

Protective Effect of Vitamin E Against Ischemia: Reperfusion Induced Oxidative Stress in Isolated Hearts From Hyperthyroid Rabbits

Abstract:

Background: Hyperthyroidism either clinical or experimentally induced is associated with cardiac problems such as sinus tachycardia and atrial fibrillation in addition to reduction in ventricular contractility which is due to increased free radicals. It is now generally accepted that free radical-lipid peroxidation in biological membranes is associated with variety of important pathological events and aging. Vitamin E is one of the well known antioxidants used in clinical practice. Aim of the Work: The objective of this work is to study the effect of vitamin E on the functional recovery from in vitro induced ischemia-reperfusion of isolated hearts in hyperthyroid rabbits compared to euthyroid and vitamin E treated hyperthyroid ones.

Material and Methods: In the present study 40 normal male New Zealand rabbits, weighing 2.0-2.25 kg, were used and randomly divided into 4 groups, 10 rabbits each. Group I (euthyroid "E"): rabbits received intramuscular (i.m.) injection of saline (1ml/kg/day) for 8 days and oral corn oil vehicle (1ml/kg/day) orally for 10 days, Group-II (hyperthyroid "H"): as group-I but rabbits received i.m. injection of l-thyroxin "T4" (200 µg/kg/day) instead of saline, Group-III (vitamin E-treated "VE"): rabbits received i.m. injection of saline (1ml/kg/day) and oral vitamin E (200 µg/kg/day) in corn oil vehicle for 10 days and Group-IV (hyperthyroid vitamin E treated "HVE"): as group-III but rabbits received i.m. injection of T4(200 µg/kg/day) instead of saline. At the end of therapy, hearts were isolated, weighed and exposed to 30 min. no flow ischemia followed by 25 min. reperfusion. Pre-ischemic and after 25 min. reperfusion coronary effluent, heart rate (HR) and contractility parameters (amplitude of contractions, LVDP and dP/dtmax) were assessed then hearts of each group were homogenized to measure the malondialdehyde (MDA) and guanosine 3',5'-cyclic monophosphate (cGMP).

Results: The mean heart weight/BW ratio in (H) and (HVE) groups significantly increased after T4 therapy by +32.4% and +35.1% respectively compared to (E) group. Except for the mean coronary effluent, which showed insignificant changes, all other tested parameters significantly increased in (H) and (HVE) groups compared to corresponding pre-ischemic values of (E) group. All pre-ischemic values of (HVE) group insignificantly changed compared to that of (H) group. The mean coronary effluent significantly increased in (HVE) by +19.4% compared to (H) group after 25 min. reperfusion. However, the mean HR was significantly reduced in (HVE) by -34.7% compared to (H) group after 25 min. reperfusion. The mean contractility

parameters “amplitude of contractions, LVDP and dP/dtmax” significantly increased in (HVE) by “+41.1%, +106% and +40%” respectively compared to (H) group after 25 min. reperfusion. The mean MDA and cGMP was significantly reduced in (HVE) by -45.7% and - 39.5% respectively compared to (H) group.

Conclusion: These results suggested that after exposure of isolated hyperthyroid rabbits’ hearts to ischemia-reperfusion, as a model for oxidative stress, oral vitamin E could improve the contractility parameters, coronary flow as well as tachycardic response to reperfusion in addition to the improvement of the cardiac capability to face oxidative stresses in hyperthyroidism. This might need a further clinical study to prove the role of vitamin E in preventing ischemic cardiac dysfunction in patients with thyrotoxicosis.

Key Words: Vitamin E – Hyperthyroidism – Ischemia - reperfusion – Langendorff heart preparation.