

EFFECT OF ADRENALIN AND ACETYLCHOLINE ON THE LINGUO-MAXILLARY REFLEX IN CATS

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After bilateral sympathicovagotomy on cats anesthetized with chloralose acute experiments showed that the depriming action of adrenalin (100 $\mu\text{g/kg}$) and acetylcholine (15 $\mu\text{g/kg}$) on the linguo-maxillary reflex is unconnected with their action on the peripheral components of the reflex arc or with excitation of receptors of the autonomic nervous system and it is not due to changes in the hemodynamics. Adrenalin and acetylcholine reduce the amplitude of evoked polysynaptic discharges recorded from the central end of the divided maxillo-hypoglossal nerve in response to stimulation of the central end of the divided lingual nerve both in intact animals and after intercollicular brain section.

Previous investigations showed that serotonin, adrenalin, and acetylcholine produce marked inhibition of the linguo-maxillary reflex in cats [6]. The depriming effect of serotonin on this reflex takes place through the participation of serotonin receptors in the caudal portion of the brain stem.

In the investigation described below the action of adrenalin and acetylcholine on the linguo-maxillary reflex was analyzed.

EXPERIMENTAL

Experiments were carried out on 50 cats anesthetized with chloralose (80 mg/kg, intravenously), on which bilateral sympathicovagotomy was performed. The brain of some cats was intact, and intercollicular section of the brain stem was performed on the rest [7]. The linguo-maxillary reflex was recorded mechanographically [1] and electrographically [3]. The effect of adrenalin and acetylcholine on neuromuscular transmission was studied with special reference to the myoneural synapses of the tibialis muscle. Adrenalin (100 $\mu\text{g/kg}$) was injected intravenously in most experiments, and acetylcholine (15 $\mu\text{g/kg}$) was injected into the carotid artery. In some experiments adrenalin and acetylcholine were injected into the lateral ventricle [8]. Adrenalin and acetylcholine also were injected into the carotid artery after stabilization of the arterial pressure [4]. Statistical analysis of the results was carried out by Student's method [2].

EXPERIMENTAL RESULTS

The results showed that 15-20 sec after intravenous injection of adrenalin and intracarotid injection of acetylcholine the linguo-maxillary reflex was inhibited on the average by $45 \pm 0.8\%$ ($P < 0.001$) and $37.2 \pm 5.2\%$ ($P < 0.01$), respectively.

To determine the level of the nervous system involved in the depriming effect of adrenalin and acetylcholine the effect of these drugs on different components of the linguo-maxillary reflex arc was studied. These substances were found to have no effect on the transmission of excitation through the myoneural synapses of the tibialis muscle. The experiments showed that the blocking effect of adrenalin and acetylcholine on the linguo-maxillary reflex is not due to their effect on the sensory component of the reflex arc (nerve endings in the tip of the tongue). In the experiments in which the linguo-maxillary reflex was re-

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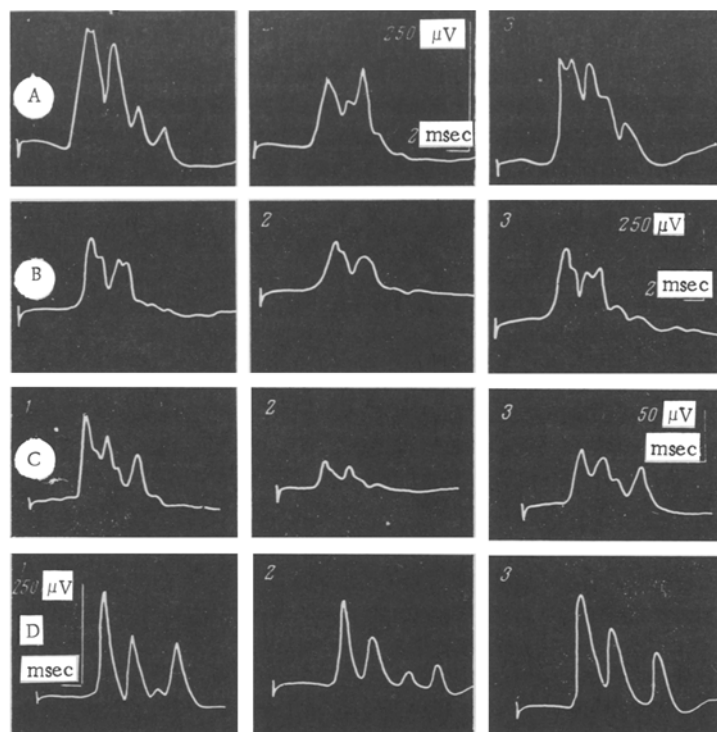


