EFFECTS OF VAGAL STIMULATION ON THE TRANSMEMBRANE ACTION POTENTIALS OF ATRIUM ISOLATED FROM GUINEA PIG

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Received for publication September 7, 1963

The effects of the cardiac nerve stimulation on the transmembrane action potentials of the frog's heart have been shown by Hutter and Trautwein (1). Hoffman and Suckling (2) and Biersteker *et al.* (3) have studied the response of the cardiac action potentials to stimulation of the vagus nerve in the dog and the rabbit *in situ*. However, studies along this line on the isolated mammalian heart with the vagus nerve have not hitherto been reported despite many publications on the modifying effects of vagal stimulation on the rate and the contraction amplitude of the isolated mammalian heart.

The effects of the vagal stimulation on the transmembrane action potentials in the isolated atrial preparations of rabbit and guinea pig are described in this short communication. The composition of the nutrient solution and the recording method of the potentials were the same as those described previously(4). Both vagi were stimulated with square waves, supra-maximal in intensity, 20/sec in frequency and 1 msec in duration.

Stimulation of the vagi did not affect the action potentials recorded from the isolated rabbit's atria (15 preparations), fixed and stretched on the cork plate in the nutrient solution. In 2 of 16 atrial preparations isolated from guinea pigs the same procedure affected the action potentials within 10 to 30 minutes after the fixation.

On the other hand, the vagal stimulation produced a negative inotropic and chronotropic responses on the isolated atrial preparation, suspended isotonicly in the nutrient solution. The effects of vagal stimulation on this preparation were successfully obtained in about 60% of rabbits and 100% of guinea pigs. In addition, the vagal stimulation affected the transmembrane potentials of guinea pig's atrial preparation. As illustrated in Fig. 1, the atrial potential shows a marked shorten-

FIG. 1. Effect of vagal stimulation for 10 sec on the transmembrane action potential of the guinea pig's atrium. A: control, B: the action potential during the stimulation of vagi, C: the action potential 5 sec after the cessation of the stimulation.

ing in the total duration, especially in the phase 2. The shortening was accompanied with the decrease in rate of the action potential duration recovered to original level 10 to 20 seconds after the cessation of the vagal stimulation. The average shortening of the half repolarization time was $25.0 \pm 1.01\%$ ($N=5$). The application of acetylcholine in a concentration of 10^{-8} to 5×10^{-8} produced the similar shortening of the action potential duration. The resting potential and the magnitude of action potential were not affected.

The effects of the deprivation of oxygen supply, the temperature change and the variation of the concentration of cations in the nutrient solution on the responses of the atrial preparations to the vagal stimulation have been investigated in this laboratory (5). By use of the microelectrode further studies are under way.

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