

Fast vascular component of cortical spreading depression revealed in rats by blood pulsation imaging

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Abstract

Cortical spreading depression (CSD) is a slowly propagating wave of depolarization of neurons and glia and has a less characterized vascular component. CSD is a commonly used phenomenon to test new methods of live brain imaging. Application of a blood pulsations imaging (BPI) technique to study of CSD induced with high-potassium solution in rat cortex allowed us to visualize for the first time the novel vascular component of a CSD wave. In our study, this wave component propagated in the limited part of the cortex along the bow-shaped trajectory in sharp contrast with concentric development of CSD measured by concurrently applied optical intrinsic signal (OIS) imaging technique. It was associated with a significant increase of the blood pulsations amplitude (BPA), started with a delay of 20 to 90 s comparing to signal measured with OIS, and propagated 40% faster than OIS signal. These findings suggest that the BPA and slower change of the cerebral blood volume are not directly related to each other even though both characterize the same vascular system. Our study indicates that the BPI technique could be used for characterization of the new pulsatile vascular component of CSDs in animal models of migraine, stroke, and brain trauma. © Society of Photo-Optical Instrumentation Engineers.

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Keywords

Biomedical optical imaging, Brain stimulation, Cortical spreading depression, Image processing