portant role in the mechanisms of action of bradykinin is probably played by its stimulating effect on synthesis of prostaglandins and histamine [10].

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PROSPECTS FOR THE STUDY OF MYOCARDIAL CONTRACTILITY IN HUMAN AUTOPSY MATERIAL

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KEY WORDS: contractility; chronotropism; inotropism.

To study the mechanisms of electromechanical processes in the myocardium in most cases strips of myocardium from experimental animals or biopsy specimens from patients undergoing operations for various heart diseases are used [2, 4, 7]. However, in view of the well-known structural and functional differences between the myocardium of experimental animals and man, some caution must be exercised in the interpretation of the experimental material, whereas results obtained on strips of myocardium taken at biopsy during operations reflect only the function of the pathologically changed myocardium. Moreover, the choice of strips of myocardium removed during surgical operation by the experimenter is very limited. For this reason the possibility of working with strips of myocardium from the heart of patients with diseases not suitable for operative treatment and also of working on strips of heart from clinically healthy subjects is of great interest.

The object of this investigation was to determine whether it is possible to record isometric contraction of strips of myocardium from human autopsy material, to attempt to reproduce the most elementary experiments in chrono- and inotropism, and also to determine the sensitivity of the myocardium to adrenalin, noradrenalin, and acetylcholine.

EXPERIMENTAL METHOD

Strips of the right atrium 0.5-0.8 cm long and 1 × 2 mm thick and the papillary muscles of the right ventricle were placed in a constant-temperature chamber with a volume of 5 cm^3 through which Ringer's

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TABLE 1. Distribution of Material by Age, Cause of Death, Duration of Postmortem Period, and Mechanical Activity of Strips

Age, years	Cause of death	Time between death and start of expt., h	Strip of right atrium	Papillary muscle of right ventricle
5	Automobile accident	1,5	+	+
28	Same	2,5	+	—
87	"	6,0	+	—
85	"	3,5	+	—
30	Ischemic heart disease	3,5	+	—
70	Same	3,5	+	—
39	CO poisoning	2,0	+	+
60	Same	5,6	+	—
74	Automobile accident	4,5	+	—
30	Asphyxia by drowning	2,5	+	+
49	Asphyxia by strangulation	5,0	+	—

Legend: +) preparation worked; −) preparation did not work.

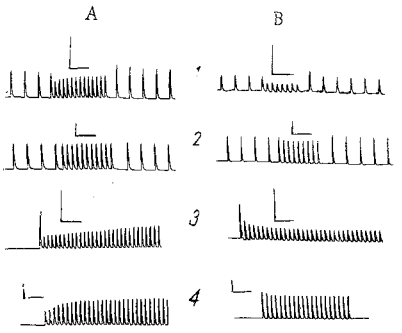

Fig. 1. Contractions of papillary muscles of right ventricle (A) and strips of right atrium (B) of human heart. 1) In normal Ringer's solution during change from basal frequency (0.3 Hz) to higher frequency (1 Hz) of stimulation; 2) in response to addition of adrenalin ($1 \cdot 10^{-5}$ g/ml) to solution; 3) change in force of isometric contraction after interruption of stimulation for 3 min; 4) change in force of isometric contraction after interruption for 3 min in the presence of adrenalin ($1 \cdot 10^{-5}$ g/ml). Calibration: vertical 100 mg, horizontal 5 sec.

solution of the following composition (in mM) was passed: NaCl 118, KCl 2.5, $CaCl_2$ 2.5, $MgCl_2$ 1.2, KH_2PO_4 1.2, glucose 5, $NaHCO_3$ to pH 7.2-7.4. The solution was saturated with a mixture of 95% O_2 and 5% CO_2. The preparations were stretched to obtain maximal contraction. The strength of isometric contraction was recorded by mechanotrons of the 6MKhIS type, the signal from which was photographed from the screen of a type SI-18 CRO and recorded in parallel on a type N 338-3 automatic writer. The preparations were stimulated (amplitude 20-50 V, duration 3-10 msec) by means of platinum electrodes placed in the perfusion fluid. The experiments were started not later than 1 h after preparation of the material at a temperature of 25°C, for at 37°C or at a higher temperature spontaneous contractions frequently arise.

