

## CHANGES IN THE ACTIVITY OF THE CARDIOVASCULAR SYSTEM AND RESPIRATION IN DECORTICATION

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The problem of the effect of decortication on the activity of the cardiovascular and respiratory systems has been the subject of investigation by the laboratories of B. I. Bayandurov [7], V. N. Chernigovskii [28], E. A. Asratyan [1-4], S. I. Frankshtein [25, 26], M. V. Sergievskii [21, 22], and N. Yu. Belenkov [8], as well as the works of N. T. Shutova [29], F. Z. Meerson [17, 18], A. A. Uzbekov [24], P. F. Avtonomov, A. A. Kremin [2], and other authors. There are available data that the disturbance of the anatomical unity of the higher sections of the central nervous system leads not only to functional, but also to structural changes of the elements of the cardiovascular system [11, 27]. This problem has not been sufficiently studied as yet, especially under conditions of a chronic experiment, and the method of electrocardiographic examination was employed in a few works only [14, 18]. Also insufficient studies have been devoted to the reactivity of the cardiovascular system and respiration of decorticated animals subjected to specific strains which contribute to the elicitation of changes in their functional state.

Our previous experiments demonstrated [6] that functional disturbances of the circulation and respiration apparatus in decortication are not always clearly manifested. In this connection, the task of present investigations was elucidation of the range of compensatory possibilities and the study of the cardiovascular system and respiration after a uni- and bi-lateral removal of the cortex of the large cerebral hemispheres. We used for this purpose pituitrin—the hormone of the posterior hypophyseal lobe which possesses strong vasomotor properties.

### METHODS OF EXPERIMENTS

The tests were carried out on rabbits of the chinchilla species, weighing 2.0-2.5 kg. The blood pressure in these animals was measured via the blood stream prior to the operation and at various periods after it. The blood pressure and respiration were recorded on a kymograph. The electrocardiogram (ECG) was recorded in three standard leads—I, II, and III—by means of a battery powered ÉKP-4 electrocardiograph, and in a number of tests with a one-channel mesh ÉKPS-1 electrocardiograph; simultaneously, for visual observation, an electrocardioscope was cut in. At the start of the experiment, the initial level of blood pressure and respiration was established and an ECG taken. Then, the rabbit received intravenously pituitrin, 0.3-0.6 units per kg weight. The blood pressure, respiration, and ECG were recorded at the moment of pituitrin administration and within 30 seconds, 1, 3, 5, 10, 20, and 30 minutes after injection of the hormone. Nembutol narcosis was employed (0.025-0.03 gm per kg weight). Decortication and feeding of decorticated animals was carried out, according to the previously described method [5]. A total of four series of experiments on 45 animals was carried out.

The first three series were conducted on 12 rabbits which were examined within 1, 2, and 4 weeks following decortication; the 4th series—on nine normal rabbits in which the changes of the ECG, blood pressure, and respiration under the effect of pituitrin were studied under conditions of acute experiments. In the experimental animals, a uni- and bi-lateral decortication was performed; thus, the first three series comprise equal numbers of rabbits with uni- and bi-lateral decortication.

## RESULTS OF EXPERIMENTS

Following decortication, especially a bilateral one, the postoperative period had a difficult course. But the basic indexes of the cardiovascular activity (blood pressure, rate of cardiac contractions, ECG, and respiration) showed only slight changes following decortication. During the first few days after the operation, a slight retardation of the rhythm of respiratory movements was noted, and in a number of instances a slight increase of their amplitude. More marked and prolonged respiratory changes were noted in bilateral decortication (Fig. 1).

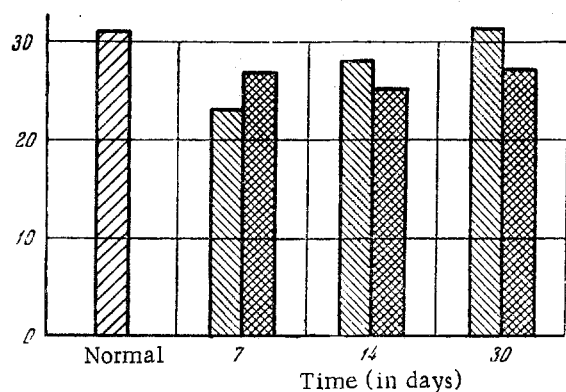


Fig. 1. Changes in the rate of respiratory movements in a rabbit after decortication. Obliquely crosshatched columns—unilateral decortication, mesh-columns—bilateral decortication.

took place within 30-40 minutes; in animals, examined a month after decortication, the character of restoration of respiration after pituitrin injection differed little from that of the control animals.

Injection of pituitrin in control animals caused a rise in the level of arterial pressure of 20-40 mm of mercury column, reaching its maximum on the 2nd-3rd minute after the injection. The maximum rise of arterial

During this period there were changes observed in the rate of cardiac contraction. A certain deceleration of the cardiac rhythm was observed in all experimental animals directly after the operation. However, already within a week after decortication the pulse rate in some animals reverted to norm. These findings are possibly explained by the sharp reduction in the activity of the animals. Various external stimuli are unable to exert their effect when the cortical apparatus which regulates organic functions is absent.

