Sodium thirst in nephrectomized and nephrectomized-anosmic rats

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Olfactory bulb resection in nephrectomized rats completely abolishes water intake in response to intraperitoneal sodium loading.

Resection of the olfactory bulbs greatly prolongs the onset of drinking and the total volume drunk in response to intraperitoneal (IP) sodium loads, while leaving water intake unchanged under ad lib conditions or during food deprivation (Vance, 1967). Olfactory osmoreceptors (Sundsten & Sawyer, 1959) were presumed to be necessary for sodium induced drinking, and the delayed drinking that did occur was presumed to be the result of an osmotic diuresis resulting from renal sodium excretion.

The present investigation tests this last assumption by comparing the water intake of nephrectomized and nephrectomized-anosmic rats in response to IP sodium injection, a condition which obviates any complications of osmotic diuresis.

Method

Eight male Wistar rats, weighing approximately 250 g, served as Ss. The animals were housed in individual wire mesh cages fitted with graduated cylinders and drinking spouts for recording water intake. Four animals underwent bilateral bulb resection, the skull being opened with a dental drill and the bulbs transected with a scalpel blade. After recovery, the anosmics and four control animals received bilateral nephrectomies. All operations were performed under Nembutal anesthesia.

Twenty-four hours after nephrectomy, both groups received a 2 ml/100 g body weight load of 1 M sodium chloride by IP injection. Water intake was then recorded for the succeeding 3 h, with readings every 10 min for the first hour and every 15 min thereafter. No food was present during the test.

Results

Postmortem examination showed the left olfactory bulb of one of the anosmics to be largely intact and the animal was therefore discarded from the experiment. The cumulated water intake for the three remaining nephrectomized-anosmics and four nephrectomized controls is given in Fig. 1. For comparison, the data from a previous experiment (on unoperated controls and anosmics; Vance, 1967) are plotted in the same figure. As may be seen, anosmic-nephrectomized animals drink no water at all in response to sodium loading while the nephrectomized group shows no significant difference from unoperated controls.

Fig. 1. Cumulated water intake for nephrectomized, nephrectomized-anosmic, anosmic, and unoperated controls following an intraperitoneal sodium load.

It might be added that at the time of the test, all animals appeared in excellent condition and, as Wayner & Burger (1966) have shown, nephrectomized animals drink normal amounts of water for up to 72 h following the operation.

Discussion

The results clearly demonstrate that the integrity of the olfactory bulbs is necessary for the induction of sodium thirst. This finding immediately raises the question of the validity of the theoretical speculations based on hypernatremic thirst (cf., Wolf, 1958) since these are intended to explain the "normal" thirst mechanism. In none of our animals have we found any aberrations in normal water intake, although Novakova & Dlouha (1960) have reported significant increases in water intake following bulb transection. Nonetheless, it appears from the results that normal thirst and sodium thirst are mediated by different mechanisms.

References

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Note

1. This research was supported by PHS grant NB 05940-02.