marked depression of these parameters was followed (by the 5th day) by their restoration to the control level.

The third and most important principle is that adaptation to short periods of stress completely prevents disturbance of myocardial contractility due to ordinary prolonged stress. The experimental results are evidence that (Table 1) this prophylactic effect is completely preserved as long as 5 days after the end of the course of adaptive exposures, i.e., under conditions when myocardial contractility of the adapted animals no longer differed from the control. In other words, complete recovery of all parameters of myocardial contractility in animals undergoing a course of short adaptive exposures to stress is in no way accompanied by disappearance of resistance to prolonged stress acquired as a result of such adaptation. This situation arises much later, namely 10 days after the end of the course of short exposures to stress (Table 1).

Consequently, a stage of the process is reached at which the negative effect of adaptation, or its "price," is not manifested at all, whereas its positive effect, namely increased resistance to the harmful action of prolonged stress, is completely preserved. As a result, extensibility of the myocardium, developed tension, and resistance to hypoxia and to excess of calcium after prolonged stress were completely indistinguishable from the control values. This main fact established by this investigation is in agreement with the view that the prophylactic effect of preliminary adaptation to short periods of stress is closely linked with activation of the inhibitory antistress systems of the brain [2, 3] and is therefore preserved for quite a long time.

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HEMODYNAMIC AND MOTOR DISTURBANCES OF THE GASTROINTESTINAL TRACT IN INTRAMURAL ISCHEMIA

Z. M. Sigal, Yu. V. Makotchenko,
A. P. Kravchuk, and P. A. Pletnev

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Motor and hemodynamic disturbances in the hollow abdominal organs lie at the basis of intramural ischemia and are responsible for viability of the stomach and intestine. These two important functions are nowadays beginning to be considered in conjunction with each other, having regard to their mutual interaction in hollow organs [1, 6, 7, 9]. The anatomical substrate for this interaction is the intimate arrangement of the principle collector of the intramural blood flow in the submucosa with the subjacent muscular coat. The main drawback to the investigations mentioned above is the use of different methods of determining the motor and hemodynamic parameters of the wall of hollow organs. The indirect nature of the methods of determining the intramural hemodynamics [2, 3, 8] and the traumatic nature of methods of investigation of motor function, which affect the reliability of the results, must also be borne in mind. In the investigation described below motor and hemodynamic para-

Department of Operative Surgery and Topographic Anatomy, Izhevsk Medical Institute.
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TABLE 1. Height of Pulse and Motor Waves and Number of Motor Waves (M ± m)

Region	Height of pulse wave, mm	Height of motor wave, mm	No. of motor waves per minute
AV:			
a	6,2±0,8	16,5±4,5	7,5±1,6
b	0,7±0,2	21,7±5,5	11,7±0,9
V:			
a	6,4±1,3	13,8±3,9	5,7±1,3
b	5,2±0,2	20,6±3,7	12,7±0,8
A:			
a	6,7±1,2	14,7±3,5	7,8±1,4
b	1,4±0,4	15,7±2,5	12,3±1,2

Legend. AV) Region with arteriovenous ischemia, A) with arterial ischemia, V) with venous hypertension; a) before, b) after ligation.

meters of hollow organs were studied for the first time by a single atraumatic method, namely pulsomotorography, based on recording changes in optical density of the wall of the hollow organ [4].

EXPERIMENTAL METHOD

Experiments were carried out under intravenous thiopental anesthesia. During operations on 80 dogs, regions of the gastrointestinal tract were illuminated. Changes in optical density were recorded by means of photoelectric transducers connected by screened leads to an electrocardiograph of ÉLKAR-6 type. Direct current sources were used. The paper winding speed varied from 5 to 100 mm/sec. Pulse waves, waves synchronous with the pulse, and slower motor waves were differentiated on the pulsomotorogram. To study quantitative criteria of the intramural hemodynamics, angiotensometry also was carried [5]. A pressure chamber with a source of light and a rubber membrane, set up during the operation behind the object, was used, the chamber was fixed with a translucent plate, and air was pumped into it through a manometer; during decompression the maximal and minimal arterial pressure (AP) and venous pressure in the intramural vessels were determined on the basis of visual patterns in the field of vision of the apparatus.

To investigate the intramural hemodynamics with the aid of the same apparatus, but with barriers fixed to the translucent plate, the "collateral" blood pressure was determined, and during movement of the source of light into the lumen of the hollow organ AP and the venous pressure were investigated in the presence of a high intraluminal pressure in the hollow organ.

Intramural ischemia was simulated by a devascularization of the stomach and intestine, elevation of the intraluminal pressure, strangulation of a loop of intestine, and measured occlusion of extramural arteries. In this way reversible and irreversible ischemia, associated with loss of viability, and arterial and arteriovenous ischemia were distinghished.

EXPERIMENTAL RESULTS

On devascularization of the hollow organs as a rule the intramural BP, pulse pressure, and amplitude of the pulse oscillations decreased, and motor activity changed. After ligation of two intestinal vessels the motor and hemodynamic parameters were found to differ depending of whether arteries were ligated together with their companion veins or only extramural veins. Average statistical data before and after ligation are given in Table 1.

Both under normal conditions and during reduction of the intramural hemodynamics a decrease was found in the pulse oscillations in the period of marked motor activity, which can be attributed to the onset of so-called momentary ischemic episodes. At the same time both motor and hemodynamic factors, it can be assumed, participate in the correction of intestinal ischemia. Devascularization of the stomach, as well as of the intestine, is accompanied by reversible and irreversible motor and hemodynamic disturbances. The viability of the stomach under these circumstances as a rule is preserved, but the blood flow becomes reduced and its direction changes. After ligation of all extramural vessels except the left gastric artery and coronary vein, the intramural AP in all parts was sufficient to maintain the viability of the organs. However, the pulsed blood flow in regions of the stomach and antrum was converted into a continuous flow and the pulse pressure disappeared.

Motor activity of the intestine was inhibited at 40 mm Hg. The number of motor waves per minute fell compared with that at zero intraluminal pressure from 8.8 ± 1.1 to 2.4 ± 0.8 ($P < 0.05$). If the intraluminal pressure was 80-100 mm Hg the intramural venous pressure could not be determined and the pulsed blood flow was gradually transformed into continuous flow and the pulse pressure disappeared. At higher values of intraluminal pressure the intramural AP fell to zero. Against the background of inhibition of motor activity, the arterial intramural blood flow was completely paralyzed.

Measured constriction of the extramural vessels also led to regular ischemic disturbances in the wall of the hollow organ. Under these circumstances the intramural AP fell to critical levels (30-40 mm Hg), incompatable with viability of the hollow organ. This model of regional hypotension can be regarded as controllable, for it was found that different values of intramural AP could be obtained.

Despite different methods of creating intramural ischemia, common disturbances of the hemodynamic and motor activity of the gastrointestinal tract were discovered. They included approximation of values of the maximal and minimal AP, lowering of the intramural AP, conversion of the pulsed blood flow into continuous flow, inhibition of motor activity, and approximation of values of the arterial and venous pressure. According to the results of morphological investigations, the earliest and severest damage is suffered by regions with drastically reduced AP and without an intramural pulse, and these regions were found to be nonviable. Conversely, even with lower levels of blood pressure, regions in which pulse oscillations were preserved had a more favorable morphological appearance. The facts and principles described above must be taken into consideration when the characteristics of pathological processes are determined, when operations are contemplated on the gastrointestinal tract, and for the diagnosis of viability and establishment of criteria of compensation and decompensation.

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