
To the Editor,

We thank Mr. Herbst for his comments and review of our article “Air transmission comparison of the Affinity Fusion oxygenator with an integrated arterial filter to the Affinity NT oxygenator with a separate arterial filter.” We designed this in vitro study to answer the question of whether the Fusion oxygenator with its integrated arterial filter was as safe as our clinically used Affinity NT oxygenator with attached Affinity CB351 arterial filter (“Affinity system”) in terms of relative microbubble transmission of introduced air.

We agree that the Fusion oxygenator showed a larger percentage increase in median total bubble volume and count at the higher blood flow of 5 L/min vs. 3 L/min, than the Affinity system. Whether this is statistically significant, or more importantly clinically significant, is worth addressing. An analysis of variance (ANOVA) statistical analysis revealed no significant interaction effect ($p > .05$), so we cannot say that the flow rate has a greater effect on the transmitted bubble volume or count in one oxygenator–arterial filter system vs. the other. However, this assumes that the transmitted bubble volume and count linearly rises with increasing flows. A third flow rate would clarify if the transmitted bubble volume and count follows a linear or nonlinear trend. The study covered the most common range of pump flows in our adult perfusion practice. However, as all the devices are rated to 7 L/min, it would be instructive to understand their behavior at such a high flow rate. Nevertheless, the median total bubble volume transmitted by the Fusion was still almost half—and its median total transmitted bubble count at two-thirds—that of the Affinity system at 5 L/min.

As mentioned in our article, the apparent transmission of bubbles measured larger than the rated filter pore size may be a feature of the GAMPT BC100 Doppler overestimating bubble size, especially at higher flows (1). We concur that the Fusion did show a higher percentage increase in median bubble size relative to its rated pore size (Fusion: 25 μm; Affinity arterial filter: 38 μm), particularly during the first minute after air challenge. However, the Fusion’s median transmitted bubble size remained consistently smaller than that of the Affinity system in all scenarios—an important clinical point.

As noted in our article, there was an increased inlet air volume seen in the Affinity system vs. the Fusion at 3 L/min. As both systems purged into the cardiectomy, an explanation was that of differing rates of bubble recirculation. We reviewed the bubble-count-by-time curves for evidence of recirculation (as defined as a secondary rise in bubble count on the inflow). Recirculation curves were commonly seen in both oxygenator–arterial filter systems at either flow rate—with the notable exception of being observed only once in the Fusion at 3 L/min. So the phenomenon may be more a case of a lower Fusion recirculation than a higher Affinity system recirculation. This tentative explanation for the differences observed in infusion bubble load could be clarified by simultaneously measuring the microbubbles exiting the cardiectomy.

We feel that potential discrepancies of pressures within the oxygenator–arterial filter should not bias against the Affinity system. The air challenge was delivered under identical pressure conditions up to the roller pump. Likewise, the line pressure distal to the oxygenator–arterial filter system was kept the same. Discrepancies in pressures between the roller pump and the oxygenator–arterial filter are an intrinsic feature of the system being tested. Generally in practice, one does not alter pump flows because a device has a different pressure drop; the flow (and secondarily the pressure) in the arterial line is primarily determined by patient parameters not extracorporeal circuit components.

We agree that there is a need for a standardized test circuit and protocol for the testing of extracorporeal component bubble handling capabilities, as the absence of such a standard make the comparison of published studies perplexing (2). However, there is also a need to understand how the systems work within ones clinical environment. This trial was designed to emulate the clinical circuit used under our familiar clinical parameters; being part of our department’s consideration of a replacement oxygenator.

Working toward best practice during extracorporeal circulation implies a constant fine tuning of available circuit components to optimize patient safety. We hope that our study contributes to this process. As the Fusion oxygenator is sold as a stand-alone device with integrated filter,
understanding how it performs gives a baseline on which to decide whether to use it clinically alone, or with an additional arterial filter.

Finally, it should not be overlooked that arterial filter performance also requires an assessment of its particulate handling—we hope to see more future studies investigating this important aspect of perfusion safety.

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REFERENCES