METHOD OF DETERMINING THE VELOCITY OF THE BLOOD FLOW IN SMALL LABORATORY ANIMALS

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A method of determining the circulation time in albino rats in the segment from the lungs to the dorsal skin by means of an oxyhemograph is described. A value of 7.7 ± 0.5 sec was obtained for this parameter.

The velocity of the blood flow (VBF) is rightly regarded as among the most important of the hemodynamic indices. Various methods of recording the VBF in man have been described, including that based on the use of an oxyhemograph [1, 3]. No descriptions of methods of determining the VBF by an oxyhemographic method in laboratory animals, especially small animals (albino rats), could be found in the accessible literature.

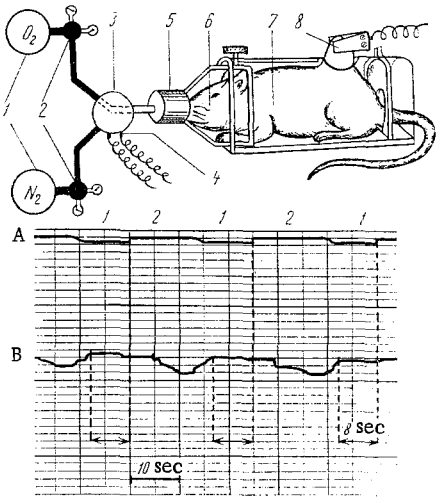

Fig. 1. Recording of CT of an albino rat. Above: diagram of apparatus (explanation in text). Below: graphic record of CT. A) Marker of supply of nitrogen (1) or oxygen (2); B) oxyhemogram; graphic calculation of CT (in this case 8 sec) shown by broken lines; to be read from right to left.

The suggested method consists of determining the time required for displacement of the oxyhemographic curve in response to inhalation of nitrogen after preliminary breathing of oxygen. In this way the circulation time (CT) is obtained, and the VBF can be estimated from it.

The determination is easy in practice, and its details are as follows (Fig. 1). The albino rat is placed in a modified Kogan's immobilizing chamber [2]. The modifications to the chamber are as follows: the head part of the chamber (6) is fitted with a special mouthpiece (5) and bypass valve (3), with an electrical contact for operating the marker which indicates the beginning of nitrogen administration, attached to the tape-winding mechanism of the oxyhemograph. The bypass valve is connected with the oxygen and nitrogen cylinders (1) through reducing valves (2). In the upper part of the chamber (7) a special window is cut out, through which the fold of skin to which the probe of the oxyhemograph is secured is exteriorized. As a preliminary measure the skin at this point is treated with Nikiforov's mixture. The probe of the instrument is secured to a fold of dorsal skin in the same place, 1 cm below the costal margin. In this way the CT is recorded in the segment: lungs–blood vessels of the dorsal skin. The CT is recorded on a type 036-M oxyhemograph adapted for high-speed winding of the paper tape (up to 2 mm/sec).

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After preliminary heating of the tissues by the small lamp of the probe, the oxyhemogram was recorded during inhalation of oxygen. The oxygen supply to the head part of the chamber was then replaced for 10-15 sec by a supply of nitrogen and the time from the moment of its entry into the chamber to the beginning of the deflection of the oxyhemographic curve (Fig. 1) was measured. This gave the value of the CT, from which the BVF could be estimated.

The CT was determined several times in succession in the same animals and the arithmetic mean value calculated. In investigations on intact albino rats, the CT for the segment of the blood stream from the lungs to the dorsal skin vessels was 7.7 ± 0.5 sec (4-10 sec). Differences in the value of the index were eliminated as a result of the repeated measurements. Besides the method of determining CT described above, a polarographic method of its determination described by Chernyakov [5] also was tested. A series of experiments was carried out in which the CT was recorded simultaneously by two instruments: the oxyhemograph and the polarograph. The marker of administration of nitrogen was operated on both instruments simultaneously, thus facilitating comparison of the results.

The Soviet PA-3 polarograph with certain modifications and improvements [4] was used. The active electrode, consisting of a metallic needle with an exposed platinum surface of about 0.05 mm^2, was inserted into the skin fold to which the oxyhemograph probe was secured. The reference electrode was a calomel electrode with KCl agar bridge, fixed to the animal's tail.

The CT recorded polarographically was found to be significantly ($P < 0.001$) longer than when recorded by the oxyhemographic method, and its value was 14.4 ± 1.2 sec (9.1-19.7 sec). The possible explanation is that when CT is determined by the polarographic method, the time taken for oxygen to diffuse from the blood vessels into the tissues is also recorded.

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