α-Adrenoreceptor blockade in puppies 3 days after ischemia of the kidneys thus caused the blood pressure to fall below normal through a decrease in both SPVR and the cardiac index (Table 2). The systolic index, IVP, and TTI also fell under these circumstances. Shortening of the phase of isometric contraction and the expulsion time also was observed in the phase structure of the cardiac cycle. It must be emphasized that injection of pyrroxan into intact puppies led to similar, but less marked changes in the hemodynamics. The fall in the peripheral vascular resistance under the influence of pyrroxan was mainly connected with the peripheral α-adrenoblocking action of the drug, whereas the decrease in the cardiac output in both the "hypertensive" and the intact puppies must be regarded as the result of blockade of α-adrenergic structures in the posterior hypothalamus [1]. Since the hemodynamic changes under the influence of pyrroxan were more marked in the "hypertensive" puppies it can be concluded that in young animals the early phases of vasorenal hypertension are characterized by a higher level of central and peripheral α-adrenergic activity. During α-adrenoreceptor blockade, despite the weakening of adrenergic stimulation of the heart and the reduction in the cardiac output, the intrinsic inotropic properties of the myocardium evidently increase, and this is reflected in an increase in the index of contractility.

Even more marked changes in the hemodynamic parameters were produced by pyrroxan 14 days after ischemization of the kidneys compared with 3 days after ischemization.

The data described above indicate that central and peripheral α-adrenergic influences play a role in the genesis of the hemodynamic changes in the initial period of formation of vasorenal hypertension.

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CHANGES IN FAST UTERINE MUSCLE POTENTIALS IN RABBITS EXPOSED TO CHRONIC HYPOXIA

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Changes in high-frequency myometrial electrical activity after separate and simultaneous division of the uterine and ovarian vessels were studied in 137 chronic experiments on 18 nonpregnant parous rabbits. The deepest and longest (up to 45 days) depression of the amplitude and frequency of fast myometrial potentials was shown to take place after simultaneous division of the uterine and ovarian arteries and veins. Both the amplitude and frequency of the potentials were gradually restored during compensation of the circulation along collateral vessels.

KEY WORDS: spike potentials; circulatory hypoxia; myometrium; uterine and ovarian vessels.

Ligation of the principal uterine vessels in cases of atonic uterine bleeding in the early puerperium is an effective emergency treatment of this pathology [2, 12, 15].

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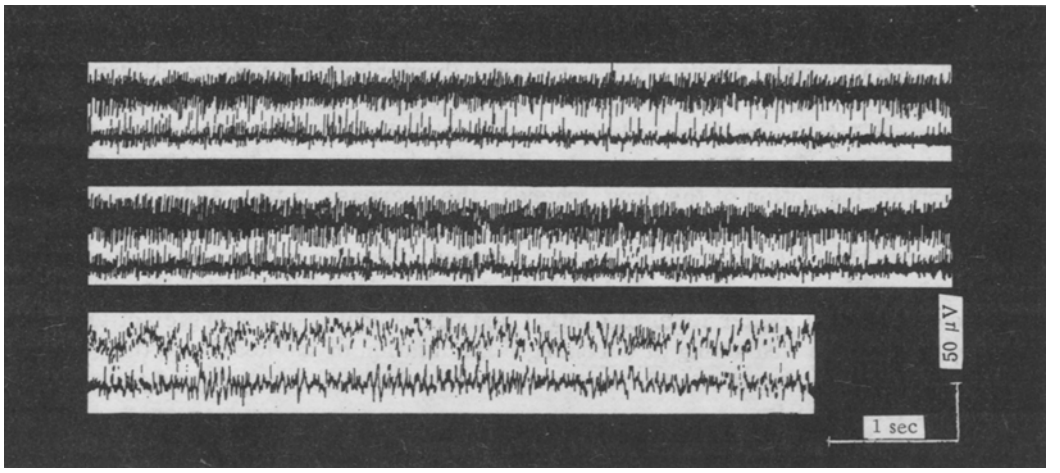

Fig. 1. EHG of rabbit No. 16 taken 24 h (A), 12 days (B), and 45 days (C) after ligation of left uterine artery and vein. Top curve shows EHG of right uterine cornu, bottom curve EHG of left uterine cornu.

