

REACTIVITY OF THE CARDIOVASCULAR SYSTEM IN EXPERIMENTAL NONINFECTIOUS PERITONITIS

Communication II. Reaction to the Intravenous Injection of Acetylcholine and Potassium Chloride

P. P. Gusach

From the Department of Pathological Physiology (Head, Prof. M. M. Smyk)

of the Luga Medical Institute (Dir., Prof. E. I. Pal'chevskii)

(Presented by Active Member AMN SSSR V. N. Chernigovskii)

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As we showed in the previous communication [1], in experimental noninfectious peritonitis, the character of the reaction of the cardiovascular system to the intravenous injection of adrenalin and caffeine is modified. In rabbits with peritonitis, a predominantly depressor reaction appears after the injection of these substances, i.e., the tone of the cholinergic part of the nervous system is observed to be increased.

In the present communication we have attempted to examine whether—and if so, how—the reaction of the cardiovascular system to the intravenous injection of acetylcholine and potassium chloride is modified in animals with peritonitis.

EXPERIMENTAL METHOD

The experiments, which were carried out on rabbits, consisted of four series, with 5 rabbits in each series. In the first series, we studied the reaction of the cardiovascular system of healthy animals to the injection of acetylcholine (0.002 mg/kg body weight) and in the second series, to the injection of potassium chloride (2 ml of a 2% solution). In the third and fourth series, 18-20 hours before the experiment noninfectious peritonitis was induced in the rabbits by means of the method described in the previous communication [1].

EXPERIMENTAL RESULTS

During the analysis of the pattern of changes in the blood pressure, we took into account the duration of the phase of lowering the pressure, its minimum level, the duration of restoration of the original pressure, and the magnitude of the fall in pressure from the initial level.

These results are shown in Tables 1 and 2.

Analysis of the data shows that, in rabbits with peritonitis after injection of acetylcholine, the arterial pressure fell considerably and reached its minimum

level more quickly than in the control animals; the fall in pressure in these animals was almost 2.5 times greater than in the controls. Another characteristic feature of the change in the blood pressure in rabbits with peritonitis was the sharp retardation (five-fold) of its return to its initial level (Fig. 1).

In response to the injection of acetylcholine, the cardiovascular system in rabbits with peritonitis thus reacted by a greater fall in the arterial pressure and also by a slower return to its original level.

It can be seen from an analysis of the changes in the arterial pressure after injection of potassium chloride that, in rabbits with peritonitis, it reached its minimum level slightly more slowly. However, this level was lower than in the control animals. The degree of the fall in pressure in the rabbits with peritonitis was considerably greater than in the controls, but the time of its return to the initial level was only two-thirds of that in the controls (Fig. 2).

Thus, in rabbits with peritonitis, in response to the intravenous injection of potassium chloride, the blood pressure fell much more than in healthy rabbits, but the fall developed slightly more slowly.

The results described show that, in rabbits with peritonitis, after injection of potassium chloride, the

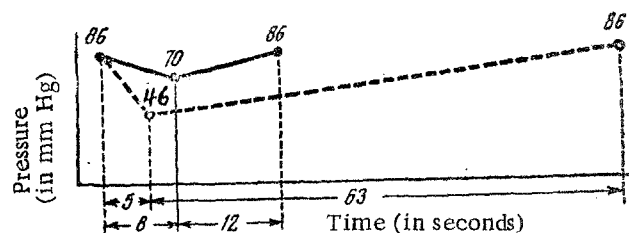


Fig. 1. Trend of the changes in the arterial pressure in healthy rabbits (—) and rabbits with peritonitis (---) after intravenous injection of acetylcholine.

TABLE 1. Values Showing the Pattern of the Changes in Blood Pressure of Rabbits after Injection of Acetylcholine

Limits of variation (A) and mean value (B)	Initial level (in mm Hg)	Time taken to reach minimum (in sec)	Minimum level (in mm Hg)	Time taken to return to initial level (in sec)	Magnitude of fall (in mm Hg)
Control group					
A	80-90	2-11	60-80	9-16	10-20
B	86	8	70	12	16
Experimental group (with peritonitis)					
A	75-90	4-6	42-50	56-72	30-50
B	86	5	46	63	40

TABLE 2. Values Showing the Pattern of the Changes in Blood Pressure of Rabbits after Injection of Potassium Chloride (height in mm Hg, time in seconds)

Limits of variation (A) and mean value (B)	Initial level	Time taken to reach minimum	Minimum level	Time to return to initial level	Magnitude of fall
Control group					
A	80-120	2-5	60-80	8-49	25-40
B	96	3	65	27	31
Experimental group (with peritonitis)					
A	70-120	2-9	40-60	15-30	30-60
B	92	5	53	18	39

arterial pressure fell by 26%, and after injection of acetylcholine, by 150% more than in the controls (Fig. 3).

