Histochemical Demonstration of Adrenergic Fibers in the Renal Tubulus in Dog

A rich supply of sympathetic innervation of the kidney was considered and a lot of clinical, anatomical and physiological investigations have been reported[1-3]. The recent histochemical report with a fluorescence method of ANGELAKOS[4] denied the existence of the adrenergic nerves in the tubulus.

In the course of experiments to investigate the mode of distribution of adrenergic fibers in the kidney, we have been able to find a specific fluorescent material representing catecholamines in the loops of Henle of dogs.

Twenty adult healthy mongrel dogs of both sexes and weighing 10–15 kg were used. All animals were anesthetized with i.v. nembutal sodium in the dose of 30 mg/kg. Small pieces of specimen were taken from the kidney and were frozen in isopentane, freeze-dried, treated with formaldehyde and sectioned for fluorescence microscopy. The animals of another group were treated with i.p. injection of 0.5 mg/kg of reserpine twice a day at a time interval of 12 h for succeeding 3 days, and 24 h after the last injection the animals were killed for the fluorescent histochemical procedures. The borohydride reduction test was sometimes undertaken to differentiate the specific fluorescence from high autofluorescence in the tissues. Chronic kidney denervations were performed on 7 dogs. After injection of nembutal sodium i.v. in the dose of 30 mg/kg, a left lateral rectus incision was made and the left kidney exposed. The capsel of the kidney and ureter were carefully stripped. The nerves traveling with the renal vessels of the left kidney and adventitia of the renal artery and vein were carefully stripped, beginning at the hilus and extending toward the aorta and vena cava inferior. The kidney of the mother side served as control. 7 days after the surgical operation the animals were sacrificed and both kidneys were removed. The same tissue sections were sometimes stained with hematoxylin-eosin for the confirmation of the tissue structures.

The fluorescent fibers distributing to the loops of Henle 10 μ in diameter are shown in Figure 1. Surrounding the tubulus these fibers were found immediately adjacent to the wall, and their course was exhibited with the varicose structures. However, no fluorescent fibers traced inner part of the tabulus.

Hematoxilin-eosin stain of the same section is shown in Figure 2. Owing to freeze-dried technique, atrophy of the tissue was observed, but location of the fluorescent fibers in the tissue structures could be seen. The specific fluorescent in the loops of Henle was increased in number and intensity after being treated with nialamide and noradrenaline. Treatment with reserpine or chronic denervation of the kidney induced total disappearance of the specific fluorescent fibers in the kidney. Treatment with sodium borohydride affected the fluorescence of the tubulus.

We could not find fluorescent fibers of noradrenaline in any other part of the tubulus. It is noteworthy to mention that the specific fluorescence fibers are observed only loops of Henle. With the use of a silver impregnation technique, MIZUMURA[5] reported the existence of nerve fibers in the tubulus. From our experimental results, fluorescence fibers located in the tubulus proved to be the adrenergic nerve fibers. The physiological significance of the existence of adrenergic nerve fibers only in the loops of Henle needs further study.

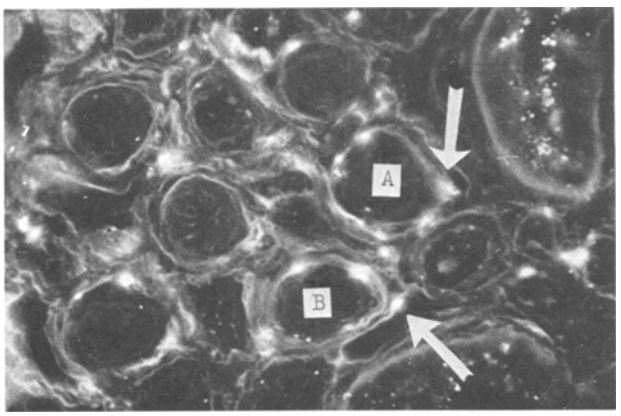

Fig. 1. Loops of Henle of dog. The fluorescent fibers were found immediately adjacent to the wall of tubulus. Arrows show the fluorescence of noradrenaline. Fluorescence microphotograph. × 320.

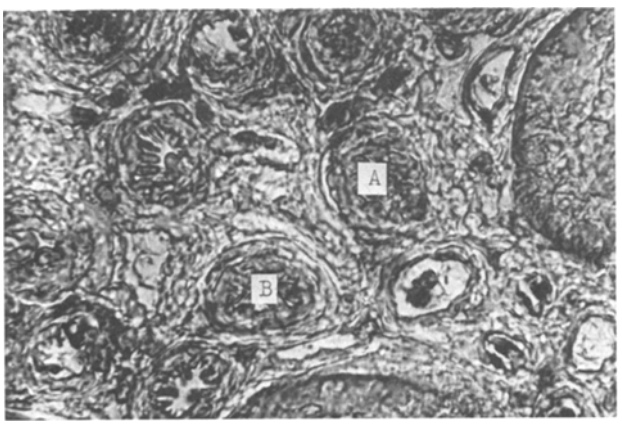

Fig. 2. Hematoxilin-eosin stain of the same section. Atrophy of the tissue was observed, but location of the fluorescent fibers in the tissue structures could be confirmed. The signs A and B on the Figure 2 correspond to the signs A and B on the Figure 1. × 320.

Zusammenfassung. Mittels histochemischer Fluoreszenzmethode werden bei Hunden in den Nierentubuli adrenerge (Noradrenalin) Nervenfasern nachgewiesen.

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