INFLUENCE OF ASCORBIC ACID ON CAROTID BODY MORPHOLOGY IN SENESCENT RATS

J. Antosiewicz[1], M. Walski[2], and M. Pokorski[1]

[1]Department of Respiratory Research Mossakowski Medical Research Center and

[2]Institute of Biostructure, Warsaw Medical University, Warsaw, Poland,
jantosiewicz@cmdik.pan.pl

Vitamin C or ascorbic acid is an effective reducing agent influencing the functions that are involved with the redox mechanism. Endogenous ascorbic acid is present in the carotid body where it is part of free radical mechanisms operative in the carotid body in hypoxia. Previous studies demonstrate that different forms of vitamin C enhance the hypoxic ventilatory response: ascorbyl palmitate in the cat and ascorbic acid in old rats and human subjects. The nature of the increase in hypoxic ventilation associated with ascorbic acid supplementation is unclear. In this study we investigated the hypothesis that ascorbic acid supplementation could have an effect on carotid body morphology, which would help explain the enhancement of the hypoxic ventilatory response in old rats. We addressed this issue by comparing the ultrastructural picture of carotid bodies in three groups of rats: young (3 months old) and two groups of senescent (24 months old) rats - one untreated, taken as control, and the other chronically supplemented with vitamin C, given by gavage in a dose 50 mg/kg daily for 14 days. The animals from each group were then euthanized by perfusion through the left heart with mixture of aldehydes, the carotid bodies were rapidly dissected and postfixed. Ultrathin sections were made, dehydrated in a series of increasing concentrations of ethanol, and embedded in Spurr resin. The specimens were viewed under a transmission electron microscope. We found that carotid body parenchyma of the old untreated rats displayed a host of variably expressed degenerative changes as compared with the young carotid bodies. The most prominent changes were present in the chemoreceptor cells and consisted of damage to the mitochondrial matrix, vacuolization of the cytoplasm, fewer secretory vesicles, the appearance of phagolysosomes. In contrast, in the ascorbic acid-treated rats the age-changes in the carotid body were visibly decreased. There were fewer swollen mitochondria and most of them had an undisturbed arrangement of inner membranes. The Golgi area and endoplasmic reticulum were no more hyperplastic. In this presentation we further discuss the favorable effects on carotid body morphology of ascorbic acid in the context of functional hypoxic ventilatory responses in the aforementioned groups of rats. We conclude that ascorbic acid may protect carotid bodies from degenerative changes caused by age. The protection is afforded, in all likelihood, owing to the antioxidant properties of ascorbic acid. The resolution of the exact mechanisms of ascorbic acid action requires alternative study designs.