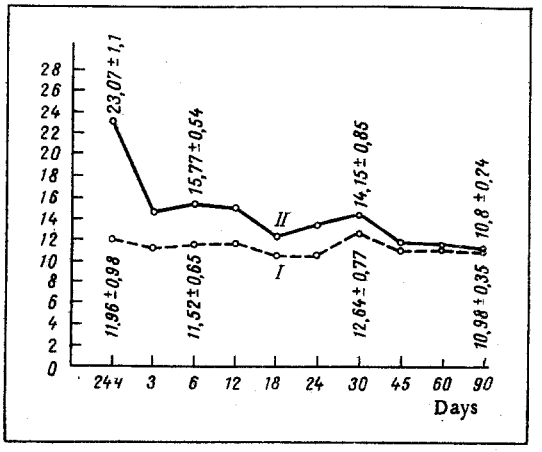

Fig. 2. Dynamics of amplitude of spike potentials of ischemized (I) and contralateral (II) uterine cornua of rabbits Nos. 15, 16, 17, and 18 after simultaneous unilateral ligation of uterine and ovarian arteries and veins (mean data). Abscissa, time after ligation of vessels; ordinate, amplitude of spike potentials (in μV).

What changes arise in the uterus after ligation of the main source of its blood supply and how are these changes reflected in its function? According to some workers [10, 14], acute ischemia of the uterus does not cause any appreciable structural changes in it, whereas others [4, 8] observed disturbances of vascular permeability, extravasation of blood, and subsequent diffuse proliferation of connective tissue in both the endometrium and the myometrium, with atrophy of the uterus after ligation of the uterine arteries, but these disturbances were temporary [9, 12]. In monkeys, under these conditions, the normal histological structure of the uterus is restored after 6 weeks [13]. There is no such general agreement regarding the clinical results of ligation of the uterine vessels. Aleksandrov [1] and Tsirul'nikov [13], for example, consider that simultaneous ligation of the uterine vessels and the uterine branches of the ovarian arteries for atonic bleeding does not represent a risk for the mother and enables the menstrual and even the childbearing function to be preserved, whereas Timoshenko and Zhitskii [11] are of the opinion that it causes the development of profound degenerative changes, even amounting to tissue necrosis, in the uterus.

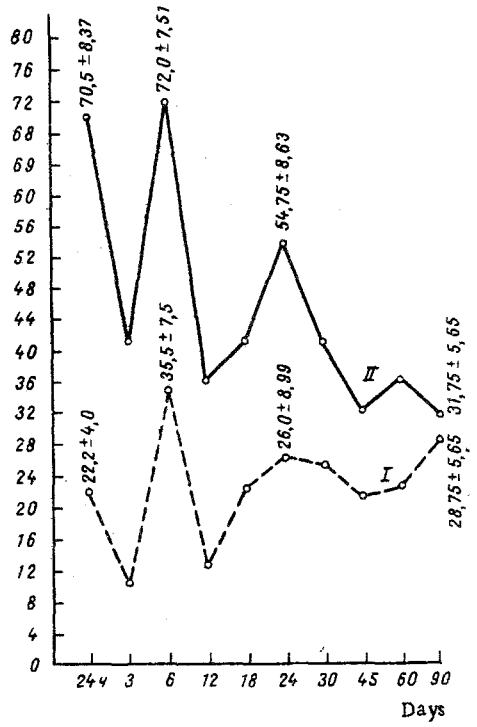

Fig. 3. Dynamics of frequency of spike potentials of ischemized (I) and contralateral (II) uterine cornua of rabbits Nos. 15, 16, 17, and 18 after simultaneous unilateral ligation of uterine and ovarian arteries and veins (mean data). Abscissa, time after ligation of vessels; ordinate, frequency of spike potentials (spikes/sec).

