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Hyperhomocysteinemia and Increased Oxidative Stress Levels Are Associated with Impaired Membrane Fluidity of Red Blood Cells in Hypertensive and Normotensive Men: An Electron Spin Resonance Investigation

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ABSTRACT

Hyperhomocysteinemia and oxidative stress may be strongly linked to hypertension, atherosclerosis and other cardiovascular diseases. The present study was performed to investigate possible relationships among plasma total homocysteine, plasma 8-iso-prostaglandin F_{2a} (8-isoPG F_{2a}: an index of oxidative stress), and membrane fluidity (a reciprocal value of membrane microviscosity) in hypertension. We measured the membrane fluidity of red blood cells (RBCs) in hypertensive and normotensive men using an electron spin resonance (ESR) and spin-labeling method. Membrane fluidity of RBCs was significantly decreased in hypertensive men compared with normotensive men. Plasma total homocysteine levels were significantly higher in hypertensive men than in normotensive men, and correlated with plasma 8-isoPG F_{2a}. In contrast, plasma nitric oxide (NO)-metabolites (an index of endothelial function) were lower in hypertensive men than in normotensive men. The reduced membrane fluidity of RBCs was associated with increased total homocysteine and plasma 8-isoPG F_{2a} levels and decreased plasma NO-metabolite levels. Multivariate regression analysis showed that, after adjusting for general risk factors, plasma total homocysteine and 8-isoPG F_{2a} were significant determinants of membrane fluidity of RBCs, respectively. These results suggest that hyperhomocysteinemia and oxidative stress with endothelial dysfunction might have a close correlation with impaired rheologic behavior of RBCs and circulatory disorders in hypertensive men.

KEYWORDS

Homocysteine; Oxidative Stress; 8-Iso-Prostaglandin F_{2a}; Nitric Oxide; Membrane Fluidity; Red Blood Cell; Electron Spin Resonance; Hypertension

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