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TIME COURSE OF LYMPH NODE FUNCTION AFTER DENERVATION

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The aim of this investigation was to study lymph flow in the popliteal lymph nodes of dogs in two groups of experiments: in the course of 1 week and 3 and 5 months after unilateral division of the sciatic and femoral nerves. A parallel investigation was undertaken on lymph nodes of the contralateral limb. Lymph nodes of intact dogs served as the control. Altogether 38 popliteal lymph nodes from 19 mature mongrel dogs were used. The operative access to the lymph node was obtained under thiopental anesthesia.

EXPERIMENTAL METHOD

Movements of the surface of the lymph nodes were measured by means of an apparatus, the sensory element of which was a 6MKh1S mechanotron, designed for the high-precision measurements within the rate of $\pm 100 \mu$. The mechanotron was secured to a massive stand, and a contact surface measuring 3.5 mm^2 was fixed to the end of its rod, and pressed with a force of 200-300 mg force against the surface of the lymph node. Rapid movements of the lymph node capsule caused by pulsations of arteries, interfering with the recording of the slow oscillations, were eliminated by means of an RC circuit with time constant of 1.6 sec. The power source of the mechanotron consisted of a bipolar voltage source with stabilization factor of 5000 and with voltage pulsation of under 0.4 mV. The mechanogram was recorded for between 15 and 40 min, on an automatic X-Y Recorder, with built-in voltage amplifier.

EXPERIMENTAL RESULTS

In the course of 1 week after the experiment the results recorded on the mechanograms demonstrated acceleration of filling of the lymph nodes with lymph in the denervated and contralateral limbs. The period of oscillations of the lymph node capsule (filling and emptying of the node) in the denervated lymph nodes averaged $2 \text{ min } 27 \text{ sec} \pm 3 \text{ sec}$ (Fig. 1B), and in the contralateral nodes $1 \text{ min } 42 \text{ sec} \pm 3 \text{ sec}$ (Fig. 1C), which is much shorter than the period of oscillations of the capsule in the lymph nodes of intact dogs, namely $3 \text{ min } 26 \text{ sec} \pm 4 \text{ sec}$ (Fig. 1A). At the time of maximal filling of the denervated and contralateral lymph nodes with lymph the amplitude of the oscillations showed a tendency to increase compared with the initial level ($49.2 \pm 2.2 \mu$).

In the later postoperative stages (3-5 months) the period of oscillation of the capsule of the denervated lymph nodes remained virtually unchanged ($2 \text{ min } 8 \text{ sec} \pm 3 \text{ sec}$ Fig. 1D), but in the lymph nodes of the contralateral limb it became statistically significantly slower ($2 \text{ min } 34 \text{ sec} \pm 5 \text{ sec}$, Fig. 1E), although as before the period of oscillation was less than that in intact animals. The amplitude of the oscillations during maximal filling of the denervated ($22.6 \pm 2.5 \mu$) and contralateral nodes ($21.7 \pm 2.7 \mu$) was less than half of that both in intact nodes ($49.2 \pm 2.2 \mu$) and at the previous postoperative stage.

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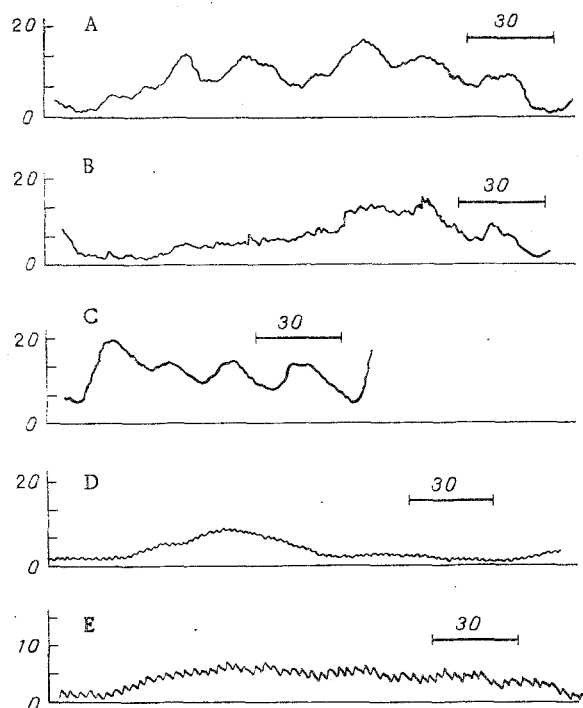


Fig. 1. Mechanogram of popliteal lymph node of dog. A) Intact node, B) denervated node (1 week), C) contralateral node (1 week), D) denervated node (3 months), E) contralateral node (3 months). A, B, C, D) Three divisions equivalent to 20 μ , E) one division equivalent to 5 μ . Line above trace is time marker, 30 sec.

The results of this mechanographic study are in agreement with those of determination of the throughput of the lymph nodes by the "running bubble" method [1], evidence of a considerable increase in the minute volume of fluid reaching the denervated and contralateral lymph nodes, compared with the initial level, throughout the period of oscillation [2]. The more rapid filling of the denervated lymph nodes and, correspondingly, shortening of the wavelength of the periodic oscillations of the capsule, can be explained by atony of the contractile system of the node and also, evidently, by transport of fluid mainly along the shorter pathway, namely the marginal sinus. Morphometric data demonstrate a significant increase in area of the marginal sinus in denervated and contralateral nodes compared with lymph nodes of intact dogs. The decrease in amplitude of the oscillations at a time of maximal filling of the lymph nodes in the late postoperative stages was probable due to pathomorphological changes in them. Histological verification at this stage of the experiment reveals sclerotic changes in lymph node tissues [4].

The results of the mechanographic study thus demonstrate that denervation of a lymph node quickens the period of filling and emptying of the node with lymph. Changes observed in the lymph node of the contralateral limb are evidently the result of a reflex effect. As regards the rhythm of oscillations of the capsule in the intact lymph nodes, the results are in agreement with data in the literature, according to which the rhythm of periodic fluctuations in the volume of fluid in lymph nodes is characterized by a cycle of between 3 and 6 min [3].

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