EXPERIMENTAL METHOD

Experiments were carried out on parous nonpregnant rabbits. Potentials were recorded separately from the two uterine cornua, for which purpose two laminated chlorided silver electrodes were implanted into each cornu [3]. During laparotomy the uterine and ovarian vessels of the uterine cornu were ligated. The animals were divided into four groups: 1) healthy, 2) with ligation of the ovarian arteries and vein, 3) with ligation of the uterine arteries and vein, and 4) with ligation of both uterine and ovarian arteries and veins.

Action potentials were recorded from both uterine cornua on a four-channel oscilloscope with a frequency transmission band of 0.2-8000 Hz. Electrohysterograms (EHG) of the two uterine cornua were recorded in the animals of groups 2, 3, and 4 at intervals of 24 h and 3, 6, 12, 18, 24, 30, 45, 60, and 90 days after ligation of the vessels. During each experiment the EHG was recorded five or six times, for 20-30 sec each time, over a period of 30-60 min. Changes in the amplitude and frequency of the spike potentials were subjected to quantitative analysis, with statistical analysis of the results by the difference method.

EXPERIMENTAL RESULTS

The spontaneous electrical activity of the healthy control rabbits (15 experiments on five rabbits) was characterized mainly by spike potentials appearing more or less regularly or in small groups (volleys). Their mean amplitude was 12.34 ± 1.2 μV and frequency 21.4 ± 6.94 spikes/sec. Against the background of these potentials, slower electrical waves were recorded periodically on the EHG, at different time intervals.

When the blood flow to the uterus was disturbed the amplitude and frequency of its spike potentials were depressed to a degree which depended on the degree and duration of circulatory hypoxia of the uterus. The most marked depression of electrical activity of the ischemized uterine cornu was found in the animals of group 2 (32 experiments on four rabbits). The amplitude of the spike potentials of the ischemized cornu 24 h after the operation averaged 10.6 ± 0.1 μV, compared with 11.42 ± 0.22 μV in the contralateral cornu, i.e., it

was reduced by 7.2% ($P < 0.02$). A comparatively small (by 8.4%) but significant ($P < 0.05$) decrease in amplitude of the spike potentials of the ischemized uterine cornu also was recorded 3, 6, and 12 days after ligation of the blood vessels: 10.84 ± 0.195 μV compared with 11.83 ± 0.32 μV for the contralateral cornu. During subsequent observations (after 18, 24, 30, 45, and 90 days) no statistically significant difference could be found between the mean values of the amplitude and frequency of the spike potentials of the experimental and contralateral uterine cornua.

A more marked depression of uterine electrical activity was observed in the animals of group 3 (50 experiments on five rabbits). The amplitude of the spike potentials of the ischemized cornu after 24 h averaged 11.07 ± 0.34 μV (contralateral cornu 15.87 ± 0.66 μV) and their mean frequency was 14.8 spikes/sec (contralateral cornu 30.4 spikes/sec), i.e., the indices studied fell by 30.4% ($P < 0.0001$) and 51.4% ($P < 0.01$) respectively. A significant decrease in the amplitude and frequency of the spike potentials of the ischemized uterine cornu also was recorded on the 3rd and 6th days. On the 12th day this decrease was no longer significant ($P > 0.2$), and after 18, 24, 30, 45, and 90 days the difference between the amplitude and frequency of the spike potentials of the two uterine cornua was not statistically significant (Fig. 1).

The most profound depression of electrical activity of the ischemized uterine cornu was recorded in the animals of group 4 (40 experiments on four rabbits). After 24 h the mean amplitude of the spike potentials of this cornu was 11.96 ± 0.96 μV (compared with 23.07 ± 1.1 μV for the contralateral cornu), and the mean frequency was 22.2 ± 4.0 spikes/sec (compared with 70.5 ± 8.37 spikes/sec), i.e., these indices were reduced by 48.6% ($P < 0.001$) and 68.6% ($P < 0.01$) respectively. Statistically significant depression of electrical activity of the ischemized uterine cornu in the animals of this group was longest in its duration (Figs. 2 and 3).

