In-Vitro Study Comparing Venous Air Removal and Cardiotomy Suction Air Removal of Two Cardiopulmonary Bypass Systems

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Abstract:

**Background:** Gaseous microemboli (GME) result during cardiopulmonary bypass (CPB) and are a potential cause for neurological deficit postoperatively. The objective of this research study was to compare GME removal performance of the Medtronic Fusion (Fusion) oxygenator to the Terumo FX15 (FX15) oxygenator. Gross air enters the bypass circuit through two main mechanisms, venous air and cardiotomy suction air.

**Methods:** We evaluated the efficacy of each system to remove 0.05 liters per minute (LPM) of gross venous air and 1 LPM of gross cardiotomy suction air. We used the Bubble Counter BC100 by GAMPT (Merseburg, Germany) to quantify GME 10-500 µm/second under varying conditions of pump flow and reservoir level. Ultrasonic bubble counter probes were placed post reservoir, pump, oxygenator, and ALF (arterial line filter). Three trials of each condition were performed. These results were averaged and compared between systems.

**Results:** The Fusion and FX15 with the ALF (0.95 ± 0.005, 1.0 ± 0.00) was able to remove more GME per second during the 0.05 LPM gross venous air tests than without the ALF (0.70 ± 0.02, 0.95 ± 0.005) at 4 LPM with a reservoir level of 1 L. The FX15 with the ALF (1.0 ± 0.0) was more efficient in removing GME than the Fusion and the Fusion with the ALF (0.70 ± 0.02, 0.95 ± 0.005). The Fusion with the ALF outperformed the FX15 without the ALF during the venous air and cardiotomy suction air tests.

**Conclusion:** In our observations, both the Fusion and FX15 systems with the ALF removed more GME during the venous air and cardiotomy suction air tests. The IFUs for each oxygenator should not be exceeded because an increase in GME occurs.