To Purge or not to Purge?

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Disclosures

I have no conflict of interest to disclose.
Relevance

- Gaseous Micro Emboli (GME) during cardiothoracic surgery is irrefutable\(^1\)
- Adverse Cerebral events 1-3\(^%\)\(^2\)
- Cognitive disturbances 20-60\(^%\)\(^3\)

Aims of Study

- Whether purging of a contemporary oxygenator is beneficial
- What factors might have an effect on purging
Related Literature

- **Rodriguez et al. (2005).** Effect of perfusionist technique on cerebral embolization during cardiopulmonary bypass.

- **Mathis et al. (2012).** Evaluation of four pediatric cardiopulmonary bypass circuits in terms of perfusion quality and capturing gaseous microemboli.

- **Lin et al. (2012).** Evaluation of Quadrox-i and Capiox FX neonatal oxygenators with integrated arterial filters in eliminating gaseous microemboli and retaining hemodynamic properties during simulated cardiopulmonary bypass.
Oxygenators & Reservoirs
Gampt BCC200

- Two probes
- Pulse ultrasonic Doppler technique
- GME measure range 5 – 500 μm
- Accuracy limit 1000 GME/s
- Blood flow 0.5 tot 8 l/min
Methods

- Flows of 3 l/min and 5 l/min
- Freshly drawn porcine blood with a hematocrit of 35-40%
- Venous reservoir volume kept at 1500 ml
- GME introduced continuously with an airflow of 1 l/min

\[
\text{Filter index} = \left( 1 - \frac{\sum N_i \text{ Output}}{\sum N_i \text{ Input}} \times \frac{\sum N_i \times V_i \text{ Output}}{\sum N_i \times V_i \text{ Input}} \right) \times 100
\]
In-vitro set up

Air flow of 1 l/min.

Cobe roller pump

Purge Line

Oxygenator

Connected to Vacuum

Channel 1

Channel 2

GAMPT

Tested Oxygenator

Tested Reservoir
Results - Reservoir Efficiency in GME removal
Results – Oxygenators Efficiency in GME removal

Quadrox-i-Adult

- No Purge
- With purge
- Linear (No Purge)
- Linear (With purge)
Results – Oxygenators Efficiency in GME removal

Inspire 8F

- No Purge
- With Purge
- Linear (No Purge)
- Linear (With Purge)
Results – Oxygenators Efficiency in GME removal

Capiox FX25

Efficiency % vs Flow L/min

- No Purge
- With Purge
- Linear (No Purge)
- Linear (With Purge)
Results – Oxygenators Efficiency in GME removal

Efficiency % vs Flow L/min for Affinity Fusion with and without purge.
Results – Oxygenators Efficiency in GME removal

Admiral AF

<table>
<thead>
<tr>
<th>Flow L/min</th>
<th>Efficiency %</th>
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<tbody>
<tr>
<td>No Purge</td>
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- Linear (No Purge)
- Linear (With Purge)
## Efficiency

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<th>Oxygenator</th>
<th>3 l/min</th>
<th>5 l/min</th>
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<tr>
<td></td>
<td>No Purge</td>
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<tr>
<td>Admiral AF</td>
<td>89.33</td>
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Statistical Analysis

- Wilcoxon test
- No significant difference between purged and non purged groups
Theory

- Buoyancy vs drag
- Increase in GME size
- Purge flow
- Turbulent flow and recirculation
Conclusion

- No beneficial reason for continuous purging of the oxygenator during adult CPB
- Leads to a decreased oxygenator efficiency in GME removal
- Increased stolen blood flow
Take home message

- Several factors influence removal of GME
- During high velocity flows drag dramatically trumps buoyancy
- Cautious purging rather than continuous purging
Thank you!

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