

QUANTITATIVE CHARACTERISTICS OF THE MICROCIRCULATION DURING ASEPTIC INFLAMMATION IN THE RAT UTERUS AND THE EFFECT OF LOCAL APPLICATION OF CARBON-MINERAL ADSORBENTS

Yu. I. Borodin, E. D. Ustyugov,
N. A. Sklyanova, M. S. Lyubarskii,
Yu. I. Sklyanov, and V. A. Burlaka

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Biogenic inflammatory complications are an urgent problem in current obstetric and gynecologic practice [1, 2]. We also know that local inflammatory reactions lead to a disturbance of the regional microcirculation [3]. However, virtually no experimental analysis has been made of the quantitative changes at the level of the main components of the uterine microcirculatory bed in the presence of inflammation before pregnancy, and absolutely nothing has been published on the correction of this state by carbon-mineral adsorbents.

The aim of this investigation was to study the uterine microcirculatory bed of non-pregnant rats with experimentally induced aseptic inflammation and after local application of carbon-mineral adsorbents.

EXPERIMENTAL METHOD

Experiments were carried out on 58 nonpregnant albino rats aged 2.5-3 months and weighing 220-250 g. The animals of Group 1 served as the control. Animals of Groups 1, 3, 4, and 5 underwent a midline laparotomy under open ether anesthesia under aseptic conditions, after which a sterile silk thread was passed through the wall of the right uterine cornu so as not to constrict the lumen of the uterine cavity. The operation ended with suture of the anterior abdominal wall in layers. The rats were decapitated under ether anesthesia 24, 48, 72, and 96 h respectively after insertion of the suture into the uterine wall. The anesthetized animals of Group 6, 48 h after insertion of the uterine suture, were treated by applications of carbon-mineral adsorbent: UMSPT by intrauterine application and SUMS-I intraperitoneally (the adsorbents were obtained by Senior Scientific Assistant L. N. Rachkovskaya, of the Institute of Catalysis, Academy of Sciences of the USSR). The spherical carbon-mineral adsorbent (SUMS-I) is effective as regards adsorption of Gram-positive and Gram-negative cocci [4], whereas UMSPT is effective against Escherichia coli and Bacillus pyocyaneus [6]. Animals undergoing a mock operation (Group 7) had the suture inserted into the uterine wall under the same conditions of anesthesia, and this was followed 48 h later by midline laparotomy. In Groups 6 and 7, after the end of the operation the anterior abdominal wall was sutured in layers. Material was taken from the above-mentioned groups 96 h after insertion of the uterine suture. For histologic investigation the uterus was fixed in 10% neutral formalin and embedded in paraffin wax; sections were stained with Mayer's hematoxylin and eosin. The bulk density of the arterial, capillary, and venous divisions of the microcirculatory bed was counted by means of a standard ocular grid in transverse sections through the uterine cornu. The results of morphometry were subjected to statistical analysis [5] and differences between the mean values were taken to be significant at the $p < 0.05$ level.

Department of Lymphology, Institute of Physiology, Siberian Branch, Academy of Medical Sciences of the USSR, Novosibirsk. Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 110, No. 10, pp. 430-432, October, 1990. Original article submitted November 15, 1989.

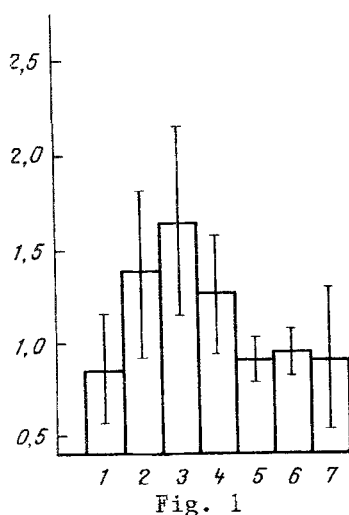


Fig. 1

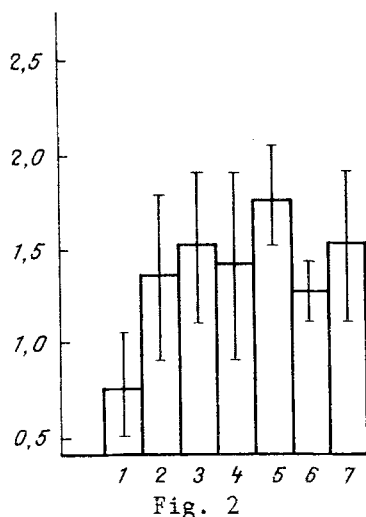


Fig. 2

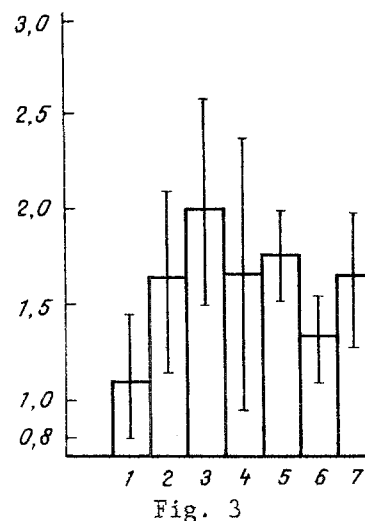


Fig. 3

Fig. 1. Bulk density of arterial division of uterine microcirculatory bed in rats at different periods of inflammation and after application of carbon-mineral adsorbents. Abscissa, groups of animals; ordinate, bulk density (in conventional units).

