluorescent agents in multiple organs using multispectral optoacoustic tomography (MSOT). A spatial resolution of approximately 150 µm through mouse cross-sections allowed us to image blood vessels, the kidneys, the liver and the gall bladder. In particular, MSOT was employed to characterize the removal of indocyanine green from the systemic circulation and its time-resolved uptake in the liver and gallbladder. Furthermore, it was possible to track the uptake of a carboxylate dye in separate regions of the kidneys. The results demonstrate the acquisition of agent concentration metrics at rates of 10 samples per second at a single wavelength and 17 s per multispectral sample with 10 signal averages at each of 5 wavelengths. Overall, such imaging performance introduces previously undocumented capabilities of fast, high resolution in vivo imaging of the fate of optical agents for drug discovery and basic biological research.