
CONTRACTILE RESPONSE OF THE MYOCARDIUM OF CARDIAC PATIENTS TO CHEMICAL SCARIFICATION OF THE CELL MEMBRANE

V. I. Shumakov, P. B. Tsiv'y'an, V. S. Markhasin, and E. Sh. Shtengol'd

Strips of myocardium from the auricles of the hearts of patients with mitral stenosis (MS) and patients with cardiac septal defects (CSD) were treated with a solution of EDTA (3 mM) to increase the permeability of the cell membrane (scarification). In a 3 mM solution of ethylene-hexamintetraacetic acid (EHTA), against the background of increased permeability of the membrane to the Ca-EHTA complex, whereby the Ca$^{2+}$ concentration in the myofibrils can be regulated between $10^{-5}$ and $10^{-4}$ M, a mechanical response of the contractile proteins to a change in Ca$^{2+}$ concentration was recorded. Despite identical threshold concentrations ($5 \cdot 10^{-8}$ M) and saturation concentrations ($10^{-4}$ M) of Ca$^{2+}$, strips from patients with MS were found to develop a maximal force per unit cross section of the strip only half as high as preparations from patients with CSD, which suggests a probable lesion of the contractile proteins in the hearts of patients with MS. The ratio between the amplitudes of contraction under conditions of complete calcium activation of the contractile proteins and a single isometric contraction for preparations obtained from patients with MS was 8–10 and from patients with CSD 4–5. It is suggested that this is the result of more profound changes in the apparatus of electromechanical coupling of the myocardium of patients with MS.

KEY WORDS: heart failure; calcium ions; contractile proteins.

Comparison of the parameters of isometric contractions of the myocardium of the atrial auricles of patients with mitral stenosis (MS) and cardiac septal defects (CSD) reveals certain significant differences. On average the time taken to reach the maximum of the isometric contractions has been found to be appreciably longer in the myocardium of patients with MS than in the myocardium of patients with CSD. In MS, moreover, the normal response of the myocardium to an increase in the frequency of stimulation is modified much more often than in CSD, and this is reflected in the total or partial suppression of the Bowditch phenomenon [1, 3].

In view of data indicating a disturbance of the function of the sarcoplasmic reticulum (SR) in cardiac failure [2] it has been concluded that the severer disturbances of the contractile function of the myocardium
Fig. 1. Contractile response of myocardium of patient with CSD (ventricular septal defect) to change in concentrations of Ca$^{2+}$. Several isometric contractions shown at beginning of record. ss) Time of addition of scarifying solution. Vertical lines on curve represent artefact of change of solution.

Fig. 2. Contractile response of myocardium of patient with MS. Legend as in Fig. 1.

Fig. 3. Calcium-mechanical relationship in atrial myocardium of patients with CSD (I) and MS (II). Abscissa, negative logarithm of Ca$^{2+}$ concentration in DHTA solution; ordinate, force developed (in mg/mm$^2$ cross section of strip).