Changes in the composition of LDH fractions in the injured gland and its regional lymph nodes were completely unsynchronized in character: the content of the $LDH_1$ fraction fell in the gland and rose in the lymph nodes, whereas the content of the $LDH_5$ fraction rose in the gland and fell in the lymph node.

Scrutiny of these data sheds new light on our results and, in particular, enables the re-evaluation of data obtained previously [2]. The present investigation confirms that LDH is the right choice for marker. A significant change was found in the total LDH activity in the blood, whereas the physicochemical blood constants (partial pressure of oxygen and carbon dioxide, buffer base concentration) were unchanged. A possible explanation for the absence of antigenic breakdown products of SMSG after trauma, as described in [2], was found. It was shown that the passage of breakdown products into the bloodstream takes place through the lymph node, where these products with antigenic properties are processed (antigenic stimulation). Evidence in support of this view is given by the change in functional properties of the lymphocytes as early as 17 h after trauma [6].

This investigation thus showed that the breakdown products enter the general bloodstream through the regional lymph nodes, and this process can be recorded as early as 30 min after trauma to the gland. Migration of leukocytes into the zone of trauma and macrophagocytosis develop more slowly. In our view, it is evidently the breakdown products of the gland tissue which trigger compensatory hyperplasia [4] in the salivary glands in response to their resection.

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## COMPARISON OF MICROCIRCULATORY DISORDERS IN THE PERIMETRIUM OF INTACT AND PREGNANT RATS UNDER THE INFLUENCE OF OXYTOCIN


V. G. Ovsyannikov, I. V. Fomina, and V. I. Orlov



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The microcirculation is the process by which tissue cells obtain nutrients and get rid of metabolites. Without an adequate microcirculation the normal exchange of materials and the normal functioning of any organ would be impossible [4, 10]. In clinical obstetrics, a leading component in the pathogenesis of many complications of pregnancy is a disturbance of the microcirculation. However, there have been only a few studies of the microcirculation in the uterus [2, 6, 7]. Changes in contractility of the uterus after injection of oxytocin have been studied by many investigators [1, 3, 8]. However, the effect of oxytocin on the microcirculation in the uterus has not previously been studied. The aim of this investigation was to study the microcirculation in the perimetrium under the influence of oxytocin.


Department of Pathological Physiology, Rostov Medical Institute. Rostov-on-Don Research Institute of Obstetrics and Pediatrics.


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## EXPERIMENTAL METHOD

Experiments were carried out on 50 albino rats. Group 1 consisted of 20 intact rats with a mean weight of 226.9 ± 6.6 g. Group 1 consisted of 30 rats between 5-7 and 18-21 days of pregnancy, with a mean weight of 280.6 ± 2.9 g. The animals were anesthetized with a 2% solution of pentobarbital injected intraperitoneally in a dose of 50 mg/kg body weight. To inject the anesthetic, the right jugular vein was catheterized and the animal fixed to a special platform and heated automatically to 37°C. After laparotomy the uterine cornu was covered with balls of cotton soaked in physiological saline. For biomicroscopy and to photograph the microvessels, a luminescence microscope was used. The microcirculation in the initial state was studied: the duration of microspasm of the vesels, the duration of dilatation of the vessels, the character of the blood flow, and the diameter of the microvessels were determined. The same parameters were studied 5, 10, 20, 30, 40, and 50 min after injection of $10^{-2}$ unit of oxytocin in 1 ml of 5% glucose [5].

## EXPERIMENTAL RESULTS

The microcirculation in the rat perimetrium is characterized by periodic alternation of spasm and dilatation of the vessels [6, 7]. The duration of dilatation in intact rats in the initial state was greater than the duration of spasm by 1.7 times on average (Table 1).

In the animals of group 1, spasm and dilatation of the microvessels were well defined. For instance, the diameter of the vessel in the period of spasm was 12.3 times less on average than the diameter during dilatation (Table 2).

In the initial state, a forward blood flow, slowing of the blood flow, stasis, and a retrograde flow were observed during biomicroscopy in the microvessels [6, 7]. After intravenous injection of oxytocin into the intact rats, slowing of the blood flow took place on average after 43 sec, leading to stasis with aggregation of the blood cells. These changes took place against the background of severe spasm of the microvessels. During this period contraction of the myometrium was observed; to begin with the blood flow became slower, after which contraction of the myometrium could be detected visually. The maximum of contraction coincided with stasis of the blood and maximal spasm of the vessels (Fig. 1c). A large number of functioning capillaries with a very slow forward blood flow in them next appeared and relaxation of the myometrium began. Compared with their initial state, the microvessels studied were dilated (Fig. 1d) but the blood flow in them was slowed and was forward in character. The blood flow then became slowed and the cycle was repeated. When studying the duration of spasm and dilatation, it was noted that during the first 5 min of action of oxytocin the duration of dilatation and the duration of spasm became almost equal (Table 1). The duration of spasm was increased on average by 2.2 times compared with the initial state whereas the duration of dilatation of the vessels was only 1.3 times longer than initially. The diameter of the arterioles during the period of maximal spasm was on average 25 times less during dilatation (maximum at the 10th minute of action), but compared with the initial diameter, it was 1.7 times less. During dilatation the diameter of the vessel was 1.2 times greater than initially (Table 2). By the 20th minute the duration of spasm and of dilatation was close to the initial state. On average after 24-30 min the initial diameter of the microvessels was restored, and after 38 min the initial blood flows was also.

