

METHODS

THE METHOD OF BALLISTOCARDIOGRAPHY IN CHRONIC EXPERIMENTS ON DOGS

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As a method of clinicophysiological investigation of the contractile function of the myocardium, ballistocardiography has been widely used abroad, and in recent years it has begun to be developed in the Soviet Union [1-3, 5, 6].

The use of this method experimentally on animals is necessary also when observations are being carried out on the hemodynamic manifestations of experimental lesions of the cardiovascular system (experimental arteriosclerosis, myocardial infarction, artificial defects of the heart and so on), and in the solution of a number of cardinal problems of the theory of ballistocardiography a whole host of difficulties is encountered. These are mainly concerned with the necessity of ensuring complete muscular relaxation of the animal at the time of recording the ballistocardiogram (BCG). In consequence of this, the majority of the existing methods of experimental recording of the BCG are used in acute experiments on anesthetized laboratory animals [4].

It is clearly of the greatest interest to clinical physiology to be able to record the BCG during a chronic experiment. In such cases repeated recordings on the same animals would be possible, and consequently observations of a dynamic character would be facilitated on animals in various physiological states or at different stages of development of an experimental pathological condition. From this point of view Darby's method [7], with which the BCG can be recorded in chronic experiments on dogs, is in our opinion the most promising.

Darby's method is as follows. Into the spinous processes of T_6 - L_5 of an anesthetized dog are inserted nylon threads by means of which a curved aluminum rod, 25-40 cm long and weighing 40-60 g, is attached to the spine; the rod projects 15 cm beyond the sacrum and to its end is attached an Arbeit feeder. The dog is placed prone, its head is supported and its spine is made as flat as possible. The dog lies on a rubber sheet.

According to the authors' paper, the BCG recordings made 2 weeks after insertion of the nylon threads were inferior in unanesthetized dogs to anesthetized, since many artefacts were observed because of muscular contractions and respiration. Thus, among the disadvantages of this method are such complicating factors as insertion of nylon threads operatively into the spinous processes of the vertebral column under anesthesia, and the occurrence of numerous artefacts during recording of the BCG on unanesthetized dogs.

While engaged in developing a method of recording certain hemodynamic indices in chronic experiments on dogs, we discovered a means of obtaining a BCG of perfectly satisfactory quality (Fig. 1) in unanesthetized dogs. For recording the BCG we used a Dock electromagnetic feeder. The feeder is fixed to the animal's body as follows: a duralumin plate, bent to the shape of the animal's spine, is firmly fixed to the vertebral column and sacrum by rubber bands (Fig. 2); there are tags along the edge of the plate to which the rubber bands are attached; these pass beneath the abdomen of the animal to the opposite side of the plate; at its wide part the plate is fixed to the sacrum by a rubber band passed under the groin and fixed to the plate on the same side again.

At the end of the wide portion of the plate are mounted the coils of the Dock feeder, made of organic glass. These are fixed by side pieces of the same material to an organic glass plate which is attached by copper screws to the duralumin plate. In order to minimize the risk of breakage of the feeder by accidental movement of the

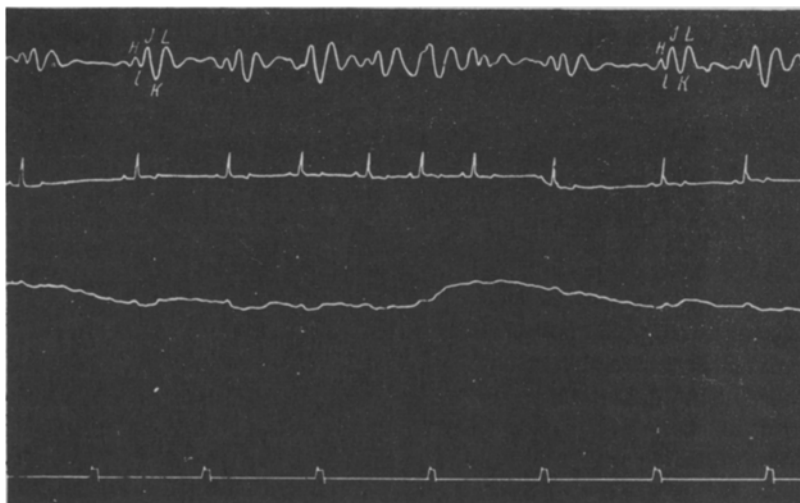


Fig. 1. Ballistocardiogram of an unanesthetized dog. (Recording made with a 4 PFD 7 apparatus for functional diagnosis).

