

METHOD FOR CONTINUOUS RECORDING OF THE THICKNESS OF THE MYOCARDIUM

V. S. Sinyakov

Laboratory for the Development of Biophysical Methods of Investigation
(Head, V. S. Sinyakov), Institute of Normal and Pathological Physiology
(Director, Active Member AMN SSSR Professor V. V. Parin), AMN SSSR
(Presented by Active Member AMN SSSR V. V. Parin)

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At the present time there are four methods for the investigation of the mechanical work of the heart; 1) recording pressure in the cavities; 2) recording cardiac contractions; 3) measurement of the mechanical forces developed by the myocardium (strain gauges); 4) measurement of the cardiac diameter (mercury-rubber transducers, ultrasound).

However there is a very important aspect of the mechanical work of the heart, and that is the change in thickness of the myocardium, which has not been studied heretofore. The amount of blood expelled by the heart is determined by the reduction of the volume of the cavities. This in turn depends upon the thickness of the wall. It is therefore clear that this parameter is one of the most important for an evaluation of the functional activity of cardiac muscle as a pump.

We have developed a simple method for the continuous recording of the thickness of the myocardium, for use in acute experiments on animals.

The principle of the device is illustrated in Fig. 1. The potentiometer (1) is a displacement transducer which is coupled with the capron strip (2) 0.35 mm thick and with the return spring (3).

At the end of the strip there is a metallic pin (4) bearing a hole in its center through which the strip passes. The end of the strip is flattened to attach it to the washer. The washer is held by the return spring pressed up against the wall of the heart (5).

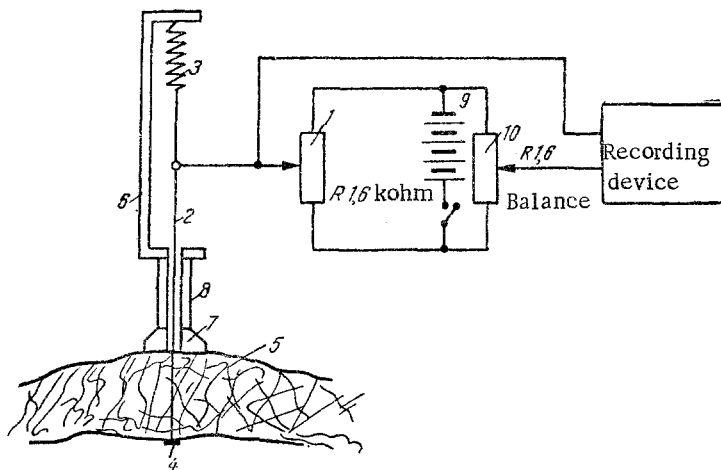


Fig. 1. Diagram of the device for determination of the thickness of the heart wall.