In a study of the microcirculation in pregnant rats the authors found that the perimetrium of pregnant animals has a more highly developed microcirculatory bed [6, 7]. On the whole the processes of spasm and dilatation are much less marked than in intact rats. In the initial state, for instance, the duration of dilatation was 1.7 times longer than the duration of spasm (the same ratio as in Group 1). However, the diameter of the vessel during the period of spasm was only 1.3 times less than the diameter during dilatation (Table 2). The character of the blood flow was the same as in intact animals. After injection of oxytocin slowing of the blood flow was observed compared with the initial state on average after 50 sec. The phase of dilatation of the arterioles also was on average 1.6 times longer in duration than the phase of spasm (the same ratio as in the initial state). On the whole, however, the duration of spasm and of dilatation were only 1.1 times greater than the initial values (Table 1). The blood flow both in the period of spasm and in the period of dilatation remained slow and forward. Stasis and aggregation of the blood cells were not observed. The diameter of the vessels was increased, compared with the initial state, both during spasm and during dilatation: by 1.3 times during spasm and by 1.4 times during dilatation (Table 2). Constriction of the arterioles in pregnant rats during spasm was not observed after injection

TABLE 1. Duration of Spasm and Dilatation of Microvessels of the Rat Perimetrium

| Rats | Duration, sec | Time after injection of oxytocin, min | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 20 | 30 | 40 | 50 |
| Intact | | | | | | | |
| spasm | 36,6±1,9 | 79,2±2,8 | 38,7±2,8 | 34,0±1,8 | 32,6±1,8 | 31,9±1,8 | 44,0±2,1 |
| dilatation | 61,0±12,4 | 80,8±12,8 | 54,0±2,3 | 74,4±2,7 | 74,8±2,7 | 74,8±2,7 | 57,5±2,4 |
| Pregnant | | | | | | | |
| spasm | 38,7±1,1 | 41,5±1,2 | 40,6±1,2 | 43,6±1,2 | 44,6±1,2 | 37,2±4,1 | 40,5±1,2 |
| dilatation | 68,7±1,8 | 70,1±1,5 | 59,4±1,4 | 53,3±1,3 | 57,6±1,4 | 57,8±1,4 | 53,3±1,3 |

Legend. P = 0.05.

TABLE 2. Diameter of Arterioles of the Rat Perimetrium

| Rats | Diameter, μ | Time after injection of oxytocin, min | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 10 | 20 | 30 | 40 | 50 |
| Intact | | | | | | | |
| spasm | 3,4±0,6 | 2,0±0,4* | 2,0±0,4* | 2,0±0,4* | 3,4±0,6* | 3,4±0,6* | 3,4±0,6* |
| dilatation | 41,6±2,0 | 44,6±2,1* | 50,0±2,2 | 48,0±2,2 | 41,6±2,0* | 41,6±2,0* | 41,6±2,0* |
| Pregnant | | | | | | | |
| spasm | 38,0±1,1 | 50,0±1,3 | 47,6±1,2 | 46,6±1,2 | 40,0±1,1 | 38,0±1,1 | 38,0±1,1 |
| dilatation | 50,0±1,3 | 72,6±1,5* | 62,2±1,4* | 53,3±1,3* | 51,3±1,3* | 50,0±1,3* | 50,0±1,3* |

Legend. P = 0.05.

of oxytocin. The diameter during spasm was reduced by only 1.4 times compared with the diameter during dilatation. The initial level of the microcirculation was restored after 24 min and the diameter of the arterioles returned to its initial level after 40 min.

Oxytocin thus has a marked effect on the state of the microcirculation on the perimetrium and on its contractility. In both groups of animals changes in the microcirculation took place initially, followed by changes in the motor function of the uterus. However, the disturbances of the microcirculation in the perimetrium differed in type in intact and pregnant rats. After injection of oxytocin the duration of spasm and of dilatation was increased in both groups. However, in the intact rats the cycle was lengthened on account of a very considerable increase in the duration of spasm, whereas in the pregnant rats it was lengthened equally on account of spasm and of dilatation. On the whole the duration of the cycle increased more in intact rats. The phasic changes which we observed in the microcirculation and the microcirculatory bed were confirmed by other investigators [9], who observed periodic changes in the oxygen concentration in the uterus, which they called "hypoxic cycles." The diameter of the microvessels after injection of oxytocin increased during dilatation in both groups of animals. The response of the microvessels after injection of oxytocin was more marked in intact animals (the diameter during spasm was reduced more than the diameter during dilatation). Comparison of the character of the microcirculation shows that slowing of the blood flow took place in pregnant rats after injection of oxytocin but stasis could not be observed. On the whole, the initial level of the microcirculation was restored in the animals of both groups 38-40 min after injection of oxytocin.

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