Electroretinogram

The electroretinogram (ERG) is a diagnostic test that measures the electrical activity generated by neural and non-neuronal cells in the retina in response to a light stimulus.

Neurovascular coupling refers to the relationship between local neural activity and subsequent changes in cerebral blood flow (CBF).

Impairment of neurovascular coupling (NVC) was reported in the context of subarachnoid hemorrhage and may correlate with disease severity and outcome. However, previous techniques to evaluate NVC required invasive procedures. Retinal vessels may represent an alternative option for non-invasive assessment of NVC.

A prototype of an adapted retinal vessel analyzer was used to assess retinal vessel diameter in mice. Dynamic vessel analysis (DVA) included an application of monochromatic flicker light impulses in predefined frequencies for evaluating NVC. All retinae were harvested after DVA and electroretinograms were performed.

A total of 104 retinal scans were conducted in 21 male mice (90 scans). Quantitative arterial recordings were feasible only in a minority of animals, showing an emphasized reaction to flicker light impulses (8 mice; 14 scans). A characteristic venous response to flicker light, however, could observed in the majority of animals. Repeated measurements resulted in a significant decrease of baseline venous diameter (7 mice; 7 scans, $p < 0.05$). Ex-vivo electroretinograms, performed after in-vivo DVA, demonstrated a significant reduction of transretinal signaling in animals with repeated DVA ($n = 6$, $p < 0.001$).

To the best of Albanna et al. knowledge, this is the first non-invasive study assessing murine retinal vessel response to flicker light with characteristic changes in NVC. The imaging system can be used for basic research and enables the investigation of retinal vessel dimension and function in control mice and genetically modified animals [1)].

1)
Albanna W, Kotliar K, Lüke JN, Alpdogan S, Conzen C, Lindauer U, Clusmann H, Hescheler J, Vilser W, Schneider T, Schubert GA. Non-invasive evaluation of neurovascular coupling in the murine retina by dynamic retinal vessel analysis. PLoS One. 2018 Oct 4;13(10):e0204689. doi: 10.1371/journal.pone.0204689. eCollection 2018. PubMed PMID: 30286110.