Explanation of tracings (from above down): ballistocardiogram of rate, electrocardiogram (lead II), respiration, time marker (1 second).

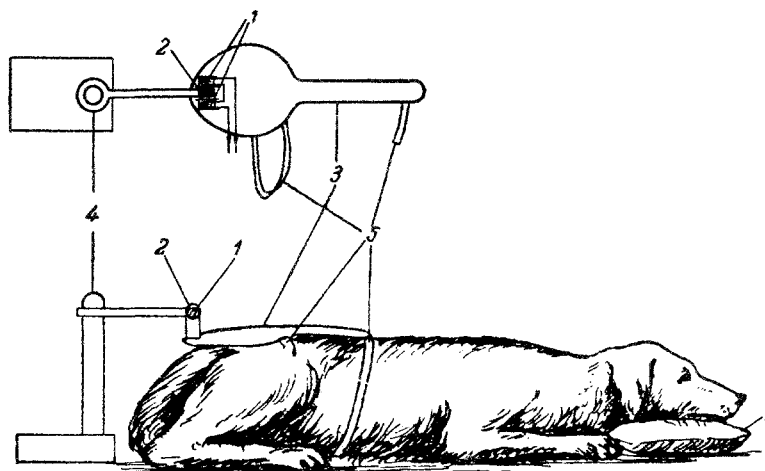


Fig. 2. Position of the animal and feeder during recording of the BCG. 1) Feeder coil; 2) flat magnet; 3) aluminum plate fixed to the region of the sacrum; 4) stand for the magnet; 5) rubber bands fixing the plate to the body of the animal; 6) sandbag pillow.

dog, the distance between the coils is increased to 17 mm. Further, to maintain adequate sensitivity of the feeder, the number of turns in the coil windings must be taken to 12,000. The feeder projects 3 cm beyond the border of the sacrum. The dimensions of the duralumin plate are as follows; over all length of the plate 36 cm, width of the narrow portion 6 cm and of the wide portion 20 cm, thickness 1.1 mm. Weight of the plate and feeder 235 g.

The experiment is preceded by a definite preparation of the animal. Dogs designated for BCG recording are accustomed to lying prone on a sand tray with their spine extended. For this purpose a sandbag is placed under the animal's head so that its forepaws are situated at the side of the sandbag (See Fig. 2).

By the method described above, a bent duralumin plate of the given dimensions, without feeder, is fixed to the spine and sacrum of the animal. On the sand behind the dog, on a firm stand, is mounted a flat magnet. After

2-3 weeks of such training, when placed on the familiar apparatus, the animal lies in what has become a usual pose, perfectly motionless and with its muscles relaxed, which permits the BCG to be recorded.

It is desirable for the work to be carried out in a room which is insulated from outside stimuli. This shortens the period of preparation and improves the quality of the BCG recording. We performed the experiments in a conditioned reflex chamber, and whereas the dog was placed in the chamber, the experimenter and the recording equipment were in an adjoining room.

The method suggested for direct ballistocardiography during chronic experiments on dogs is simple and does not require the animals to be anesthetized before the recording of the BCG is made. The need for a special operative procedure is eliminated.

Drawbacks of the method include the necessity for preliminary preparation of the animal and also the fact that during the experiment, the operator must have an assistant near the animal.

SUMMARY

The method which is suggested in this paper permits to record the ballistocardiogram of nonanesthetized dogs in chronic experiments using the Dock's electromagnetic feeder. If the dogs are trained beforehand to lie in the necessary position with a feeder fixated on the sacrum it is not necessary to anesthetize them.

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