Effects of Chronic Hypotension on the Adrenergic Nervous Plexus of the Saphenous Artery in Rats and Its Regeneration after Femoral Nerve Injury

V. A. Puzdrova, R. A. Kargina-Terent’eva, and O. S. Tarasova

The effects of chronic hypotension on the density and intensity of fluorescence (after treatment with glyoxylic acid) of the plexus of adrenergic fibers in the wall of the saphenous artery and on the reinnervation of this vessel were studied in Wistar rats. Regional hypotension in the vascular bed of the hind part of the rats’ bodies was induced by stenosis of the abdominal part of the aorta distal to the renal arteries. After four weeks, the saphenous artery was denervated in one limb by resection of a segment of the femoral nerve. In the limb with the nerve lesion, chronic (6–7 weeks) hypotension led to a reduction in the intensity of nerve fiber fluorescence by 20% as compared with normotensive animals (controls), though the density of the nerve plexus did not change. Partial reinnervation of the vessel was observed 2–3 weeks after femoral nerve lesioning. Measures of reinnervation in normotensive and hypotensive rats were no different at two weeks, though at three weeks rats with hypotension showed more complete recovery of innervation.

KEY WORDS: arteries, adrenergic innervation, denervation, regional hypotension.
orthostasis or antiorthostasis. In orthostasis, hindlimb artery and vein walls show increases in the quantity of varicose swellings of sympathetic fibers [10]. Conversely, antiorthostasis leads to impairment to hindlimb vessel innervation [13, 17]. It should, however, be noted that simulation of chronic ortho- and antiorthostasis exposes animals to stress, which is inevitably reflected in the activity of the sympathetic nervous system. The model of regional hypotension used in the present study provides long-term reductions in pressure in the hindlimb vessels which is not accompanied by experimental stress. This treatment models occlusive lesions of the aortoiliac segment of the vascular bed, which lead to so-called Lerish syndrome [2]. In addition, decreases in blood pressure in the leg vessels are observed in patients on prolonged bed rest.

The aim of the present work was to test the hypothesis that chronic reductions in transmural pressure lead to impairments to the innervation of arterial vessels and slows the process of their reinnervation after lesioning of postganglionic sympathetic fibers.

**MATERIALS AND METHODS**

Experiments were performed on Wistar rats in accordance with the “Regulations for Studies using Experimental Animals.” Studies addressed the saphenous artery, which is a branch of the femoral artery running to the foot. Regional hypotension was created (hypotensive rats, HR, \( n = 21 \), body weight 273 ± 20 g) under Nembutal anesthesia (40 mg/kg, i.p.) by applying a metal clamp with a lumen of 0.4 mm to the abdominal aorta distal to the renal arteries [3]. Controls consisted of normotensive rats (NR, \( n = 19 \), body weight 268 ± 24 g), in which a wide brace was placed on the aorta instead of a clamp. After four weeks, rats were again anesthetized with Nembutal and the saphenous artery was denervated as described by Todd [15]. A segment of the femoral nerve of 5–7 mm located between the wall of the abdominal cavity and the local branch of the superficial gastric artery was excised on one side. Sham surgery was performed on the contralateral limb. Periarterial adrenergic nerve fibers were visualized two and three weeks after the second surgery. Under Nembutal anesthesia (40 mg, i.p.), arterial blood pressure (ABP) was measured in the arteries located rostrally and caudally to the aortic stenosis site: the right common carotid and the ventral tail arteries. The animals were then decapitated using a guillotine and segments of the saphenous arteries of length 10–13 mm were collected from both hindlimbs (one denervated vessel and one control vessel). Vessels were incised longitudinally and placed in 0.1 M phosphate-salt buffer solution (pH 7.2) supplemented with glyoxylic acid (2%, Sigma, USA), sucrose (10%), and pontamine sky blue (0.03%, Sigma, USA). After incubation for 30 min, preparations were flattened.

![Fig. 1. Plexus of adrenergic nerve fibers in the wall of the saphenous artery in controls (a) and two weeks after lesioning of the femoral nerve (b). Whole planar preparations. Nerve fiber fluorescence was induced by treatment with glyoxylic acid. Magnification: ×40.](image-url)