

Oxidative stress and myocardial injury: spin-trapping and low-temperature EPR study

Enno K. Ruuge, Irina V. Zabbarova, Olga V. Korkina, Andrei N. Khatkevich, Vladimir L. Lakomkin, Aleksander A. Timoshin

The aim of this study was to examine the effect of duration of ischemia and ischemic preconditioning on postischemic myocardial function, oxygen-derived free radical production by cardiac mitochondria and functional characteristics of mitochondrial electron carriers. Isolated Wistar rat hearts were perfused aerobically and then subjected to global ischemia of variable duration and reperfusion. The EPR spectra of freeze-clamped hearts were measured at 6-40 K and 243 K. Mitochondria were isolated after aerobic perfusion, ischemia of variable duration or reperfusion. TIRON was used as a spin trap to study the superoxide radical generation in mitochondria. The prolonged (30- and 45-minute) ischemia resulted in an essential enhancement of the superoxide-generating activity of the heart mitochondria, but both the relatively brief (15-minute) episodes of ischemia or ischemic preconditioning before more extended ischemia maintained the contractile function and energy metabolism of the postischemic heart. The ischemic preconditioning depressed the production of superoxide radicals after prolonged ischemia and changed the balance between the free radical intermediates of coenzyme Q differing in stability and contribution to the electron-transfer reactions in mitochondria.