EXPERIMENTAL RESULTS

By the use of the technique described above isometric contraction of strips of right atrium taken from the hearts of persons aged from 5 to 87 years could be obtained. The preparations for the experiments were

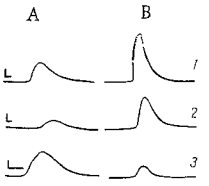

Fig. 2. Changes in force of isometric contraction of strips of human right atrium. A: 1, 2, 3) In normal Ringer's solution; B: 1) in presence of adrenalin ($1 \cdot 10^{-5}$ g/ml), 2) of noradrenalin ($1 \cdot 10^{-5}$ g/ml), 3) of acetylcholine ($1 \cdot 10^{-5}$ g/ml). Calibration: vertical 200 mg, horizontal 0.1 sec.

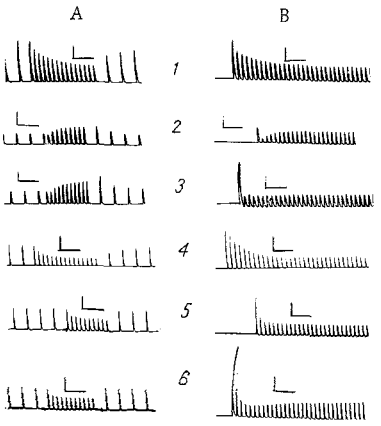

Fig. 3. Changes in force of contraction of strips of atrium and papillary muscles of right ventricle of different experimental animals. A) On change of frequency of stimulation from 0.3 to 1 Hz; B) after interruption of stimulation for 3 min. 1) Papillary muscles of right ventricle of rat, 2) of guinea pig, 3) of rabbit; 4) strip of atrium of rat, 5) of guinea pig, 6) of rabbit. Calibration: vertical 100 mg, horizontal 5 sec.

taken 1.5-6 h after death (Table 1). Mechanical activity of the papillary muscles of the right ventricle could be recorded in only three cases (Table 1). With a change from the basal frequency of stimulation (0.3 Hz) to a higher frequency (1 Hz) a decrease in the force of isometric contraction both of strips of the right atrium and of the papillary muscles of the right ventricle was observed, followed by an increase in the force of contractions of the positive "staircase" type in the strip of right atrium. With a change from the higher frequency (1 Hz) to the basal frequency (0.3 Hz), on the contrary, an increase in the force of contraction was observed, followed by a gradual decrease of the negative "staircase" type (Fig. 1). If the stimulation was interrupted for 3 min, a strong first contraction of the strips of right atrium and papillary muscles of the right ventricle was observed (Fig. 1). Addition of adrenalin ($1 \cdot 10^{-5}$ g/ml) caused an increase in the force of contraction of strips of right atrium. Noradrenalin had a similar action (Fig. 2). Adrenalin "smoothed" the changes in the force of contraction in response both to a change in the frequency of stimulation and to its temporary inter-

ruption (Fig. 1). Addition of acetylcholine ($1 \cdot 10^{-5}$ g/ml) to the perfusion fluid caused a decrease in the force of isometric contraction of strips of the right atrium (Fig. 2). It is interesting to note that the phenomena observed in the experiments on strips of atria of the experimental animals (Fig. 3) were similar to those obtained on strips of the right atrium of human autopsy material.

In view of generally accepted observations [1, 3, 5, 6, 7, 9] that catecholamines exert their effects on myocardial energetics and contraction through adenyl cyclase and the enzyme systems stimulating it, together with the results of the present experiments, it can be tentatively suggested that the functioning of this system in the myocardium persists during the post mortem period studied. The possibility of using autopsy material to obtain biochemical, biophysical, and physiological mechanisms lying at the basis of contraction of the human heart thus cannot be ruled out.

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CORRELATION BETWEEN EEG RHYTHMS AND GASTRIC CONTRACTIONS IN DOGS DURING PHYSIOLOGICAL HUNGER

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KEY WORDS: periodic contractions; frequency spectrum of the EEG; stomach.

Among the ultradian rhythms a rhythm with cycles of 90-120 min, shared by periodic synchronous changes in many physiological functions (blood pressure, respiration rate, cardiac frequency, etc), can be distinguished. One of its clearest manifestations is the rhythm of periodic activity (PA) of the organs of the digestive tract under conditions of physiological hunger. Combined cyclic changes in the secretory and motor functions of organs of the gastrointestinal tract and in other physiological functions suggested that PA may exist in the body in cases other than digestion [2]. Recording PA and behavior of dogs every 5 min in the course of experiments lasting several hours, whether by day or by night, has shown that synchronous changes in the functional state of the CNS are an invariable component of PA. They are expressed as regular changes in the depth of sleep or as awakening of the dogs before the beginning of the next period of gastric activity, and sometimes again immediately after a period of such activity [2, 3].

It was accordingly decided to study possible correlations between CNS rhythms and PA of the gastrointestinal tract, and the investigation described below was undertaken for this purpose.

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