EXPERIMENTAL BIOLOGY

Study of Local Blood Flow and Pressure in Tissues and Vessels of Hip Joint of Experimental Animals

R. M. Rasulov, N. V. Kornilov, Sh. S. Tashaev*, and O. P. Bol'shakov*

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Acute experiments on dogs showed that clamping of the femoral artery below origination of its deep branch playing the leading role in blood supply to the hip joint increases local blood flow in femoral head due to redistribution of arterial flow in favor of the deep femoral artery. This fact is essential for the development of surgical methods for the treatment of patients with aseptic necrosis of the femoral head.

Key Words: *local blood flow in the head of femur; necrosis*

Aseptic necrosis of the femoral head and other degenerative diseases of the hip joint are an important problem of modern orthopedics and traumatology. Though this group of the hip joint diseases is polyetiological, the pathogenesis is mainly vascular in all types of diseases [2]. Traditional surgical methods for the treatment of hip joint diseases are usually extensive and traumatic interventions augmenting tissue ischemia, especially in the head of the femur [1,3]. That is why low traumatism and the use of compensatory potential of the organism are essential factors to be borne in mind when developing new treatment methods notably improving blood supply to osteonecrotic foci.

Here we studied blood supply to the head of the femur in dogs after complete or partial ligation of the femoral artery below the site of origination of the deep femoral artery.

MATERIALS AND METHODS

Local blood flow in the femoral head and in the femoral vein was studied by the method of hydrogen clearance before, during, and after clamping of the femoral artery. Transformed electric signal from platinum electrodes entered via 4 channels into Polarograf-4 device. Changes in intraosseous and intraarterial pressure were monitored using a 3-channel Mingograf-34 device. Oscillation impulse on the transducer membrane was transmitted via a closed system of rigid catheters filled with normal saline. Signals from devices entered the computer. Local blood flow and pressure were digitizing (ACP-88) and processed on a computer.

The experiment was carried out on 18 mongrel dogs of both sexes (12-35 kg). After standard premedication (0.20 ml/kg 0.25 droperidol intramuscularly; 0.15 ml/kg 2% rometar; 1.0 ml/kg 0.1 atropine subcutaneously) the dogs were narcotized (1% sodium thiopental intravenously until disappearance of the corneal reflex), intubated, and connected to a lung ventilation system. During surgery platinum electrodes and pressure transducer needles were inserted into the head of the femur and into the femoral vein wall. Gaseous hydrogen was delivered into the intubation tube and the basal values of local blood flow and pressure were recorded with PC for 20-25 min until complete elimination of hydrogen from the head of the femur. Then a vascular clamp was placed on the femoral artery below origination of the deep artery, after which hydrogen was delivered again and the values were

R. R. Vreden Russian Institute of Traumatology and Orthopedics, St. Petersburg; *I. P. Pavlov St. Petersburg State Medical University. ***Address for correspondence:*** rasulov@list.ru. Rasulov R. M.

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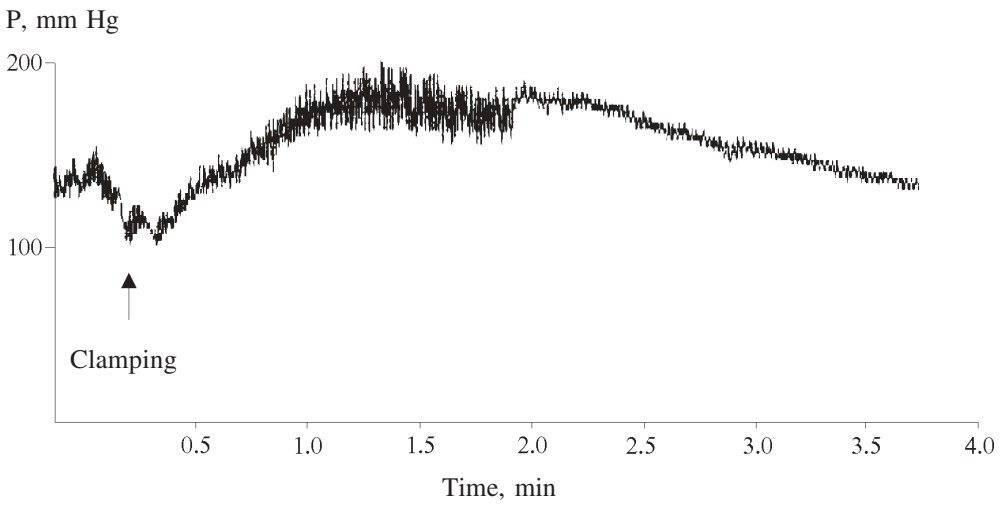

Fig. 1. Changes in intraarterial pressure before and during clamping of the femoral artery below the site of origination of the deep artery.

recorded for 10-15 min. Then the vascular clamp was removed from the femoral artery, hydrogen was delivered, and parameters were recorded for 20-25 min.

RESULTS

The mean basal level of local blood flow in the femoral head was 41.16±12.23 ml/100 g tissue/min. Clamping of the femoral artery below the site of deep femoral artery branching and the resultant redistribution of arterial blood flow towards deep femoral artery led to intensification of the local blood flow in the head of the femur by 53.3% (63.10±15.21 ml/100 g tissue/min). The pressure in the proximal portion of the femoral artery and in the deep femoral artery increased to 180±17 mm Hg but then returned to initial level (110±15 mm Hg) within 3-5 min (Fig. 1).

After removal of the clamp from the femoral artery blood flow in the femoral head remained high (64.02±21.11 ml/100 g tissue/min) for 25-30 min, which was 55.54% higher than the initial basal level.

The basal level of venous return from the hind limb was 24.58±7.25 ml/min; during clamping it decreased by 36.7% (to 15.56±5.15 ml/min). After removal of the clamp this parameter tended to increase by 39.91% for 25-30 min in comparison with the initial level (34.39±7.35 ml/min).

The hydrogen clearance method used for evaluation of local blood flow in the head of the femur allows rapid measurements in small volumes (0.5-1.0 mm^3) of tissue.

Hence, isolated clamping of regional vessels of the hip joint leads to redistribution of the arterial bloodflow in favor of the deep artery of the femur and to intensification of local bloodflow in the head of the femur. This can promote revascularization of osteonecrotic zones and stimulate osteogenesis in the femoral head, which is important for the development of new methods for the treatment of patients with aseptic necrosis of the femoral head.

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