EXPERIMENTAL ANALYSIS OF MACROREENTRY FORMATION IN THE RABBIT RIGHT ATRIUM

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The commonest cardiac arrhythmias found in clinical practice are supraventricular disturbances of the cardiac rhythm, a large proportion of which consists of arrhythmias connected with the atrioventricular (AV) node [3, 8]. The hypothesis has been put forward that reentry formation within the AV node can be explained by assuming the existence of several pathways for the conduction of excitation in the AV node [12, 15]. On the other hand, the accumulation of clinical experience with the surgical treatment of cardiac arrhythmias has shown that several supraventricular arrhythmias can be effectively abolished by cryodestruction of the perinodal regions of the AV node [6, 11, 16]. This realistically describes the situation, for example, when macroreentry, intersecting the region of the AV node, is formed in the atria.

In the present study we concentrated our attention on arrhythmias due to the formation of macroreentry in the atria, with a loop including the region of the AV node.

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Fig. 1. Examples of circulation of excitation in two opposite directions (a and b). Broken line with arrows shows direction of spread of excitation wave. SVC) Superior vena cava, IVC) inferior vena cava, SN) sinus node, CS) coronary sinus. Electrograms recorded at points 1, 2, 3, and 4. Time intervals corresponding to spread of excitation along RA, through AVN, and along IAS, shown on time axis below electrograms. Order of circulation can be determined by numerical values of moments of excitation indicated by series of electrograms. On electrogram 2 (b): A) atrial complex, H) His bundle complex. Remainder of legend and explanation in text.

EXPERIMENTAL METHOD

 Altogether 17 experiments were conducted on isolated preparations of the rabbit atrium. The atrial preparations were obtained by a method similar to that described in [4]. The preparations included the auricle of the right atrium (RA), the interatrial septum (IAS), and the region of the AV node (AVN) (Fig. 1). The isolated preparations were perfused by the standard method with Tyrode solution of the following composition (in mM) NaCl – 136, KCl – 2.7, CaCl2 – 1.8, MgCl2 – 0.5, NaH2PO2 – 4.6, NaHCO3 – to pH 7.35, glucose 2 g/liter. The temperature of the solution was 37 ± 0.5°C. Against the background of periodic stimulation testing stimuli were applied with a delay after the periodic stimulus that could be regulated. Delay of the testing stimulus was changed so that it fell within the vulnerable phase of the cardiac cycle, i.e., to induce tachycardia. A multichannel electrode was used for recording. This electrode was placed on the auricle of the right atrium from the endocardial side. Signals recorded from the 32 electrodes were amplified and led into a measuring and calculating system based on the SM-1600 computer. By means of a special program, isochronous recorder charts (Fig. 1) of the spread of the excitation wave front were constructed from the data of the moments of excitation from all 32 monopolar electrograms. Three additional bipolar electrodes were placed in the region of IAS, on the crista terminalis (CT), and close to the bundle of His (H). Local cooling of the preparation by means of a metal tube, 1.5 mm in diameter, continuously perfused internally with water at 4°C, was used. The tip of the tube was applied to the surface of the preparation, so that the temperature in a local area could be lowered to 10°C.