THE ROLE OF INCREASE IN Na CONCENTRATION IN CSF IN ARTERIAL PRESSURE REGULATION IN DEHYDRATED RATS: INTERACTION WITH ARTERIAL BAROREFLEXES.

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Summary

To analyze the mechanism of the greater decrease in mean arterial pressure (MAP) at a given decrease in [Na]csf (ΔMAP/Δ[Na]csf) in dehydrated rats, we measured [Na]csf with a Na sensitive microelectrode in the lateral ventricle (LV) and MAP during infusion (INF) of hypertonic arterial cerebrospinal fluid (ACSF) (~400 mOsm) into the LV of rats with and without sino-aortic denervation (SAD). [Na]csf in both groups increased significantly ~1 min after the start of INF and attained the maximal increases of 16.4±2.4 meq/kg H_2O in innervated rats and 20.5±1.3 meq/kg H_2O in SAD rats (n=10) at the end of INF. There was no significant difference in Δ[Na]csf between the two groups throughout the experiment. On the other hand, MAP in SAD rats increased to a significantly higher level than in innervated rats from 6.0 to 17.0 min after the start of INF ($p<0.05$) and the increase at the end of INF was 19.0±2.3 mmHg and 7.7±1.4 mmHg in the SAD and innervated rats, respectively ($p<0.01$). Changes in MAP in both groups were highly correlated with Δ[Na]csf throughout the experiment, but and the slope was steeper by two-folds in SAD rats (ΔMAP=0.99Δ[Na]csf +0.78, r=0.97, $p<0.001$) than that in innervated rats (ΔMAP=0.49Δ[Na]csf+0.80, r=0.97, $p<0.001$) and was identical to that in dehydrated rats (ΔMAP=1.03Δ[Na]csf+0.25, r=0.96, $p<0.001$).

To clarifiy the mechanism of the decrease in MAP during hypotonic INF into the LV of dehydrated rats, [Na]csf, MAP, CVP (mmHg), and cardiac output (CO, ml/min 100g) were measured in dehydrated rats when [Na]csf was gradually reduced to the pre-dehydrated level. Total vascular conductance (TVC, (ml/min 100g)/mmHg) was calculated as TVC=CO/(MAP-CVP). MAP and CO decreased and TVC increased as [Na]csf decreased with high correlations (r^2=0.82-0.94, $p<0.001$).

Thus, the decrease in MAP at a given decrease in [Na]csf was greater in dehydrated state which might be caused by the reduced gain of arterial baroreflexes. The increase in [Na]csf is important to maintain arterial pressure by causing systemic vasoconstriction and preventing the decrease in CO during dehydration.