

## Letters to the Editor

# Evaluation of Quadrox-i<sup>®</sup> Adult Hollow Fiber Oxygenator with Integrated Arterial Filter

To the Editor,

In your June issue of the *Journal of ExtraCorporeal Technology* we read the interesting article of Guan et al. in which they investigated the air handling capacity of two different oxygenators used in cardiopulmonary bypass (1).

We congratulate the authors for their results, showing that the Quadrox-i adult oxygenator had better gaseous microemboli handling than the standard Quadrox adult oxygenator, while both artificial lungs had similar trans-membrane pressure drops. Nevertheless, we want to comment on the data presented by the authors. Table 2 shows both emboli count and volume. When comparing baseline values, the reader notices that both venous emboli count and volume differ significantly. To be more specific, the baseline count values for the Quadrox are nearly three times higher and the baseline volume values are nearly twice those measured in the Quadrox-i group. As the venous bubble measurement is located before the pump and the oxygenator, one expects the measured total venous bubble volume to be equal for all groups at the three flow rates, respectively. Moreover, intergroup difference in baseline is expected to bias the post-oxygenator emboli count and might explain the study outcome, which is in favor of the Quadrox-i.

Applying their protocol, the authors were able to separately investigate the impact of the integrated arterial filter on gaseous emboli removal. However, since the authors state both the standalone Quart filter and the integrated filter to be similar in terms of the filter component, would simply investigating the emboli removal capabilities of a standalone Quart filter in a mock circulation not be the same?

Part of the volumetric data on bubbles presented in Table 2 contains measured volumes larger than .5 mL, which is beyond the range of the bubble counting device. The discussion section hypothesizes that the centrifugal pump induces bubble break-up which aggravates the creation of smaller bubbles at higher flows and rpm. As

a result, bubbles may become too small to detect, and the presented number of bubbles counted may be misleading. Indeed, the potential of centrifugal pumps to break up air emboli into even smaller bubbles has been reported in literature (2). Table 3 presents bubbles in three size ranges of which one corresponds to bubbles of 0–20 microns, thus including the bubbles that cannot be detected since they are too small to be measured. Would this not weaken the conclusion of the study?

In the literature currently available and also in this study, air handling of cardiopulmonary bypass components is tested by infusing air into mock circulations. In an ongoing clinical study at our hospital, we found that microembolization occurs when kinetic venous assisted drainage as used in minimized bypass circuits is applied, and found a positive correlation between sub-atmospheric pressure and the number of gaseous emboli counted. Compared to the bubble data presented by the authors, we found similar diameters of gaseous bubbles. This implies that air injection into mock circulations can be a reliable method to assess air handling capacity of bypass components under comparable conditions as found in clinical routine.

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## REFERENCES

1. Guan Y, Su X, McCoach R, Wise R, Kunselman A, Ündar A. Evaluation of Quadrox-i adult hollow fiber oxygenator with integrated arterial filter. *J Extra Corpor Technol.* 2010;42:134–8.
2. Rider SP, Simon LV, Rice BJ, Poulton CC. Assisted venous drainage, venous air, and gaseous microemboli transmission into the arterial line: An in-vitro study. *J Extra Corpor Technol.* 1998;30:160–5.