

IN VITRO comparison of 3 types of oxygenators during priming procedure using pulsatile flow

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1. Introduction

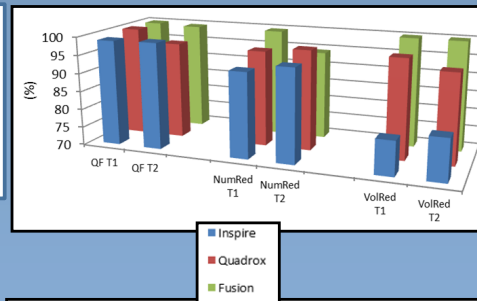
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The physiological way our heart pumps blood throughout our body is using **Pulsatile Flow (PF)**; consequently, our tissue beds and capillary networks are perfused under conditions of **Pulsatile Perfusion (PP)**. Recent publications concluded that PP may be better than conventional perfusion in terms of cardiac, renal and pulmonary functions during the post bypass period in both pediatric and adult patients. ¹⁻⁶ In order to safely use PP during clinical cardiopulmonary bypass (CPB), the clinicians have to stress their extracorporeal circuit (ECC) by using PF during the priming procedure.

Study Objective: To evaluate our daily practice after 4 events of abnormal appearance of air in our ECC during priming procedures that we have been unable to explain.

2. Methods

- Investigation of the best mode for PP with SIII and S5
- Recording of different pressures and real negative pressures induced by PF
- Recording of GME produced in different conditions using the Gampt BCC200
- Comparison of 3 oxygenators in CF and PF: Inspire 8F, Quadrox-I, Fusion



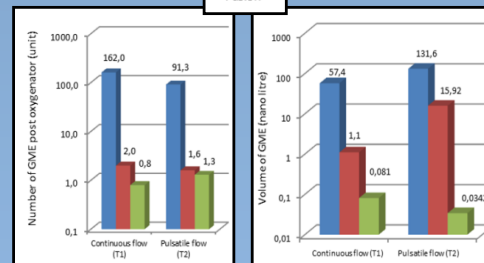
3. Results

Quality Factor, NumberReduction and VolumeReduction

- Do not differ between T1 and T2 within a same oxygenator
- Are statistically different between the 3 oxygenators in T1
- In T2, are comparable between oxygenators, except VolRed of the Inspire which was statistically different from the two other ones

Number and Volume of GME:

- Within a same oxygenator, are similar in T1 and T2
- Differ statistically from one oxygenator to the other
- Remain very low, the lowest values being recorded with Quadrox and Fusion



4. Take Home Message

- ✓ Fusion and Quadrox are associated with significantly lower number and volume of GME; No real clinical implication is expected from this
- ✓ Membrane and ECC must be stressed during the priming procedure when PF is used with a pressure line above 200 mmHg and a high level in the reservoir more than recommended by companies
- ✓ New oxygenator used in clinical setting must be tested before clinical use to demonstrate their limitations with PF

5. References

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1. Artif Organs, 2014. A Meta-Analysis of Pulmonary Function With Pulsatile Perfusion in Cardiac Surgery. Lim CH, Nam MJ, Lee JS, et al.
2. J Cardiothoracic Vasc Anesth, 2011. Direct observation of the human microcirculation during cardiopulmonary bypass: effects of pulsatile perfusion. Elberts PW, Wijbenga J, Solinger F, et al.
3. J Extra Corp Technol, 2012. A meta-analysis of renal benefits to pulsatile perfusion in cardiac surgery. Stevert A, Sestino J
4. Journal of Applied Physiology, 2013. Reply to Pancheva, Panchev, and Pancheva. Nick J. Koning, Christa Boer
5. ASAIO J, 2006. An evaluation of the benefits of pulsatile versus non pulsatile perfusion on vital organ recovery during and after pediatric open heart surgery. Alkan T, Akçevim A, Undar A, et al.
6. Artif Organs, 2011. Clinical evaluation of the air removal characteristics of an oxygenator with integrated arterial filter in a minimized extracorporeal circuit. Marco C. Stehouwer, Chris Boers, et al.