Scientific Paper:

Radial oxygen gradients over rat cortex arterioles

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Abstract:

Purpose We present the results of the visualisation of radial oxygen gradients in rats´ cortices and their potential use in neurocritical management.

Methods PO_2 maps of the cortex of ten sedated, intubated and controlled ventilated Wistar rats were obtained with a camera (SensiMOD, PCO, Kelheim, Germany). Those pictures were analysed and edited by a custom-made software. A virtual matrix, designed to evaluate the cortical O_2 partial pressure, was placed vertically to the artery under investigation, and afterwards multiple regions of interest were measured (width 10 pixels, length $15 - 50$ pixels). The results showed a map of the cerebral oxygenation, which allowed us to calculate radial oxygen gradients over arterioles. Three groups were defined according to the level of the arterial pO_2: $PaO_2 < 80$, PaO_2 $80 - 120$ and $PaO_2 > 120$. Gradients were analysed from the middle of the vessel to its border (1), from the border into the parenchyma next to the vessel (2) and a combination of both (3).

Results Gradient 1 showed significantly different cortical pO_2 values between the three different groups. The mean pO_2 values were 2.62, 5.29 and 5.82 mmHg/mm. Gradient 2 measured 0.56, 0.90 and 1.02 mmHg/mm respectively. Gradient 3 showed significant results between the groups with values of 3.18, 6.19, and 6.84 mmHg/mm.

Conclusion Using these gradients, it is possible to describe and compare the distribution of oxygen to the brain parenchyma. With the presented technique, it is possible to detect pO_2 changes in the oxygen supply of the brain cortex.

Key-words: Oxygen gradients, cortex, pO_2 maps, visualisation of radial oxygen gradients, rat cortices