

**Participation of the Autonomic Nervous System in the Response
of the Blood-Tissue Exchange of ^{22}Na to the Elevation
of Venous Pressure**

T. YOSHIMURA, S. HIRAKAWA, T. SUGIYAMA, T. IMAO, H. ITO and S. HAYASE

Department of Medicine, University of Gifu, Gifu

Purpose: Little is known about the extent to which autonomic nervous system participates in the response of the blood-tissue exchange of small-sized molecular solutes to the elevation of venous pressure. This study represents an effort to clarify this point.

Methods: Hindlimbs of adult mongoreal dogs, anesthetized with 20-30 mg/kg pentobarbital, were studied for blood-tissue exchange of ^{22}Na . The extraction ratio (E) for ^{22}Na was calculated from Chinard's equation, $1-E = (C_v/C)/(R_v/R)$, using a single injection method and a mixture of $^{22}\text{NaCl}$ and R^{131}ISA . Diffusion capacity (PS) for ^{22}Na was calculated from E, using Renkin's equation for a model capillary. The venous blood was allowed to flow out of the open end of the femoral vein, the height of which could be varied. The rate of the venous outflow was kept constant.

Various procedures applied to the hindlimbs, singly or in combination, were: (a) removal of the skin, (b) autonomic ganglionic blockade with pentolinium tartrate (1 mg/Kg, i.v.) (c) acute sectioning of the sciatic nerve and (d) isolation of a hindlimb

so that the only connection was by way of a single inflowing artery and a single outgoing vein, plus the femur.

Results: PS was decreased by about 30% when venous pressure was elevated up to 200mmH₂O, in both skinned and intact hindlimbs. This response of PS was abolished by (1) pretreatment with pentolinium tartrate, (2) acute sectioning of the sciatic nerve, with or without removal of the skin, and also with or without the isolation of the hindlimbs. There was no significant change in the mean transit time (MTT) and active vascular volume (AVV) for R^{131}ISA during the elevated venous pressure.

Initial (pre-congestion) values of PS, E, MTT, or AVV did not differ significantly among the variously treated hindlimbs or from the untreated hindlimbs.

Conclusion: The decrease in diffusion capacity (PS) for ^{22}Na in dog's hindlimb capillary bed that occurs during the elevation of venous pressure is probably a phenomenon mediated through the local sympathetic nervous system and limited to the skeletal muscle.