INTERACTION BETWEEN SECRETORY RESPONSES TO NICOTINE AND MUSCARINE FROM PERFUSED ADRENAL GLAND OF THE GUINEA PIG

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1. This study aimed to examine the roles of extracellular Ca^{2+} and Na^{+} in agonist-induced catecholamine (CA) secretion from perfused adrenal gland of the guinea pig under continuous stimulation of nicotinic or muscarinic receptors. We also studied the interaction between cytosolic Ca^{2+} responses to nicotine and muscarine in isolated guinea pig adrenal chromaffin cells loaded with fura-2.

2. In the presence of nicotine (30 μM), both adrenaline (Ad) and noradrenaline (NA) secretions evoked by application of muscarine (20 μM) or KCl (56 mM) for 1 min were enhanced.

3. The enhancing effect of nicotine on the muscarinic response almost disappeared in Ca^{2+}-free solution and was blocked by methoxyverapamil (a voltage-dependent Ca^{2+} channel blocker) in a dose-dependent manner. However, it increased in Na^{+}-free solution.

4. In the presence of muscarine (15 μM), only Ad secretion evoked by application of nicotine (30 μM) for 1 min was enhanced, although, under the same conditions, application of KCl (56 mM) for 1 min caused enhanced secretion of both Ad and NA. The enhancing effect of muscarine on the nicotinic response increased in Na^{+}-free solution.

5. There was no interaction between cytosolic Ca^{2+} responses to nicotine and muscarine.

6. These results suggest the following: first, enhancement of CA secretion under continuous stimulation of nicotinic- or muscarinic-receptors was caused by an increase of the Ca^{2+} influx through a voltage-dependent Ca^{2+} channel; second, extracellular Na^{+} acts as an inhibitory factor in this enhanced response; and last, since cytosolic Ca^{2+} responses to nicotine and muscarine did not show interaction, the structure of the adrenal gland may need to be intact for this enhancement to occur.