Effect of Ivory Shell Toxin on the Parasympathetic Ganglia of the Dog Urinary Bladder

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Taira, N., Iwatsuki, K., Hashimoto, K. and Hirayama, H. Effect of Ivory Shell Toxin on the Parasympathetic Ganglia of the Dog Urinary Bladder. Tohoku J. exp. Med., 1972, 107 (2), 191-192 — A small amount (3-10 μg) of a toxin isolated from the Japanese ivory shell (Babylonia japonica) was injected into the caudal vesical arteries of the dog bladder in situ. This greatly diminished the bladder contraction in response to pelvic nerve stimulation and antagonized that to 1,1-dimethyl-4-phenylpiperazinium iodide, a nicotinic ganglionic stimulating agent. The toxin was ineffective on the contractile response to 4-(m-chlorophenylcarbamoyloxy)-2-butynyltrimethylammonium chloride, a muscarinic ganglionic stimulating agent. Thus, the toxin appears to be highly specific in blocking the nicotinic receptors at the parasympathetic ganglia of the dog bladder.

METHODS

Experiments were performed on non-pregnant female mongrel dogs anesthetized with sodium pentobarbital. For close-arterial injection of drugs the bladder was perfused in situ with arterial blood via both caudal vesical arteries after heparinization, as described previously (Taira et al. 1971). Motor responses of the bladder were recorded as changes in intravesical pressures. Both hypogastric and pelvic nerves were cut bilaterally. Pelvic nerve stimulation was performed on either side by using an electronic stimulator. IST (Kohjin), acetylcholine chloride (ACh), 1,1-dimethyl-4-phenylpiperazinium iodide (DMPP), 4-(m-chlorophenylcarbamoyloxy)-2-butynyltrimethylammonium chloride (McN A-343, McNeil Lab.) were all dissolved in 0.9% saline. Injected volume of drug solutions measured constantly 0.1 ml. All doses except for IST refer to their salts.

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Fig. 1. Effects of a single i.a. injection of IST on the bladder contraction in response to pelvic nerve stimulation (PNS, P), DMPP (D), acetylcholine (ACh, A), and McN A–343 (M). In upper frame are shown control responses. Traces continue from the upper to the lower frame. IVP refers to intravesical pressure. Stimulus parameters of PNS: 6 V, 0.06 msec, 20 pps, and for 5 sec. Flow rate of blood through both caudal vesical arteries was constantly about 10 ml/min.

A typical experimental result is shown in Fig. 1. A single intra-arterial injection of IST in dosage as small as 3 μg greatly reduced the bladder contraction produced by submaximal pelvic nerve stimulation and almost abolished that caused by 3 μg of DMPP, a nicotinic ganglionic stimulating agent. In contrast, the contractile response to 30 μg of McN A–343, a muscarinic ganglionic stimulating agent (Taira et al. 1971), was not affected at all by IST. The contractile response to 30 μg of ACh, which was shown to present the pure muscle response (Taira et al. 1969) was not affected by IST either.

The above results indicate clearly that at the parasympathetic ganglia of the dog bladder IST blocks specifically the nicotinic receptors.

References