Visualisation of Cortical pO₂ During an Epidural Mass Lesion in Rodents

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Abstract:

Monitoring p₆O₂ is a valuable supplemental procedure for neurocritically ill patients. Here, we utilise an opto-chemical method for measuring cortical pO₂ during a reversibly introduced epidural mass lesion in a rat model. The sensor was placed in a cortical window of 17 ventilated Wistar rats. Inflating the balloon device over the contralateral hemisphere increased ICP. Physiological parameters and cortical pO₂ were recorded. The ICP increased from 6.2 ± 4.6 to 44.6 ± 12.6 mmHg (p < 0.001). Cortical pO₂ over arterioles changed from 28.9 ± 2.1 to 19.0 ± 2.1 mm Hg (p < 0.001), over venules from 14.8 ± 1.2 to 9.9 ± 1.5 mmHg respectively (p < 0.002) and over parenchyma from 4.1 ± 0.7 to 2.4 ± 0.8 mmHg respectively (p < 0.001), while basic physiological parameters remained constant (p > 0.05). During baseline, arterial pO₂ correlated significantly with cortex arteriole and venole pO₂, but not with cortex parenchyma pO₂. While ICP was raised, cortical pO₂ did not correlate with arterial pO₂. In this model, a moderate epidural mass lesion causes a significant decrease in cortical pO₂. The correlation of cortex vessel pO₂ with arterial pO₂ disappeared during the epidural mass lesion. These findings show the capability of the device to elucidate the behaviour of functionally different cortex areas at pathophysiological conditions.

Key-words: Brain tissue oxygen, p₆O₂, partial oxygen pressure, epidural haematoma, time-resolved luminescence imaging, neuromonitoring