The reoxygenation phenomenon

To the Editor:

Martin and colleagues[1] presented an interesting study on infants undergoing extracorporeal membrane oxygenation (ECMO). It was reported that, during ECMO, 5% of the surveyed infants had an exaggerated depression of cardiac performance, called cardiac stun, at initial presentation, and this condition was associated with a significantly ($p < 0.001$) higher mortality (42% versus 19% of infants without cardiac stun). The statistical analysis performed by Martin and colleagues revealed a significant ($p < 0.005$) difference in the arterial oxygen tension (Po_2) before the onset of ECMO: 27 mm Hg in the group with cardiac stun versus 42 mm Hg in the group without cardiac stun. It was argued that "it is possible that a reperfusion abnormality was causative."

In our opinion there is little doubt that the myocardial injury observed by Martin and colleagues was a consequence of the so-called oxygen paradox driven by the acute reoxygenation of hypoxemic tissues. Indeed, reoxygenation phenomenon similar to the cardiac stun was observed both experimentally[2] and clinically.[3] Also, our experimental observations have already addressed this issue.[4, 5] In particular, one of the previously reported studies[2] reports that three factors primarily influence the reoxygenation injury, that is, the duration of hypoxia, the Po_2 gradient between hypoxia and the reoxygenation (direct relationship exists between the magnitude of enzyme release and Po_2 at reoxygenation), and temperature at reoxygenation (hypothermia reduces the negative effects of reoxygenation).

The reported clinical experience with infants undergoing ECMO[1] seems to substantiate these experimental observations. Indeed, assuming that the duration of hypoxia, temperature, and arterial Po_2 at the onset of ECMO were constant, cardiac stun appears more frequent and more severe in infants with lower arterial Po_2 during hypoxia and thus higher Po_2 gradient at the onset of ECMO. In addition, our experimental study[5] demonstrated a substantial myocardial effect of hypoxemia/reoxygenation, likely due to the high energy demand of the hearts during hypoxia. It should therefore be interesting to include in the statistical analysis the data on myocardial performance during hypoxia, before the onset of ECMO.

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