METHOD FOR DETERMINATION OF THE ARTERIAL PRESSURE IN THE LABORATORY ANIMALS WITHOUT BLOOD LOSS

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In the usual bloodless method for determination of the arterial pressure in dogs or rabbits an operation is performed to bring the common carotid out onto the neck on a fragment of skin [5]. The operation is quite difficult. Also compression of the common carotid causes an increase of arterial pressure through its influence on the pressoreceptors [11]. Some authors have therefore attempted to measure the arterial pressure in the superficial arteries of the limbs [1, 6, 7]. However contraction of the large muscles which occurs regularly on compression of the limbs [8] greatly complicates determination of the pressure in these arteries.

For chronic experiments on dogs, cats, and rats we have found that the caudal artery is the most convenient blood vessel for bloodless determination of arterial pressure.

The device required for determination of the arterial pressure in dogs and cats from the caudal artery is extremely simple (Fig. 1). The tail is shaved for a considerable distance, and a compression sleeve (1) and plethysmometer (3) are fitted. The sleeve consists of a glass tube of appropriate dimensions fitted with a thin-walled rubber jacket which is hermetically joined to the edges of the aperture.

The sleeve is connected with a Riva-Rochi tonometer. The plethysmometer consists of a glass tube connected through a rubber join (9) to capillary (4) and by means of tube (2) with vessel (6) may regulate the level of water in the capillary (4).

To prevent water passing between the tail and the edges of the plethysmometer we have used a special paste made of equal parts of lanoline, colophony, and beeswax. The melting point of the paste is 52-54°. It must be warmed before use.

The tail is kept still by means of clamp (8), which holds it horizontal. When tube (2) is closed by clamp (7) oscillations of the water column appear in capillary (4) due to pulsation of the caudal artery. To amplify these pulsations the tail region in the plethysmograph should be warmed with an ordinary electric lamp. As the pressure in the compression sleeve is gradually raised by the Riva-Rochi tonometer the amplitude of the oscillations of the water column is reduced. The pressure at which the oscillations cease is equal to the arterial pressure.

Instead of the water plethysmometer described above an electroplethysmograph may be used. For this purpose we have used a finger plethysmograph made in Hungary (Triodin II). It is connected to a suitable cathode ray tube (for example: ÉNO-1, VÉKS-2); on the screen the pulsations of the caudal artery can be seen, as will any changes in this pulsation relating to compression of the tail. These changes may be photographed or recorded by an electrocardiograph. As a transducer we have used the plethysmometer described above. Water from the plethysmometer is removed and tube (2) is connected with the finger electroplethysmograph. Capillary (4) is removed and rubber join (9) is closed. Such a transducer is much simpler and more convenient than the miniature Marey's capsule recommended in [2], or than a microphone [12], etc.

The plethysmometric method has been widely used for the bloodless determination of arterial pressure in rats [3, 4, 9, 10]. However pulsation in the caudal artery of rats is too weak to induce oscillations of the water column in the capillary of the plethysmometer. Therefore the pressure in the compression sleeve is initially raised above the arterial pressure level, and then gradually reduced until the lumen of the artery opens somewhat, allowing blood to

