

Multimodal nonlinear optical microscopy for label-free imaging of liver tissue

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Abstract:

Liver fibrosis and steatosis represent the complex conditions and major symptoms for many liver diseases. In this study, we applied four modalities of nonlinear optical microscopy imaging on the bile-duct-ligation (BDL) induced fibrosis model of rat livers. Specifically, second harmonic generation (SHG) imaging quantifies the growing of the collagens, the two-photon excited fluorescence (TPEF) imaging reveals the morphology of hepatic cells, coherent anti-Stokes Raman scattering (CARS) imaging maps the distributions of fats or lipids quantitatively across the tissue, and third harmonic generation (THG) imaging is used to visualize the microstructures and morphology changes of the tissue. Our results demonstrate that both liver steatosis and fibrosis occur in the BDL liver tissue; while they develop at different rates. A certain correlationship between the two diseases in the same model can also be revealed. This study may provide new insights into the understanding of the mechanisms of liver disease (steatosis/fibrosis) transformations at the cellular and molecular levels.