

Novel fluid using oxygen microbubbles

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Background

Microbubbles have been used in a variety of fields and have unique properties, such as shrinking collapse, long lifetime, efficient gas solubility, a negatively charged surface, and the ability to produce free radicals. In the medical fields, microbubbles have not been used in common. In this study, we demonstrated that microbubbles could achieve oxygen supersaturation in fluids and improve hypoxic conditions in the blood.

Methods

Sodium chloride solution and swine venous blood were applied to the following experiments. Blood sampling was approved by the Ethics Review Committee of Okayama University of Science. Generation of microbubbles Fine microbubbles of oxygen gas were generated in the liquid (150 mL) using a micro-nanobubble aerator with hydrodynamic function for 15 min, with which oxygen gas was supplied in a flow volume of 1 L/min. Evaluation of dissolved oxygen in blood samples Dissolved oxygen partial pressure (Po₂) in the blood mixed with oxygen microbubble normal saline solution (NSS) samples were measured by a blood gas analyzer.

Results

Microbubbles could achieve oxygen supersaturation in fluids (Po₂=1003.2 ± 25.5mmHg). The Po₂ values were 64.6 ± 1.4 mmHg in control blood, 72.4 ± 1.5 mmHg in blood diluted 10% with NSS, and 81.9 ± 3.3 mmHg in blood diluted 10% with Oxygen microbubble NSS (P < 0.05).

Conclusions

Oxygen microbubble NSS was effective for improving hypoxic conditions in the blood. Thus, the use of oxygen microbubble fluids is a potentially effective novel method for hypoxic blood oxygenation.