Near-Infrared spectroscopic imaging of cardiovascular disease

Kupriyanov V.V.

Institute for Biodiagnostics, 435 Ellice Avenue, Winnipeg, R3B 1Y6, Canada, 1-204-984-6620, Valery.Kupriyanov@nrc-cnrc.gc.ca

Applications of near-infrared spectroscopic (NIRS) imaging to detection, localization and grading of acute cardiac ischemia and chronic infarction in pig models in vivo are described. The models involved an occlusion of the left anterior descending artery (LAD) or its branches. NIR reflectance spectra (650-1050 nm) obtained for each pixel provided oxygenation maps of sub-epicardium, which depicted relative contents of oxy-hemoglobin (Hb) + oxy-myoglobin (Mb). Kinetics of passage of NIR flow tracer, indocyanine green (ICG), imaged at 800 nm provided relative flow distribution. Optical data were compared with results of thermal imaging, which probed epicardial flow as well as with data of manganese- and gadolinium-enhanced magnetic resonance imaging, which assessed transmural flow & viability. NIRS imaging is well suited for intra-operative applications during coronary artery bypass surgery in humans.

NIRS was also used for analysis of oxygenation heterogeneity associated with diabetic cardiomyopathy in isolated rat and transgenic mouse hearts. Spatial distribution profiles of the oxygenation parameter were constructed and analyzed under different physiological situations. This approach is useful for investigation of diffuse vascular disease characteristic of diabetes & hypertension.