The experiments showed that ligation of the main vessels to the uterus in chronic experiments is accompanied by depression of high-frequency electrical activity of the myometrium, the depth of which is determined by the degree of ischemization of the uterus. In particular, if the ovarian vessels alone were ligated, the decrease in amplitude of the uterine spike potentials was least of all. Blocking the main vessels supplying the uterus – the uterine arteries and veins – led to a much greater decrease in the amplitude and frequency of the potentials.

The results of control experiments and of those carried out previously [5, 7] suggest that this inhibition of uterine electrical activity may depend on several factors: a decrease in the inflow of blood caused by ligation of the corresponding vessels, a decrease in the level of metabolism, hypoxia in the ischemized cornu, ligation of nerves along with the corresponding blood vessels, the effect of ischemia on the receptor nerve endings in the uterus, and so on. Disturbance of hormonal influences on the uterus as a result of structural and functional changes in the ovary during circulatory ischemia may also play an important role in this phenomenon, as experiments by other workers have shown [6, 8, 12-14].

During compensation of the circulation through collateral vessels the amplitude and frequency of the myometrial spike potentials was gradually restored over a period of 18-45 days.

The results showed that the method of study of high-frequency electrical activity of the uterus under chronic experimental conditions has advantages over the study of uterine function in experiments in vitro and also in acute experiments in situ. It provides accurate data on the character of the changes in the functional state of the uterus during chronic circulatory hypoxia.

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RESPONSE OF MICROVESSELS OF THE SUBCUTANEOUS AREOLAR TISSUE TO ARGON LASER IRRADIATION

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The effect of argon laser irradiation on the microvessels of the subcutaneous areolar tissue of the rabbit ear, mounted in a transparent chamber by Clark's method, was studied. The capillaries and venules, in which dysfunctional changes were found in the microcirculation, were most sensitive to argon laser irradiation. Besides destruction of the vessel walls and perivascular inflammation, active reorganization of the microcirculatory system and a redistribution of the blood flow were observed under the influence of the laser beam.

KEY WORDS: laser; microcirculation; blood vessels.

Lasers are being used on an increasingly broad scale in clinical and experimental medicine. However, the action of laser radiation on biological objects and, in particular, on blood vessels has not yet been adequately studied, although tissue coagulation has been shown to result from exposure to the laser beam [5-8]. Argon lasers, giving the principal radiation at wavelengths of 488.0 and 514.5 nm [2], have been found to be very effective for coagulating blood vessels. The study of the effect of laser beams on microcirculatory systems is particularly interesting and its biological importance continues to be widely discussed in the literature [1, 3, 4, 7, 8, 10, 11].

The object of this investigation was an intravital study of structural changes in the vessels of the microcirculatory system in response to the action of an argon laser beam.

EXPERIMENTAL METHOD

Blood vessels of the subcutaneous areolar tissue of the rabbit's ear, mounted in a transparent chamber as in Clark's method [9], served as the test object. Experiments were carried out on eight rabbits with transparent chambers made of titanium or stainless steel previously implanted in their ear. The blood flow in the microcirculatory system was fully restored 5-6 days after implantation of the transparent chamber, so that a systematic microscopic analysis could be made of the movement of blood in the microvessels. Portions of the microcirculatory system were drawn under the microscope and photomicrographs taken so that a complete picture of the angioarchitectonics could be compiled.

The microvessels were irradiated with an argon laser giving radiation with a wavelength of 514.5 nm and with a power of between 300 and 500 mW; the duration of irradiation was 0.2-0.5 sec and the diameter of the beam 100 μ. Arterioles, capillaries, and venules were subjected to photocoagulation. For this purpose

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