Injection of pituitrin caused (in non-operated rabbits) either a reduction of the amplitude of respiratory movements, or more often their complete cessation. Normalization took place within 10-15 minutes. Restoration of respiration following administration of pituitrin in decorticated animals proceeded slower than in norm. Normalization of respiration in rabbits within one and two weeks after decortication

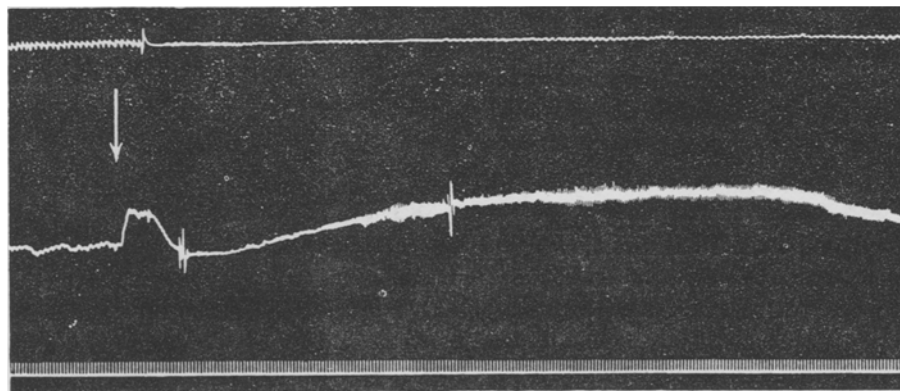


Fig. 2. Changes in arterial pressure and respiration under the effect of pituitrin in a control rabbit. Designation of curves (top to bottom): arterial pressure; time mark (one second). Arrow points to the moment of pituitrin injection.

pressure was accompanied by a sharp increase of the amplitude of cardiac contractions. Normalization of these indexes took place within 10-15 minutes after the injection (Fig. 2). The electrocardiographic changes in intact rabbits under the effect of pituitrin consisted of the development of bradycardia, prolongation of the diastole, increase of R and T waves, and reduction of the P wave. These phenomena increase for a period of four minutes, then the ECG reverts to norm toward the 10th minute.

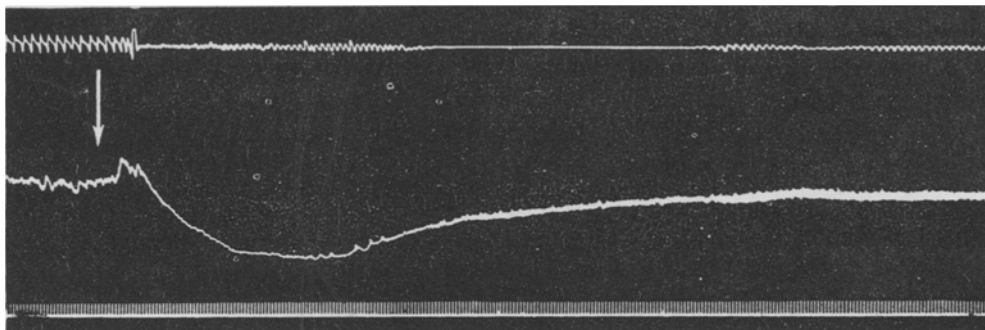


Fig. 3. Changes in arterial pressure and respiration under the effect of pituitrin in a rabbit after a bilateral decortization. Designations the same as in Fig. 2.

Within a week after decortication, there was observed under the effect of pituitrin a more pronounced deceleration of the cardiac rhythm than in the control animals and the emergence of occasional ventricular extrasystoles. Normalization of ECG indexes is retarded by 20-25 minutes. The pressor effect from the injection of pituitrin to these animals is less manifested than in control animals. Following normalization of cardiac activity, the arterial pressure was still at a lower level than prior to pituitrin administration.

Two weeks after decortication, injection of pituitrin caused more pronounced changes in the activity of the cardiovascular system: immediately after the injection the arterial pressure decreased by 20-40 mm, and the subsequent pressor effect did not exceed 10-15 mm (in norm it usually equals 20-40 mm). The arterial pressure kept decreasing and became stabilized at a lower than initial level. Evidence of reduction of the contractile property of the myocardium as well as deceleration of the rhythm of cardiac activity, following pituitrin administration, can be observed even 20-30 minutes after the injection.

Normalization of ECG in rabbits within four weeks after decortication against the background of the pituitrin action is even more retarded. Injection of pituitrin caused rotation of the cardiac axis to the left (negative T wave), as well as symptoms of overtaxation of the left ventricle. The pressor reaction of the cardiovascular system to pituitrin administration is considerably less expressed as compared to norm and is very often absent altogether (Fig. 3).

Thus, our studies demonstrated that under conditions of decortication there is an inadequacy of compensatory possibilities of the cardiovascular system and respiration which manifests itself, when increased demands are brought upon the organism. It is possible that decortication has impaired the functional capacity of the lower sections of the central nervous system, thus leading to the above-described disturbances.

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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.

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