HISTOCHEMICAL DEMONSTRATION OF SMALL CELLS CONTAINING CATECHOLAMINE IN THE ADRENERGIC PELVIC GANGLIA OF GUINEA-PIG

MASAMI DOTEUCHI, HIRONORI NAKANISHI AND HIDEO TANAKA

Division of Pharmacology, Shionogi Research Laboratory, Shionogi & Co., Ltd., Fukushima-ku, Osaka

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Norberg and Hamberger (1) have histochemically demonstrated the presence of a high concentration of noradrenaline in the various sympathetic ganglionic cells and the nerve terminals around the cells forming a basket-like synaptic structure. The existence of adrenergic pelvic ganglia near the vas deferens and seminal vesicle was found electrophysiologically (2) and histochemically (3). In the present study, the presence of a new type of small cell containing catecholamine in the adrenergic pelvic ganglia is shown by means of a histochemical method.

(a) Adrenergic pelvic ganglion of normal guinea-pig. A number of small cells (↑) surrounding large ganglionic nerve cells (†) exhibit intense green to yellow-green fluorescence. A few cells are devoid of fluorescence which are presumed to be cholinergic.

(b) Thionin staining of the same preparation as Fig. 1a. The area enclosed in the rectangle corresponds to Fig. 1a. Arrows indicate the small cells with catecholamine fluorescence.
Male guinea-pigs weighing 350 to 450 g were used. The vas deferens and seminal vesicle with surrounding connective tissue involving the pelvic ganglia were isolated under pentobarbital anesthesia. Small pieces of tissue were freeze-dried and treated with formaldehyde gas according to the method of Falck and Owman (4), and observed with a Zeiss fluorescence microscope.

As shown in Fig. 1a, two distinctly different types of cells with catecholamine fluorescence were seen in the ganglionic structure. The specificity of the fluorescence to catecholamine in both types of cells was confirmed by ordinary methods. The fluorescence in both types of cells was diffusely distributed in the cytoplasm and the nucleus was almost completely devoid of fluorescence. Also the intensity of the fluorescence of the small cells highly varied from cell to cell as was similarly seen in the nerve cells in which the heterogeneity of the fluorescence had been previously demonstrated in various ganglia by many investigators (1, 3). It was interesting that the small cells with fluorescence were observed only around the fluorescent nerve cells and never located around the non-fluorescent nerve cells.

Thionin staining of the same preparation (Fig. 1b) shows the presence of a large number of satellite cells surrounding the ganglionic nerve cells. The number of satellite cells was much larger than the number of fluorescent small cells and the satellite cells were located around not only the fluorescent nerve cells but also the non-fluorescent nerve cells.

The fluorescence of both types of cells completely disappeared 24 hours after the subcutaneous administration of 1 mg/kg of reserpine, namely no difference in the sensitivity to reserpine in both types of cells was clarified in the present study.

The existence of chromaffin cells in the mammalian sympathetic ganglia has been pharmacologically demonstrated (5). Eccles (6) presumed the importance of their physiological function in the transmission at the sympathetic ganglion. Also Norberg and Sjöqvist (7) chemically showed the occurrence of adrenaline due to the chromaffin cells in various sympathetic ganglia. Therefore, it may be considered that the small cells correspond to chromaffin cells. These cells are different from the monoamine containing small cells found by Eränkö and Harkonen (8) because of their location, size of cells and characteristics toward water.

Though the innervation of these cells has not yet been established and the possibility that adrenergic terminals on the ganglionic nerve cells originate from the interneurons in the same ganglia (7) can not be excluded, the fact that the number of small cells with catecholamine fluorescence are abundant compared with the number of ganglionic nerve cells and each small cells seems to contain a considerably high amount of catecholamine from their intensity of fluorescence suggests their physiological importance in the ganglionic transmission as described by Eccles (6). Further histochemical, pharmacological and electrophysiological investigations for characterization of this type of cell are now in process in our laboratory.

REFERENCES