

## **Metabolic changes in the brain after subarachnoid haemorrhage.**

### **Summary**

The goal of the study: The goal of this study is to set concentrations of energetic metabolites in the acute phase (first 24 hours of monitoring) after subarachnoid haemorrhage (SAH) and to define the relation of these concentrations to the clinical and imaging parameters on admission and final clinical state of the patient one month after the bleeding. Throughout the period of monitoring, in all patients we observed episodes of lactate/pyruvate (L/P) ratio  $> 30$  and their relation to actual readings of intracranial pressure (ICP) and perfusion pressure (CPP). We also monitored concentrations of glycerol in two compartments (brain interstitium and serum).

**Type of the study:** Retrospective clinical study

**The set and methodology:** From 2012 to 2015 we introduced a microdialysis catheter and a sensor for measuring ICP within a multimodal monitoring in 15 patients after subarachnoid bleeding. We performed this multimodal monitoring for a period of 84 days and processed in aggregate 10,080 readings. In 7 patients, together with multimodal monitoring, we also determined the serum concentration of glycerol. The onset of monitoring was always connected with obliteration of the source of bleeding either via surgery or endovascular procedure.

**Results:** Concentration of pyruvate during the first 24 hours of monitoring was lower in the group of patients with global edema of the brain (GEM) ( $p = 0,01$ ). The readings of L/P ratio during the first 24 hours of monitoring were higher in the group of patients with global edema of the brain ( $p = 0,004$ ). In the group of patients with grade 4 Hunt-Hess we measured higher readings of lactate pyruvate ratio compared to the group of patients with Hunt-Hess grades 1-3 ( $p = 0,04$ ). In the group of patients with a minimum of one episode of metabolic crisis (L/P  $> 40$ , glucose  $< 0,7$ mmol/l) during the whole monitoring period we demonstrated worse clinical result one month after SAH (modified Rankin scale – mRS 4-6,  $p = 0,01$ ). Out of 832 hours of monitoring with a lactate/pyruvate ratio  $> 30$  we recorded in 193 cases ICP  $> 20$  torr, which makes up 23% of cases. Out of 193 hours of monitoring during which we recorded ICP  $> 20$ , the simultaneous value of L/P ratio was  $> 30$  during 170 hours, constituting 88%. Higher readings of L/P ratio were connected with higher readings of CPP ( $p = 0,04$ ). In 4 of 7 patients we demonstrated a statistically significant relation between concentrations of glycerol in serum and brain interstitium.

**Conclusion:** Global edema of brain and admission clinical state after SAH can be defined by chosen parameters measured by brain microdialysis. The presence of metabolite crisis represents a negative prognostic marker of unsatisfactory clinical result one month after SAH. Higher readings of L/P ratio are related more with perfusion pressure than with intracranial pressure. In a certain group of patients after SAH we may track a correlation between glycerol concentration in serum and brain interstitium.