KYMOGRAPHIC RECORDING OF THE PRESSURE IN THE RIGHT VENTRICLE OF RABBITS AND CATS

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In recent years increased use has been made of electronic devices for recording blood pressure in different parts of the cardiovascular system. They are used to greatest advantage in cases where there is a need to determine blood pressure changes at different phases of the cardiac cycle. Nevertheless, for certain problems the ordinary kymographic method of recording various hemodynamic indices is justified.

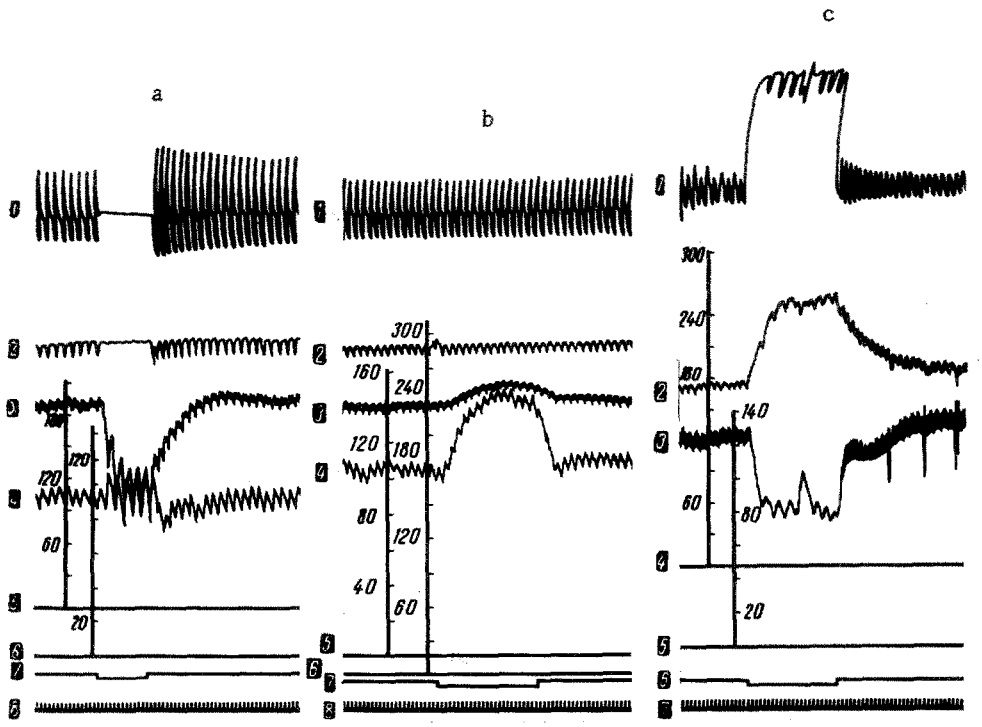
The use of a mercury manometer for the kymographic recording of the pressure in the right ventricle of such laboratory animals as the rabbit and cat involves considerable difficulties because the comparatively low pressure in the small circulation makes it difficult to obtain a sufficient amplitude of pulse pressure on account of the mercury. Also small changes of blood pressure may pass unnoticed. This is a serious drawback because when the initial blood pressure is low changes of the order of 1-2 mm of mercury are significant.

The use of a water manometer is useful for this purpose from the point of view of sensitivity, but presents a number of other difficulties. Water manometers consist of a single column, and therefore the height of such a tube may be many times greater than that of its mercury counterpart. Also, in a manometer of this kind, during the experiment blood from the blood vessel to which the device is connected will become mixed with the fluid filling the manometer and the connecting tubes of the recording system. In experiments on small animals effects can be obtained from movement of the blood into the manometer during the investigation of various influences affecting the circulation.

To eliminate such effects what is needed, in the first place, is a U-type manometer, and secondly it should have a sensitivity equal to that of the water type, and the internal diameter should be reduced as much as possible. The use of a U-shaped manometer is possible if there is a division between the fluid which fills it and the isotonic sodium chloride solution filling the system of tubes connecting the manometer with the right ventricle (through a catheter). In use, these fluids must be excluded from the manometer.

To observe these conditions we filled the manometer with carbon tetrachloride ($CC1_4$). There is practically no mixture with the isotonic solution because of the negligible solubility of $CC1_4$ in water (0.08 g per 100 g water at 18-20°). As far as sensitivity (frequency charcateristic) is concerned this fluid is far superior to mercury because the specific gravity of $CC1_4$ is 1.595 (at 18-20°). This circumstance also allows the internal diameter of the manometer tube to be reduced, because the float which should remain on the surface of the fluid in the free arm of the manometer may be reduced in volume below the value required for a water manometer. We used a ma - nometer tube having a diameter of 4 mm.

A light float carrying a capillary glass rod (diameter 0.8 mm) is lowered in the usual way into the open arm of the manometer; but before this is done, 0.2-0.3 ml of distilled water are added. The float sinks in the water but remains on the surface of the $CC1_4$ column. The weight of the float together with the rod (length 26 cm) and writer was 0.35 g. The rod of the float and its point of exit from the manometer passed through the aperture in the center of the glass plug which is inserted in the end of the "open" limb of the manometer. A well-chosen float follows accurately all movements of the fluid in the manometer, so that an accurate record of the pressure is obtained.



Kymograms recorded during experiments on rabbits (a, b) and on a cat (c). 1) Respiration (trachea); 2) respiration (pneumograph); 3) pressure in reight ventricle (2—in fig. c); 4) arterial pressure (3—in Fig. c); 5) base line of manometer, recording pressure in ventricle (4—in Fig. c); 6) base line of mercury manometer (5—in Fig. c); 7) stimulus marker (6—in Fig. c); 8) (7—in Fig. c); time marker (1 second) . Pressure scale in mm mercury.

For a long time this manometer has been used for recording pressure in the right ventricle of rabbits and cats. The diagram shows kymograms taken from different experiments in which,along with other quantities,we recorded the pressure in the right ventricle (pressure scale in the diagram is in mm of water) .

SUMMARY

A fluid manometer used for kymographic blood-pressure recording is described. It may be employed for recordings from regions of the cardiovascular system where the blood pressure in relatively low (particularly in the right ventricle) of rabbits and cats. Carbon tetrachloride was used as a fluid for this manometer.