Central nervous mechanism for the regulation of body fluid balance by salt information

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Summary

The present study examined (1) response properties of neurons in the pontine taste area (PTA) to chemical stimulation of the posterior tongue and pharyngolarynx and (2) changes in renal sympathetic nerve activity (RSNA) by electrical stimulation of the PTA.

Urethane- or pentobarbital-anesthetized male rats were used. Microelectrodes were inserted into the PTA to isolate single neuron activity. Taste responses were evoked by the following stimuli (vol= 0.3 ml): 0.5 M sucrose, 0.01-1.0 M sodium chloride (NaCl), 0.003-0.03 M hydrochloric acid (HCl), 0.01 M quinine hydrochloride (QHCl), and distilled water (DW). The evoked responses were measured for 5 s after the onset of stimulation. RSNA was recorded from the left renal sympathetic nerve.

A total 71 responses were evoked from 33 neurons in the PTA. The most effective stimulus was found to be NaCl (n= 22) and followed by HCl (20), QHCl (15), sucrose (7), and DW (7). Best stimulus category classified the neurons into four groups: NaCl- (n= 11), HCl- (10), QHCl- (8), and sucrose-best neurons (4). However, no DW-best neuron was recorded from the PTA, in spite of the fact that receptors responsive best to DW are in the tested region (the laryngeal mucosa), suggesting that afferent pathways of DW-best neurons in the brain stem may be different from those of other traditional taste neurons.

Electrical stimulation (0.1-0.2 ms, 50-150 μA, 50-200 Hz) was applied to the PTA where responses to NaCl and HCl were recorded. Succesive stimulation of the the PTA increased RSNA. The latency of the response was around 140 ms, and the increase sustained for a few minutes after termination of the stimulation. Intermittent stimulation of the region also increased RSNA synchroniously with the stimulation.

The present study demonstrates that the PTA mainly receives salt and acid information from the posterior tongue and pharyngolarynx and suggests that the PTA regulates body fluid balance by modifying RSNA using the taste information.