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Application of Molecular Hydrogen in Heart Surgery under Cardiopulmonary Bypass

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Abstract

The aim of this work was to study the effect of molecular hydrogen on oxidative processes in cardiac surgery patients with acquired valve heart disease applied during surgery under cardiopulmonary bypass (CPB).

Materials and methods: The study involved 20 patients (16 men and 4 women) with acquired heart valve disease who were operated on under CPB. Two groups of patients were formed. In group 1 (n=11), anesthesia included inhalations of molecular hydrogen, which was supplied to the breathing circuit of the ventilator at a concentration of 1.5-2.0% immediately after tracheal intubation and throughout the operation. In group 2 (n=9), inhalation of molecular hydrogen was not performed.

Blood sampling was taken at 4 stages: immediately after anesthesia induction, before CPB and after its termination, and also one day after the operation. The intensity of the processes of lipid peroxidation was evaluated by the level of diene (DC) and triene (TC) conjugates, Schiff bases (SB).

Results: In the patients of group 1, the arterial blood samples showed a decrease in the level of TC and SB, as compared to the first stage of the study, before the initiation of CPB and one day after the operation. An increase in the level of DC and TC was detected after the termination of CPB ($p < 0.05$). In the venous blood samples, an increase in the level of DC was noted before the initiation of CPB, which was restored by the third stage of the study ($p < 0.05$). At the same time, after the termination of CPB, a tendency towards a decrease in TC and SB was observed, which persisted one day after the operation. In the patients of group 2, an increase in the concentration of SB in the arterial blood samples was recorded during the study as compared to the first stage. The level of TC and SB in the venous blood samples increased one day after the operation.

Conclusion: Intraoperative inhalation of molecular hydrogen leads to a decrease in the oxidative stress manifestation, it being most pronounced one day after the operation. This suggests that molecular hydrogen can be used in cardiac surgery as an effective and safe antioxidant.

Keywords: antioxidants; cardiopulmonary bypass; lipid peroxidation; molecular hydrogen; oxidative processes.

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Figures

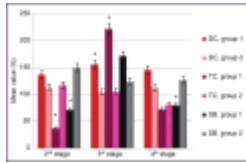


Figure 1. Dynamics of the levels of...

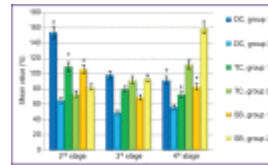


Figure 2. Dynamics of the levels of...

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