Gas transfer performance of a hollow fiber silicone membrane oxygenator: ex vivo study


Abstract
Based on the results of in vitro studies of many experimental models, a silicone hollow fiber membrane oxygenator for pediatric cardiopulmonary bypass (CPB) and extracorporeal membrane oxygenation (ECMO) was developed using an ultrathin silicone hollow fiber with a 300 microm outer diameter and a wall thickness of 50 microm. In this study, we evaluated the gas transfer performance of this oxygenator simulating pediatric CPB and ECMO conditions. Two ex vivo studies in a pediatric CPB condition for 6 h and 5 ex vivo studies in an ECMO condition for 1 week were performed with venoarterial bypass using healthy calves. At a blood flow rate of 2 L/min and $V/Q = 4$ ($V$ = gas flow rate, $Q$ = blood flow rate) (pediatric CPB condition), the $O_2$ and $CO_2$ gas transfer rates were maintained at $97.44 \pm 8.88$ (mean $\pm$ SD) and $43.59 \pm 15.75$ ml/min/m$^2$, respectively. At a blood flow rate of 1 L/min and $V/Q = 4$ (ECMO condition), the $O_2$ and $CO_2$ gas transfer rates were maintained at $56.15 \pm 8.49$ and $42.47 \pm 9.22$ ml/min/m$^2$, respectively. These data suggest that this preclinical silicone membrane hollow fiber oxygenator may be acceptable for both pediatric CPB and long-term ECMO use.

Artif Organs 2001; 25(6):498