Investigation on Blood Flow in CAM Model Using Optical Doppler Tomography

J.H. Kim[1], H. Lee[2], C.W. Park[2]

[1] Electrical Eng. & Compu. Sci, [2] Mechanical Engineering, Kyungpook National Univ, Daegu, S. Korea

The chick chorioallantoic membrane (CAM) is a well-established model for studying the effects of vasoactive drugs on blood vessels. Because the CAM microvasculature is located in a transparent matrix, direct viewing and noninvasive imaging of blood vessels are possible after the apex of the chick eggshell is removed. In conventional ODT, when the two directions are perpendicular, the Doppler shift becomes zero so that no velocity is measurable. Because a priori knowledge of the Doppler angle is often not available, and conventional intensity OCT imaging provides a low contrast image of microvasculature structure, detecting small vessels with slow flow rates is difficult. However, the Doppler angle can be estimated by combining Doppler shift and Doppler bandwidth measurements. The ability to precisely locate the microvasculature is important for diagnostics and treatments involving characterization of blood flow. In this paper, ODT technique is demonstrated in a CAM model to show its *in vivo* blood oxygenation contrast capability. We present a novel extension of ODT analogous to the features of fMRI, to image hemoglobin in erythrocytes in blood. The contrast of ODT images can be enhanced by activating iron-containing hemoglobin molecules in blood with an externally applied high-strength magnetic field gradient. Importantly, our approach requires no exogenous contrast agent to detect blood flow and location. We describe the ODT experimental setup containing an oscillating magnetic field generator, and present M-mode images of the Doppler shift of moving hemoglobin under the influence of an externally applied magnetic field gradient.