Description of the Minimized Extracorporeal Circuit to perform Haematic Antegrade Repriming in Cardiopulmonary Bypass.

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Summary:

Introduction: cardiac surgery is continuosly evolving towards a less invasive procedures and different perfusion techniques are also being studied to enhance the results. The aim of this study is to propose a standardized minimized extracorporeal circuit (MiECC) design to guarantee a fix low contact surface and haemodilution when the haematic antegrade repriming (HAR) is being applied. **Materials and Methods:** after a review of the current evidence a minimized circuit of 3/8 inch diameter was proposed and approved by our cardiac surgery team. **Results**: The initial dynamic priming of the circuit is lower than 1000ml. After HAR maneuvres, the haemodilution is reduced to 300ml of crystalloid priming. **Discussion:** The standardization of the circuit reduces errors, offers continuity between centres and savings. The basis of HAR are the detailed and reproducibile measures that could exceed the benefits of the isolated effect of reducing the circuit, applying vacuum to increase the drainage or retrogradely repriming it with blood. As a differencing factor, the standardization and detailing of the procedure offers reproducible results that should be assessed. **Conclusion**: Detailing the MiECC circuit used during HAR is a differencing feature that increases the replicability of the procedure reducing errors and the impact of the cardiopulmonary bypass.

Introduction

The current era of cardiac surgery is profoundly marked by the aim to reduce the operative insult to the patient by the combination of minimally invasive cardiac surgery (MICS) measures and perfusion strategies like minimized extra-corporeal circuits (MiECC), vaccuum asissted venous drainage (VAVD) and repriming of the circuit with autologous blood in a retrograde (RAP) or an antegrade manner) (1–3).

A multimodal approach is mandatory to maximize the potential of recovery in the cardiovascular patients after surgery, but some perfusion strategies must be standardized and audited to better examine the reduction of the insult related to the cardiopulmonary bypass (CPB).

After a review of the current evidence, a new perfusion approach was described by our team under the name of Haematic Antegrade Repriming (HAR), combining the benefits of RAP, MiECC and VAVD. The aim of this paper is to detail the Class IV MiECC(4) applied in HAR to maximize the replicability of the procedure.

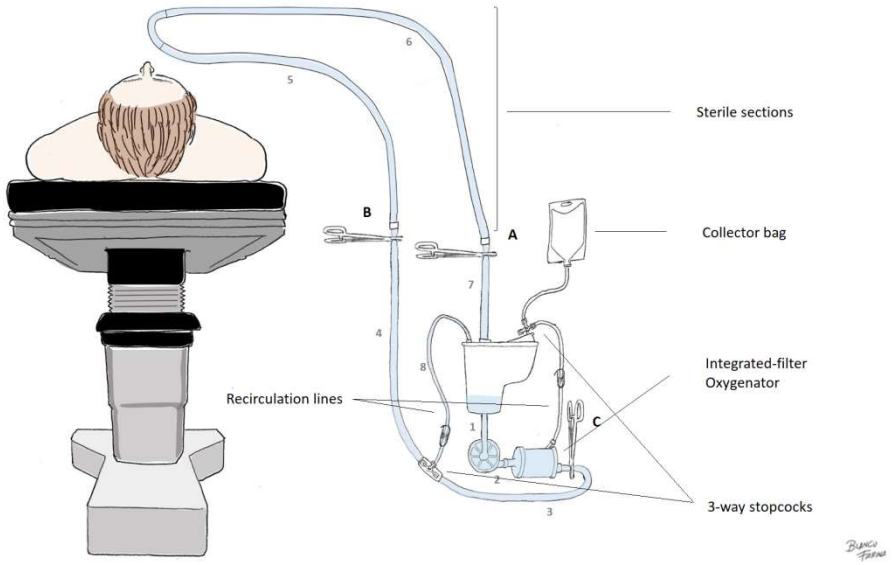
Materials and Methods

A minimized Class IV standardized circuit was constructed in order to reduce the contact surface of tubing with blood of the patient (4). For that reason, a centrifugal pump, an oxygenator with an integrated filter and a biocompatible coating were included in the design (Fig. 1).

The arterial line, coming from the oxygenator, is composed of 3 tracts of 3/8 inch diameter tubing. The first portion is 25cm long, and is continued by a 3/8 inch connector with a luer-lock branch that returns a recirculation line to the reservoir. After that, it is continued by 55cm of 3/8 inch tubing until the sterile portion of 135 cm, contained in a sash tray, and finished with a connector to the venous line.

The venous line starts in the sash tray with a sterile tract of 105cm in a 3/8 inch diameter. Out of the tray, the venous line is continued with 40 cm of 3/8 inch tubing and connected to the hard-shell reservoir.

An additional standard VAVD system is applied to initiate the CPB. The suction should not exceed -40mmHg to avoid complications.



Results

This setup can be applied with any oxygenator with integrated arterial filter and centrifugal pump, currently available on the market, with a dynamic priming volume lower than 1000ml. After the perfusion manoeuvres described in the HAR procedure, a total haemodilution of only 300ml is achievable.

Discussion

The standardization of the circuit reduces the risk of errors and favours continuity between different centres (5). This may also represent a reduction of biases in multicentre studies and decrease the production costs of the systems as well.

One of the key points of HAR in comparison to other repriming techniques is to offer a full package of standardized measures to grant a reproducible result, oppositely to the heterogeneity incurred with RAP (6–8).

The reduction of the contact surface provided by the 3/8 inch diameter on the venous line requires the application of VAVD to augment the drainage and the preload to the circuit. Different studies indicate that VAVD reduces the blood product exposure without an increment of perioperative complications in a range like the ones purposed in this setup (9,10).

While RAP has displayed very different results between publications (3,11), a preliminary study with a retrospective sample observed that the application of HAR may represent a more reliable predictor as of the nadir haematocrit as well as blood product requirements until discharge (12). Upcoming research like the clinical trial that is being carried out by our team will offer a more detailed overview of the improvements provided by the HAR (13) that should be validated by other authors.

Conclusion

Standardizing and reducing the CPB tubing to a MiECC (Class IV), applying VAVD and antegrade repriming with autologous blood are the three pillars that sustain the predictable and transferrable benefits provided by HAR that should also be validated by other authors.

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