Fig. 2. Bulk density of capillary division of uterine microcirculatory bed at different periods of inflammation and after application of carbon-mineral adsorbents. Legend as to Fig. 1.

Fig. 3. Bulk density of venous division of uterine microcirculatory bed in rats at different periods of inflammation and after application of carbon-mineral adsorbents. Legend as to Fig. 1.

EXPERIMENTAL RESULTS

Migrating neutrophils could be seen 24 h after the operation (Group 2) close to the site of injury to the uterus, and evidence of edema was observed in the connective tissue. The bulk density of the arterial division during this period was significantly higher (by 59%) than the control values (Fig. 1), and that of the capillary and venous divisions was 79% (Fig. 2) and 41% (Fig. 3) higher respectively. In the animals of Group 3 infiltration of the endometrium and myometrium by leukocytes was increased, and numerous neutrophils could be seen between the fibers of the silk thread. The time of greatest intensity of the inflammatory reaction (48 h) coincided with a significant increase in the bulk density of the arterial, capillary, and venous divisions by 91% (Fig. 1), 97% (Fig. 2), and 75% (Fig. 3) respectively. Diminution of leukocyte migration was observed 72 h after the operation (Group 4), and the formation of a leukocytic barrier was completed. Fibroblasts surrounded the focus of injury as a single-layered capsule. The bulk density of the arterial division was increased significantly by 47% (Fig. 1), the capillary by 82% (Fig. 2), and the venous by 42% (Fig. 3) compared with the control. In animals of Group 5 the number of fibroblasts around the site of injury was increased, and neutrophilic leukocytes could be seen between the fibers of the thread. The bulk density of the capillary division was significantly increased by 2.3 times (Fig. 2) and that of the venous division by 1.5 times (Fig. 3).

In the rats of Group 6 the inflammatory reaction was much weaker. A decrease in leukocytic infiltration of the tissue and disappearance of edema were observed. The morphometric data demonstrated a significant decrease in bulk density of the capillary division by 29% (Fig. 2) compared with data for Group 5, and by 20% (Fig. 2) compared with the group of animals undergoing the mock operation (Group 7). After application of the adsorbents the bulk density of the venous division was significantly reduced by 24% (Fig. 3) compared with the corresponding values in Group 5 and by 7% (Fig. 3) compared with Group 7. The results show that the use of carbon-mineral adsorbents in inflammatory conditions of the nonpregnant uterus leads to a reduction in the intensity of the inflammatory reaction, to a marked decrease in leukocytic infiltration, to disappearance of edema of the endometrium and myometrium, and to stabilization of the morphometric parameters of the exchange component of the uterine microcirculatory bed in the region of inflammation.

Thus intrauterine injection of carbon-mineral adsorbent promotes restoration of volume relationships in the microcirculatory bed and of disturbances of vessel-tissue interaction during inflammation in the endometrium and myometrium, essential steps for realization of the reproductive function of the uterus.

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MODIFICATION OF THE STRUCTURE OF FOCI OF REGENERATION OF DERMAL TYPE IN RATS

E. A. Efimov and T. V. Bukina

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It has now been shown that mammalian skin is capable not only of scar formation, but also of organotypical regeneration [2, 3]. Completeness of regeneration of the skin depends on the species of animal, the site of the wound defect, and a number of experimental conditions [2-4]. It has also been shown that the course and outcome of the healing process in the skin can be modified in certain directions [1, 3]. In this connection the method of graded mechanical injury (GMI) of newly formed foci of regeneration (FR) of the skin has proved to be promising, for in some cases, instead of scar tissue, FR closely similar in structure to intact skin have been obtained on the dorsal region in mice [6].

The aim of this investigation was to determine whether FR of dermal type can be modified in structure by the GMI method. FR of dermal type are formed as a result of healing of full-thickness skin wounds on the abdominal surface of the mammalian trunk. In FR of dermal type elastic fibers are formed, but derivatives of skin as a rule do not appear [5].

EXPERIMENTAL METHOD

Experiments were carried out on 73 noninbred male albino rats weighing 120-130 g. After epilation, full-thickness square wounds measuring 1.5×1.5 cm were inflicted by means of a stencil on the mid-abdominal skin of all the animals. On the 3rd day after total epithelization of the wound defect, which took place on the 7th-9th day after infliction of the wound, FR of 51 animals were subjected to GMI by means of a needle, at the rate of 10 full-thickness punctures 1 mm^2 of epithelized surface of FR (diameter of needle 0.1 mm).

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