Marginal Gains in Perfusion Utilizing a Dual Cardiotomy Reservoir

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Theory of Marginal Gains

In the beginning, there is basically no difference between making a choice that is 1% better or 1% worse. In other words, it won't impact you very much today. But as you keep on, these small improvements stack up. And then suddenly, there is a very big gap between people who make slightly better decisions on a day to day and those who don't.

Marginal Gains applied to Professional Cycling by Team Sky

"We are always striving for improvement, for those 1% gains, in absolutely every single thing we do."

Davide Bartolotta
Evolution of Equipment in Time Trials
Laurent Fignon 1989 vs Chris Froome 2013

Marginal Gains in Cardiovascular Perfusion

Avecor Maxima
480 mL prime
4 m² surface area

Sorin Inspire 6
184 mL prime
1.6 m² surface area

High Quality Care in a Competitive Environment
Safe
Timely
Effective
Patient Centered
Efficient
Equitable
Three Challenges Facing Perfusion

1. Blood Conservation
2. Reducing the Negative Effects of CPB
3. Increasing Safety

*Increased pressure on performance with a reduction in resources*

Dangers of Blood Product Administration

**Increased Mortality, Postoperative Morbidity, and Cost After Red Blood Cell Transfusion in Patients Having Cardiac Surgery**

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**Conclusions**

RBC transfusion appears to be harmful for almost all cardiac surgery patients and wastes scarce commodity and other health service resources. It is difficult to identify patients in whom transfusion is truly necessary on the basis of hemoglobin, age, or comorbidity. This study reinforces the need for prospective evaluation of restrictive transfusion triggers and objective clinical indicators for RBC transfusion in cardiac surgical patients.

Negative Effects of Cardiotomy Suction in CABG

**Coronary artery surgery: cardiotomy suction or cell salvage?**

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**Conclusion**

There is robust, published, clinical evidence that salvage of shed blood by cardiotomy suction and its reinfusion is deleterious to patients undergoing coronary artery bypass surgery and we suggest that there is no indication for its routine use in this group. We conclude that cell salvage represents an acceptable alternative to cardiotomy suction by attenuating the detrimental effects of the reinfusion of cardiotomy saline of blood while preserving the red cell mass.
Negative Effects of Cardiotomy Suction in AVR

Is elimination of cardiotomy suction preferable in aortic valve replacement? Assessment of perioperative coagulation, fibrinolysis and inflammation

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CONCLUSIONS. In AVR, the avoidance of direct return of pericardial blood induced considerable suppression of coagulofibrinolytic response. ACT is a favorable alternative for managing pericardial blood during cardiopulmonary bypass. Our results support the published guidelines and could help to establish ideal strategies for eliminating the use of cardiac suction, thus facilitating less-invasive valve surgery with marked suppression of coagulofibrinolytic response.

Potentially Dangerous Clinical Situations

Surgeon requesting suckers on prior to adequate ACT
Surgeon requesting suckers on during Protamine administration

Livanova Dual Cardiotomy Reservoir
Dual Cardiotomy Design

Three Major Features

Plunger separates the reservoir from cardiotomy suction
Straw in the plunger allows cardiotomy contents to be suctioned out
Vent blood routed into the main reservoir away from cardiotomy

Sequestration of Field Suction

Field Suction Scenarios

Plunger up
Fluid enters cardiotomy and flows into reservoir
Plunger down
Fluid remains in cardiotomy

The sequestered fluid can then be sent to the cell saver for processing or added to the patient's circulating volume

Sequestration of Protaminized Blood post-CPB

Prevention of Protamine Entering the Circulating Volume of the Circuit

By keeping the plunger down, any volume sucked up from the field will be sequestered in the cardiotomy
Potentially useful if reconstitution of CPB is required
Sequestration of Sucker Blood Prior to CPB

Improvement in Quality of RAP
Plunger is down prior to CPB
Sucker blood is stored for RAP
Stored blood is then used to complete RAP prior to CPB

Observations and Results

Sequestration of Field Suction:
* We have found this extremely useful after the XC is removed and large volumes of activated blood and crystalloid volume are sucked out of the pericardial well*

Sequestration of Protaminized Blood Post-CPB
*We have found this feature very useful preventing protamine from contaminating our circuit post CPB*

Sequestration of Sucker Blood prior to CPB
*We have found that the quality of our RAP has improved due to reduced mixing*

Comments on the Dual Cardiotomy Reservoir

* Dual cardiotomy reservoir has enhanced our practice in a subtle but effective way*

Very simple design; low tech and low cost
Vented blood is not held up by the reservoir, reducing exposure
Majority of sucker blood is going back to patient; diluted activated blood is being sequestered and processed by the cell saver
Practically invisible to the surgical field despite benefits resulting in enhanced communication
Future Considering for Dual Reservoir Designs

Improved vent design
Allow air to escape from the vent without mixing with the blood

Option to move LV vent location
Y the tubing with cricket clamps for the #3 sucker/LV vent

Better ability to see aquired fluid
Have a straw connect to the cardiotomy near the front of the reservoir so you can see how much volume is held up in the back

Future Research

Randomized prospective study comparing the use of the separated cardiotomy and its impact on patients

The effect of the vent design on GME

Does the loop reduce GME?

Has there been a significant improvement in RAP?

MUSC Perfusion Services Staff
Questions

Thank you for your attention!