Fig. 1. Effect of adrenalin (A, B) and acetylcholine (C, D) on evoked potentials recorded from central end of maxillo-hypoglossal nerve in response to stimulation of central end of divided lingual nerve: 1) amplitude of discharges before injection of drugs; 2,3) amplitude of discharges 15 sec and 5 min, respectively, after injection of drugs. A and C – intact animal; B and D – "cerveau isole" preparation. Effects of adrenalin and acetylcholine on evoked potentials were similar in type in all 5 experiments.

corded electrographically, when the strength of the reflex was reflected in the size of the discharges recorded in the central end of the divided maxillo-hypoglossal nerve in response to stimulation of the central and of the divided lingual nerve, i.e., after isolation of the peripheral (sensory and motor) components of the reflex arc, showed that adrenalin and acetylcholine partly reduce the amplitude of the polysynaptic discharges (Fig. 1A, C).

In the experiments in which adrenalin and acetylcholine were injected into the lateral ventricle, so that the drugs could not penetrate to the peripheral portions of the reflex arc, inhibition of the linguo-maxillary reflex was distinctly observed as before. For instance, after injection of adrenalin and acetylcholine into the blood stream the reflex was blocked to the extent of $50.1 \pm 5.9\%$ ($P < 0.001$) and $44.2 \pm 5.9\%$ ($P < 0.002$), respectively, while after their injection into the lateral ventricle the corresponding figures were $29 \pm 3.3\%$ ($P < 0.001$) and $52.5 \pm 6.3\%$ ($P < 0.002$).

It might be supposed that the effect of adrenalin and acetylcholine on the linguo-maxillary reflex is due to general hemodynamic changes. However, the experimental results showed that general hemodynamic disturbances do not play a decisive role in the action of these drugs on the reflex. For instance, whereas blocking of the reflex by adrenalin and acetylcholine before stabilization of the arterial pressure amounted to $48 \pm 7.3\%$ ($P < 0.01$) and $66.8 \pm 7.9\%$ ($P < 0.01$), respectively, after stabilization of the pressure the corresponding figures were $51.2 \pm 3.5\%$ ($P < 0.001$) and $66.8 \pm 10.9\%$ ($P < 0.01$). In addition, after intraventricular injection of these drugs the arterial pressure level did not change significantly [9, 10], although adrenalin and acetylcholine distinctly inhibited the reflex.

In view of the varied picture of the effects of adrenalin and acetylcholine on the peripheral portion of the autonomic nervous system [5], it might be assumed that blocking of the reflex was due to a change in the activity of the different parts of this system. However, it must be remembered that all the experiments

were carried out after bilateral sympathicovagotomy. Furthermore, injection of the drugs into the lateral ventricle prevents their penetration to the visceral receptors and to the carotid sinus zones; nevertheless, considerable inhibition of the linguo-maxillary reflex took place.

These results suggest that the inhibitory action of adrenalin and acetylcholine on the linguo-maxillary reflex is independent of their effect on the receptors of the peripheral portion of the autonomic nervous system.

To localize the effect of adrenalin and acetylcholine in the central nervous system a series of experiments was carried out after brain section at the intercollicular level and 1.5 mm rostrally to the anterior border of the pons. In these experiments the ability of these drugs to alter the amplitude of the polysynaptic discharges recorded in the central end of the motor nerve was studied. The results showed that intercollicular brain section has no effect on the action of adrenalin, whereas the action of adrenalin on the evoked potentials was slightly weakened (Fig. 1C, D). Probably brain structures located above the level of transection are involved in the mechanism of action of acetylcholine on the linguo-maxillary reflex.

The blocking effect of adrenalin on the linguo-maxillary reflex thus takes place with the participation of the corresponding adrenergic systems of the caudal portion of the brain stem, while cholinergic structures both in the caudal portion of the brain stem and at higher levels of the central nervous system are involved in the depriming action of acetylcholine.

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