Effects of endothelin-1 on prevention of microvascular endothelium injuries in hemorrhagic shock in rats

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Abstract:
The aim of this study was to examine the effects of posthemorrhagic hypovolemia and hypotension upon the microvascular endothelial cells and on activity of antioxidant enzymes in blood, and to investigate the influence of intravenously injected endothelin-1 in rats. The experiment was conducted on 48 rats anesthetized with ethylurethane, subjected to controlled hypotension (under 35–40 mmHg) for 60 min. Endothelin-1 was administered intravenously once at a dose of 50 pmol/kg in the 5th min of hemorrhagic shock. The control group had blood volume restored after 5 min of hypovolemia with hypotension. The arterial blood pressure, systolic and diastolic, and heart rate were monitored. After 60 min, morphological changes in the capillary endothelium of the small intestine were assessed, using electron microscope, and the activities of superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GSH-PX) in blood were measured. Animals with hypovolemia and hypotension, had edematous endothelial cells with injured cell-membrane and mitochondria, alongside of the enhancement in SOD activity (p < 0.05) and drop in the activity of CAT and GSH-PX. No signs of vascular endothelium injuries and no reduced enzymatic activities, except for GSH-PX, were observed after restoring the normal blood pressure by means of endothelin-1 in animals with hypovolemia. Hemorrhagic shock caused injuries in intestinal microvascular endothelium. Intravenously administered endothelin-1 quickly restored normal blood pressure, maintained it over a long time, and prevented the consequences of ischemia in microcirculation, thereby prolonging the survival for animals in hemorrhagic shock.

Key words:
hemorrhagic shock, vascular endothelium injuries, antioxidant enzyme activity, endothelin -1