

MORPHOLOGICAL STUDY OF THE ACTION OF ANTIDIURETIC HORMONE IN THE RENAL TUBULES

(PRELIMINARY REPORT)

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There is ample evidence to show that the re-absorption of water under the effect of antidiuretic hormone (ADH) occurs in the collecting tubules. It has been shown by micropunctures that the effect of ADH extends to both limbs of Henle's loop as also to the distal convoluted tubules [1, 3, 4, 6]. While the effect of ADH has been located by means of physiological methods, hardly any morphological observations have been made in this respect. JANCsó [5], one of the few authors who have investigated the morphological aspects of the problem, described channels in the epithelium of the collecting tubules.

The present experiments were designed to supply further morphological data about the tubular point of attack of ADH.

Material and method

Rats of the Wistar strain, weighing 160 to 180 g and belonging to both sexes, were used. The animals were kept on Larsen's diet, and received water *ad libitum*. Four groups were formed, each consisting of 6 animals. Group I contained the untreated controls; members of Group II received 6×5 ml of saline intraperitoneally daily for 4 days; those of Group III received intramuscularly 0.3 ml (i.e. 1.6 international presser units) of pitressin tannate in oil (Parke, Davis & Co., Hounslow) daily for 4 days; animals of Group IV were given, besides pitressin as in Group III, an intraperitoneal injection of 6×5 ml of saline daily for 4 days.

The rats were bled to death in ether anaesthesia on the 5th day, and two specimens from either kidney were embedded for histological examination. Four complete transverse sections from the largest horizontal plane were examined per animal by counting the dividing cells of the tubular epithelium in the outer and inner medullary zones.

Results

The results are shown in Table I.

The major part of mitoses was found in the outer zone of the medulla, while the rate of mitoses did not seem to have changed in the cortical tubules. In Group IV, 69.3 per cent of the mitoses occurred in the collecting tubules (especially in their outer medullary segment), 21.3 per cent in the thick ascending limb of Henle's loop, and 9.3 per cent in its descending thin limb. Apart from the many mitotic cells, numerous binuclear epithelial cells (pointing to amitotic division) were observed in the animals of Group IV.

Table

Group (6 rats, each)	Number of mitotic cells found in each member of the group	Average number of mitotic cells per group
I. Controls	0, 1, 2, 2 2, 2	1.5
II. Treated with physiol. NaCl	0, 2, 2, 2 3, 3	2.0
III. Treated with pitressin	2, 4, 4, 5, 9, 13	6.1
IV. Treated with pitressin and physiol. NaCl	14, 65, 75 97, 101, 125	79.1

Discussion

Since the rate of cell division is supposed to express the measure of functional activity and the corresponding attrition [2], it is justified to assume that the above data regarding the rate and distribution of mitoses present a true picture of the location and extent of water reabsorption as effected by ADH.

These findings are in agreement with the results of micropuncture studies [3, 4] and may allow certain quantitative conclusions, namely, that tubular reabsorption of water is most intensive in the collecting tubules, less in the thick ascending, and still less in the thin descending, limb of Henle's loop.

Summary

Morphological observations have shown the reabsorption of water under the effect of antidiuretic hormone to be most intensive in the collecting tubules, less in the ascending thick limb of Henle's loop, and still less in its descending thin limb. These conclusions have been based on the rate of cell divisions in the said areas of the tubular apparatus.

REFERENCES

1. ALLEN, A. C.: (1962) The kidney. Medical and surgical diseases. 2nd ed. Grune and Stratton, New York — 2. FAUTREZ, J., CAVALLI, G., PISI, E.: (1955) *Nature* (Lond.) **175**, 684. — 3. GOTTSCHALK, C. W., MILLE, M.: (1959) *Amer. J. Physiol.* **196**, 927. — 4. GOTTSCHALK, C. W.: (1959) Micropuncture studies of the mechanism for urine concentration. Nierensymposion, Göttingen. Georg Thieme, Stuttgart, 1960. — 5. JANCsó, N.: (1955) Speicherung. Verlag d. Ungarischen Akademie d. Wissenschaften Budapest. — 6. WIRZ, H.: (1959) Das Prinzip des Haarnadelgegenstromsystems. Nierensymposion, Göttingen. Georg Thieme, Stuttgart, 1960.

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