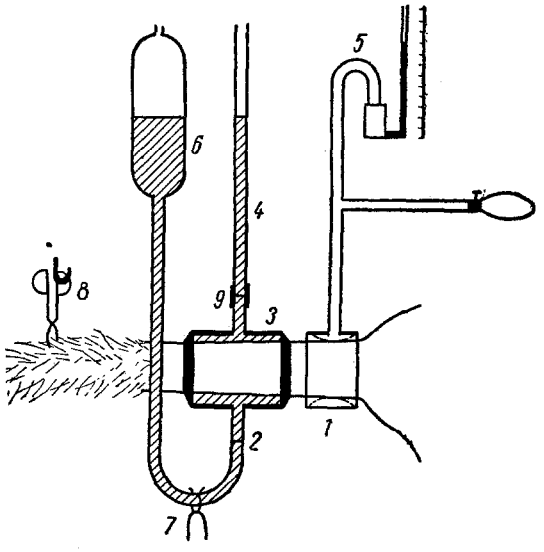

Fig. 1. Diagram of the device for determination of the arterial pressure in dogs and cats from the caudal artery. 1) Compression sleeve; 2) tube for filling the plethysmometer with water; 3) casing of plethysmometer; 4) capillary; 5) Riva-Rochi tonometer; 6) vessel for filling plethysmometer with water and for regulating the level of water in the capillary tube; 7) clamp; 8) clamp for holding the tail horizontal and restricting movement; 9) rubber join.

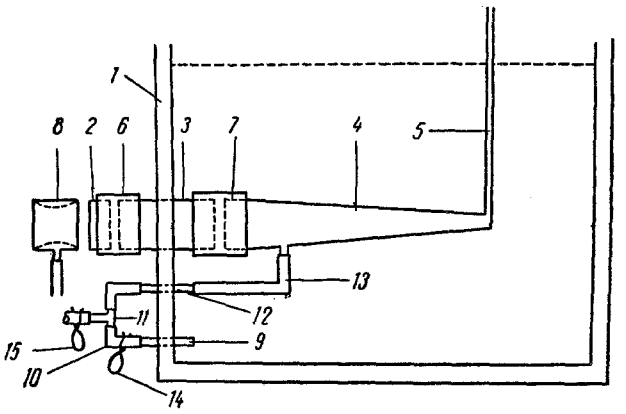

Fig. 2. Diagram of device for determination of the arterial pressure in rats from the caudal artery. 1) Water bath; 2) glass ring; 3) metal tube; 4) plethysmometer case; 5) capillary tube; 6) connecting tube made from leukoplaster; 7) rubber connecting piece; 8) compression sleeve; 9) metal tube; 10) rubber tube; 11) glass tube; 12) metal tube; 13) rubber tube; 14 , 15) clamps.

flow to the periphery. Because the caudal veins are closed at the same time, the volume of the tail begins to increase rapidly, as shown by an increased level of the water column in the capillary. The value of the pressure at which the rise in level occurs is taken as representing the arterial pressure in the caudal artery.

The method however is not without its shortcomings which make the application no easy matter. The chief difficulty is that the tail in the plethysmograph is not in direct contact with the water but separated from it by a fine rubber casing which may protrude through the slit formed between the tail and the edges of the opening of the plethysmometer. Therefore in experiments on rats we did not use the rubber casing but placed the tail directly in water.

A diagram of the apparatus is shown in Fig. 2. To determine the arterial pressure we fitted a compression cuff (8) to the base of the tail. By means of the paste described above we attached ring (2) was fixed by means of leukoplaster (6) with the metal tube (3). The plethysmometer was placed in a metallic or plastic water bath (1) which was kept at 40°. After removal of the clamp (14) warm water from the water bath flows along the system of tubes (9-13) into the plethysmometer, surrounds the tail and rises in capillary tube (5) to the level of the water in the water bath*. The warm water acting for 10-20 minutes induces hyperemia of the tail which is a necessary condition for determination of the arterial pressure by this method. At the start of the determination clamp (14) is returned to the previous position. At the end of the experiment the water must be removed from the plethysmometer. To do so clamp (15) is removed. To accelerate the work three or four of the plethysmometers just described may be mounted in a water bath.

We immobilized the rats in a device which does not differ from those described by other authors [3, 4, 9].

SUMMARY

The article presents the aqueous-plethysmometric and electroplethysmometric methods of bloodless determination of the blood pressure in the caudal artery of dogs, cats, and rats. In the aqueous-plethysmographic method the gap, formed between the edges of the plethysmometer opening and the tail is filled with a paste consisting of a mixture of lanoline, colophony, and beeswax.

*In this way and during the experiment the zero position of the water column in the capillary may rapidly be restored.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. ***Some or all of this periodical literature may well be available in English translation.*** **A complete list of the cover-to-cover English translations appears at the back of this issue.**
