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DETERMINATION OF THE LOCAL MUSCULAR BLOOD FLOW IN THE HIND LIMBS OF DOGS DURING ELECTROLYSIS OF ELECTRICALLY CONDUCTING VASCULAR PROSTHESES PREIMPLANTED INTO THE ABDOMINAL AORTA

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The peripheral blood flow in the hind limbs was studied in experiments on 25 mongrel dogs during electrolysis of electrically conducting vascular prostheses preimplanted into the abdominal aorta. After restoration of the trunk blood flow, a positive electrical potential of 3-4 V was applied to the prosthesis by means of a current conductor. The tissue blood flow was determined by a radiographic method using xenon-133. The results showed that during application of the positive potential to the electrically conducting prosthesis the tissue blood flow in the hind limbs of the dogs increased, but after application of the current stopped it fell to its initial level. It is concluded that to obtain a prolonged and stable increase in the tissue blood flow in the limbs of animals, a positive potential from a dc source must be applied continuously to the electrically conducting prosthesis.

KEY WORDS: local muscular blood flow; ^{133}Xe clearance; implantation of prosthesis into aorta.

The limited possibilities for restoring the trunk blood flow by operative means after occlusion of the small arteries of the limb necessitate the constant search for new methods of improving the collateral circulation, and, in particular, methods of overcoming spasm of the peripheral vessels and opening up a powerful collateral network.

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TABLE 1. Muscle Tissue Blood Flow in Dogs before, during, and after Application of Current to Electrically Conducting Vascular Prosthesis (M ± m)

	Number of observations	Muscle blood flow, ml/min/100 g tissue	P
Initial data	25	3,18±0,22	
During application of current	24	4,36±0,57	<0,01
After application of current	24	3,30±0,27	>0,01

Experiments have shown that during application of a positive potential to an electrically conducting prosthesis, preimplanted into the abdominal aorta of dogs, the blood volume in the hind limbs of animals can be significantly increased [3]. However, the state of the tissue blood flow – the ultimate target for the work of the circulatory system as a whole – has not been studied during electrolysis of electrically conducting prostheses.

During application of a positive potential to an electrically conducting prothesis silver ions are released from the prosthesis into the blood. Investigations by Éngel'gardt et al. [4-6] showed that silver ions inhibit the enzymic activity of myosin on account of a reduction in ATP formation. This mechanism of a change in the elastic properties of myosin may perhaps be the basis for the reduction of spasm of the muscle fibers of the vessels following an increase in the concentration of silver ions in the blood, which leads to an increase in the volume and tissue blood flow in the muscles.

The object of this investigation was to study the tissue muscular blood flow in the hind limbs of dogs during electrolysis of electrically conducting prostheses implanted into the abdominal aorta.

EXPERIMENTAL METHOD

Experiments were carried out on 25 mongrel dogs weighing 15-25 kg. Operations were performed on the animals under intravenous pentothal anesthesia following premedication with morphine hydrochloride in the usual doses. After midline laparotomy the abdominal aorta was exposed below the origin of the renal arteries. A segment of the aorta was resected. The defect in the vessel was replaced by an electrically conducting prosthesis 0.8 cm in diameter and 6 cm long. The number of silver threads in the prosthesis was 48. After restoration of the trunk blood flow and its stabilization, a positive electrical potential of 3-4 V was applied to the prosthesis. The negative electrode was connected to the animal's hind limb. The current was applied to the prosthesis for 12.5 ± 1.0 min. The tissue blood flow in the muscles of the animals' hind limbs was investigated before application of the current to the prosthesis (initially), during electrolysis, and 15 min after the end of application of the current.

To study the tissue blood flow, the isotope clearance was determined by a radiographic method [7, 8]. The isotope xenon-133 (^{133}Xe) was used as indicator [1, 2]. A depot of the isotope in the tissue was created by injecting 0.01-0.03 ml of xenon into a hind-limb muscle to a depth of 1.5 cm. A counter was placed over the depot and the liberation of isotope from the depot was recorded with the VNIIMP radiometer [2]. The rate of liberation of isotopes from the depot reflected the tissue blood flow.

EXPERIMENTAL RESULTS AND DISCUSSION

The results of determination of the muscle tissue blood flow are given in Table 1.

As Table 1 shows during application of a positive potential to the prosthesis the muscle tissue blood flow was significantly increased by 1.18 ml/min/100 g body weight ($P < 0.01$). Electrolysis of the prosthesis in 16 of the 24 animals caused the tissue blood flow to increase from 3.09 ± 0.31 to 5.19 ± 0.76 ml/min/100 g of tissue ($P > 0.01$). In the remaining eight dogs, during application of the current to the prosthesis the tissue blood flow fell from 3.50 ± 0.45 to 2.68 ± 0.33 ml/100 g weight of tissue. However, this decrease was not statistically significant ($P > 0.1$). After application of the current to the electrically conducting prosthesis ceased, the tissue blood flow in the hind limbs of the dogs fell by 1.06 ml/min/100 g weight of tissue compared with that measured during electrolysis. In only 5 of the 23 dogs was an increase in the tissue blood flow observed after removal of the electrical potential. In 15 animals the tissue blood flow was reduced, while in another 3 dogs it remained unchanged compared with its level during electrolysis.

Immediately after application of the current to the prosthesis ceased, a decrease in the tissue blood flow to its initial level was thus observed compared with its value during application of the electrical potentials.

The results of these experiments showed that during application of a positive potential to an electrically conducting prosthesis, i.e., during electrolysis of the silver framework of the prosthesis implanted into the abdominal aorta, the muscle tissue blood flow in the hind limbs of the dog increases. After application of the current to the prosthesis has ended and no more silver ions enter the blood stream, a decrease in the tissue blood flow to its initial values is observed.

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ALBINO MOUSE PAW EDEMA – A TEST FOR ESTIMATING *Escherichia coli* ENTEROTOXIN ACTIVITY

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The mouse paw edema test was evaluated as a means of detecting activity of *Escherichia coli* (strain P-99) enterotoxins. The paw edema test was shown to be simple, sensitive, and reproducible, and to permit determination of activity of the thermostable and thermolabile enterotoxins and endotoxin. This test is particularly useful for the evaluation of endotoxin preparations in the course of their isolation and purification.

KEY WORDS: *Escherichia coli*; enterotoxin; edema.

To determine the activity of enterotoxins of *Escherichia coli* the method of the ligated segment of rabbit small intestine [6] is often used. This test is somewhat laborious and its reproducibility is low, and if conducted in parallel with other tests (the skin test or cell culture) it gives contradictory results. False positive reactions also are often obtained by its use [9, 13, 15]. The skin test [5] is a sensitive test for the detection of the vascular permeability factor of enterotoxin, but this is not necessarily identical with the diarrheogenic factor tested by the ligated intestinal segment method [1].

To assess the activity of the cholerogen, several workers have used the mouse, rat, and golden hamster paw edema test [2-4, 7, 10], and in their opinion it is a highly reproducible and sensitive laboratory test.

The object of this investigation was to study the possibility of using the mouse paw edema test to determine activity of *E. coli* enterotoxins.

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