In rabbits with peritonitis, the cardiovascular system thus responds to the injection of these drugs by a more intensive depressor reaction than occurs in healthy animals.

According to the modern view, the action of acetylcholine on the cardiovascular system is based on the direct stimulation of chemoreceptors by the drug [3, 4, 7], i.e., the action is reflex in nature. The character of its effect may differ, however, depending on the

state of the central nervous system. D. N. Lazareva [2] for instance, found that after the intravenous injection of carbaminoylcholine chloride into rabbits infected with typhoid fever, a much greater slowing of the heart rate and a much quicker fall in the arterial pressure take place than in control animals. L. G. Reznichenko [5] states that after mesenteric trauma, or hemorrhage, in cats the intravenous injection of acetylcholine raises the arterial pressure, whereas in control animals the pressure is lowered.

Our results also showed that, in rabbits with peritonitis, the reaction of the cardiovascular system after the intravenous injection of acetylcholine and potassium chloride differs from its reaction in healthy rabbits. This difference is characterized by the fact that after injection of acetylcholine the blood pressure falls more rapidly and to lower figures, but then returns more slowly to its initial level. After injection of potassium chloride, the pressure falls more slowly and intensively, but returns more rapidly to its original level.

As G. M. Shpolyanskii [8] points out, in peritonitis, and especially in the second phase, a parietic state of the sympathetic nervous system develops. This has also been shown experimentally by S. D. Sokolov [6], who found that an isolated segment of bowel in a dog with

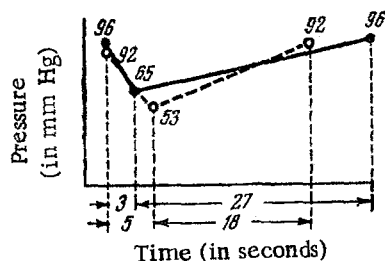


Fig. 2. Trend of the changes in the arterial pressure in rabbits after intravenous injection of potassium chloride. Legend as in Fig. 1.

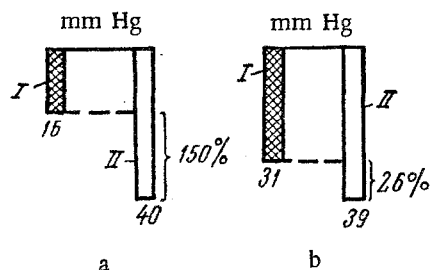


Fig. 3. Magnitude of the fall in the arterial pressure after injection of acetylcholine (a) and potassium chloride (b) in control (I) and experimental (II) rabbits.

peritonitis reacts much more strongly to choline and physostigmine than in a healthy animal, whereas the reaction to adrenalin is significantly weakened. This author considers that the sympathetic innervation of the inflamed intestine loses its excitation sooner than the parasympathetic supply, and that the latter exerts a stronger influence than the sympathetic. D. N. Lazareva [2] found an increase in the tone of the cholinergic nervous system, and also a lowering of the cholinesterase activity in rabbits infected with typhoid fever.

It may also be considered from our experimental results that, in rabbits with peritonitis, the tone of the cholinergic nerves is increased; the increase in the duration of the return of the blood pressure from its minimum to its initial level after the injection of acetylcholine may be accounted for by depression of

the cholinesterase activity. However, this problem requires further study.

SUMMARY

The author studied the reaction of the cardiovascular system in rabbits in response to the intravenous injection of acetylcholine and potassium chloride in experimental noninfectious peritonitis. It was shown that the depressor effect on the cardiovascular system induced by these substances was more pronounced against the background of peritonitis, which possibly points to the increased tone of the cholinergic nerves.

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* See English translation.