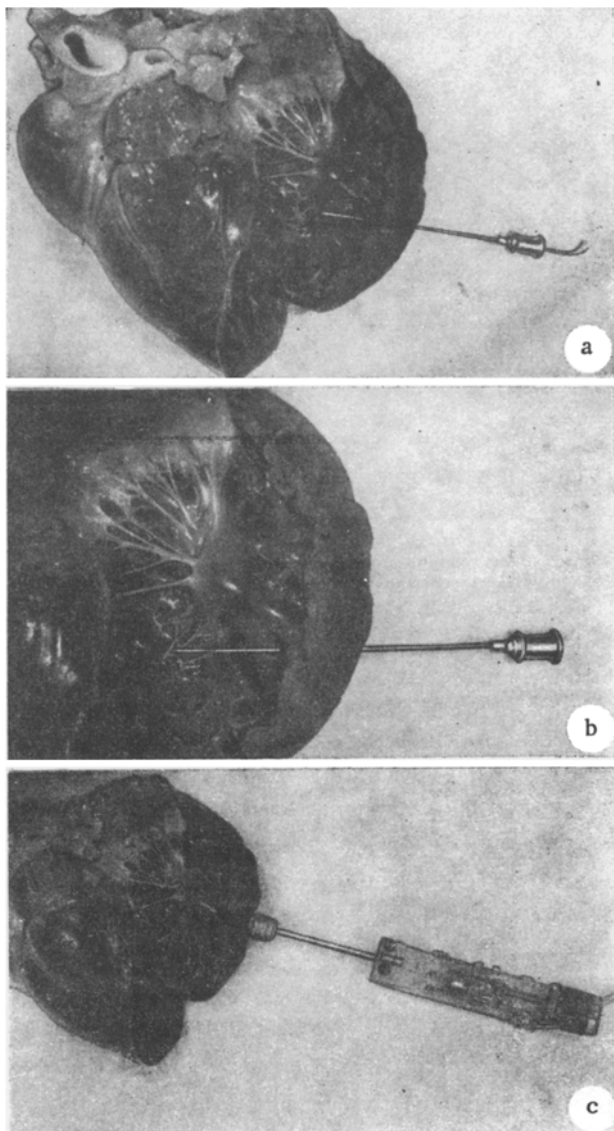


Fig. 2. Sequence of operations for introducing the pin into the cavity of the left ventricle. a) Needle introduced into the cavity of the left ventricle; b) pin pushed out by mandrin into the cavity of the left ventricle; c) needle removed from the aperture, the device is pressed up against the surface of the heart, the strip is passed into the aperture of the foot and the tube and is fastened to the slider of the potentiometer.

Figure 2 shows the sequence of operations for introducing the pin into the cavity of the left ventricle. The pin is first fixed to a No. 17 injection needle having an external diameter of 1.2 mm. A mandrin is placed behind the pin.

A. V. Mareev and I have tested this device on a dog. The change in thickness of the left ventricle was recorded together with the pressure in its cavity and the ECG, on a 6-channel "Kardiovar" electrocardiograph (Fig. 3).

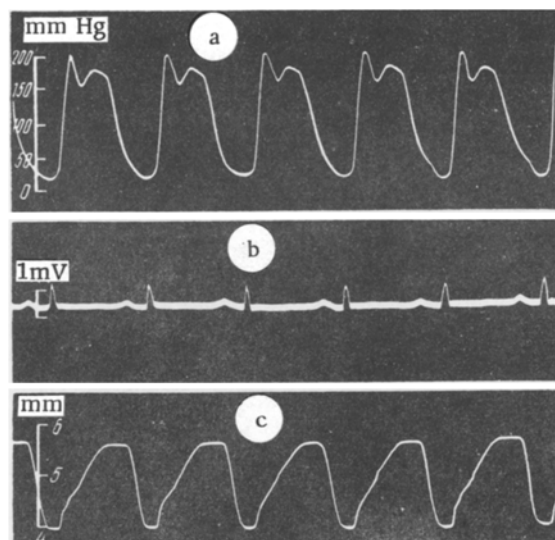


Fig. 3. Curves of: (a) pressure in the left ventricle; (b) EKG, and (c) thickness of the myocardium.

Potentiometer (1) is fixed to a base (6) connected to a tube (8) which in turn is firmly fixed to a foot (7). To prevent the possibility of artefacts due to distortion of the cardiac wall by the foot, the latter may be sewn to the epicardium.

Thus movement of the potentiometer during the cardiac cycle is proportional to the change in the thickness of the wall.

Potentiometer (1) and potentiometer (10) form a bridge supplied from storage cell (9). The potential across the diagonal of the bridge, i.e., across the riders of the potentiometers is taken to any recording device. The bridge may be balanced by turning the control knob of the potentiometer (10).

The potential of the storage cell supplying the bridge is chosen in relation to the recording device. For potentiometers up to 1.6 kohm, and for recording on a 6-channel cardiograph type "Kardiovar", the potential may be 24 v.

All the connecting leads and the storage cell must be screened to avoid picking up unwanted voltages. The device is calibrated after the experiment by means of calipers which determine the distance between the pin (4) and the foot (7).

SUMMARY

A simple instrument for continuous recording of the thickness of the myocardial wall with the aid of a recording potentiometer is described. The experimental curves presented show the relationship between the ECG, the pressure in the cavity of the left ventricle, and changes in thickness of the myocardial wall.