Effects of pH Management During Selective Antegrade Cerebral Perfusion on Cerebral Microcirculation and Metabolism: Alpha-Stat Versus pH-Stat

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Aim of the study

Selective cerebral perfusion (SCP) is used for extending the period under which surgical procedures can be safely performed, and it has become the primary brain protection method in many centers 1. We sought to determine the direct effects of pH management on cerebral microcirculation and metabolism during SCP.

Materials

Twenty-four piglets (6 to 8 weeks, mean weight 26.1 ± 4.1 kg) underwent randomly 15-minute normothermic CPB (cardiopulmonary bypass), 45-minute cooling CPB, 60-minute SCP at 25 °C and 45-minute rewarming CPB with either α- or pH stat perfusion strategy.

Methods

An experimental SCP porcine model was created by selectively allowing cold perfusate only into the bicarotid brachiocephalic trunk during the SCP period.

A cranial window over the parietal cortex was made for visualization of the cerebral vessels with intravital microscopy. Rhodamine dye was used for staining and observing adherent and rolling leukocytes in the cerebral postcapillary venules. Microdialysis analysis was used for determination of brain metabolism.

Results

Brain concentration of lactate was significantly higher in the α-stat group at 45-min SCP, and 15- and 45-min rewarming intervals (P = 0.03, P = 0.003, and P = 0.05, respectively), reaching borderline statistical significance when assessed throughout the experiment (P = 0.06).

Further, at the end of cooling, the oxygen delivery tended to be higher in the pH-stat group (P = 0.07), while at the 30 min rewarming interval, the oxygen extraction tended to be higher in the α-stat group (P = 0.06).

There were no statistically significant differences between the groups in leukocyte/endothelial interaction, arterial diameter or tissue oxygenation.

Conclusion

The higher concentration of brain lactate and the tendency to higher oxygen extraction levels during rewarming with α-stat strategy suggests anaerobic metabolism during SCP. No major differences between pH management strategies in cerebral microcirculation could be shown during SCP.

References