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Acute Hyponatremia Increases Functional Connectivity Between the SFO and OVLT: Time Course of the Response

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The subfornical organ (SFO) and organum vasculosum lamina terminalis (OVLT) have an incomplete blood brain barrier and contain specialized sodium sensing neurons. In turn, these brain regions mediate sodium-induced changes in sympathetic nerve activity, vasopressin, thirst, and blood pressure. However, few studies have investigated the network of sodium sensing brain regions in humans. **PURPOSE:** To evaluate temporally dynamic changes in connectivity between the SFO and OVLT during a HSI. **METHODS:** 11 normotensive, non-obese adults (6 male/5 female; age=30±7yr) completed resting-state fMRI at baseline followed by a 30-min 3% NaCl infusion. Thirst was assessed using a Likert scale and venous blood samples were obtained to assess serum electrolytes and plasma osmolality pre- and post-infusion. A seed-based voxel-wise connectivity analysis using a sliding-window approach was performed in AFNI with a spherical seed placed in the SFO. Functional connectivity was assessed with the OVLT and PCC (posterior cingulate cortex; control region of interest) at baseline and during nine ~3.3-min, non-overlapping bins during the HSI. One-tailed paired t-tests were used to compare thirst and blood analyses pre- and post-infusion and connectivity in each bin with baseline for the OVLT and PCC. P-values were corrected to account for false discovery rate using the Benjamini-Hochberg method (adjusted $p < 0.05$ was considered significant). **RESULTS:** Serum sodium ($\Delta 3.0 \pm 1.9$ mmol/l), plasma osmolality ($\Delta 7 \pm 4$ mOsm/kg H₂O), and thirst ($\Delta 2.1 \pm 2.1$ cm) increased post-infusion ($p < 0.01$). Head motion was negligible (0.10 ± 0.02 mm) and did not change during the scan ($p > 0.05$). Connectivity between the SFO and OVLT was higher than baseline in bins 5-9 ($p < 0.05$) but not bins 1-4 ($p > 0.05$) (z-scores: baseline=0.02, bin 1=0.03, bin 2=0.11, bin 3=0.08, bin 4=0.07, bin 5=0.11, bin 6=0.18, bin 7=0.11, bin 8=0.16, bin 9=0.18). Functional connectivity between the SFO and PCC (control region) did not change significantly ($p > 0.05$). **CONCLUSION:** Acute hyponatremia increases functional connectivity between the SFO and OVLT at 13.5 to 30 minutes of a HSI.

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