The Importance of Cardiotomy Suction Sequestration

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The art of perfusion involves many decisions that affect patient outcome. Alternatives to conventional cardiopulmonary bypass (CPB) have received much attention over the last few years, as have options to improve the outcomes of CPB. Improvements in the design of cardiovascular devices and the availability of new biocompatible surfaces have given perfusionists options to reduce the sources of bioincompatiblity. Making the right decisions regarding perioperative blood is essential if the patient is to benefit from these advances, while the wrong decisions can negate the contribution of advanced devices and surfaces.

In the past it was common practice to return all shed blood to the patient, regardless of when or where it was collected. Numerous scientific papers indicate the return of unwashed, postoperative shed mediastinal blood to be more detrimental than beneficial. The most common source for this blood is unprocessed cardiotomy suction blood, collected from the pericardial well that has been in contact with pleura and/or been exposed to a significant air interface. Most perfusionists are familiar with the profound vasodilatation that occurs when a bolus of extravascular blood is infused into the bypass circuit.

The negative effects of directly reinfused suction blood are well documented in the literature. ***Haan,*** et al., observed an immediate increase in the circulating concentration of thrombin-antithrombin III complex, tissue-type plasminogen activator, fibrin degradation products and free plasma hemoglobin associated with the reinfusion of suction blood. Recently ***DeSomer***, et al., concluded that aspirated blood contaminated by tissue contact is the most important activator of the coagulation system and is the principal cause of hemolysis during bypass.

Endotoxin has been associated with systemic inflammatory response during CPB. ***Spanier***, et al., have shown significant elevations of endotoxin in pooled pericardial blood samples compared with arterial samples.

The reinfusion of suction blood has also been associated with negative effects on the brain. ***Brooker***, et al., found a greater density of small capillary and arterial dilations of the brains of dogs when blood aspirated from the surgical field was reinfused. An investigation at Wake Forest University by ***Kincaid***, et al., showed that washing scavenged blood reduced the incidents of small capillary and arteriolar dilations (aka SCADs) associated with cerebral lipid micro embolic burdens.

Mulholland, et al., investigated the combination of nonphysiologic forces blood experiences during the collection process and determined the greatest increase in plasma hemoglobin was caused by combination of air interface and negative pressure.

In light of these findings, the case for proper management of perioperative blood seems clear: whenever possible, direct reinfusion of suction blood should be avoided. Reinfusion of viable red blood cells (RBC) is still an option by simply washing and reducing them to packed RBCs. In situations where dilute blood-saline mixture is collected or the amounts are inadequate to justify processing, this volume can often be discarded.

The real challenge in managing perioperative blood is the ability to deal with collected blood without decreasing patient safety or adding significant complexity to the perfusion circuit or its operation. The most common method employed is to direct suction blood to a cell salvage system for processing as soon as the collected volume is adequate. However, the timing of this diversion has to be considered against the volume available to the perfusion circuit. Once committed to the cell salvage system, the diverted blood is not available until processing is complete. Pump suckers are still needed in the event of large hemorrhage. Having multiple suckers at the table puts the onus for their correct use on the surgical team. Another option is the use of a dedicated cardiotomy reservoir that drains to the cell salvage system. Unfortunately, this adds complexity to the perfusion circuit.

Advances in reservoir design allow the pump sucker to be utilized for collection, while sequestering the collected blood inside the venous reservoir. The perfusionist then has the choice to divert volume to the cell salvage system at the appropriate time, or in the case of a critically low volume, directly reinfuse only what is needed.

Dideco has led these advances with the development of the ***Avant*** reservoir-oxygenator system. By creating a dedicated section inside the reservoir for suction blood to collect, and developing a way to control where that blood goes, perfusionists now have complete control of suction blood at the pump, without change surgical protocols. Because perfusion now manages where suction blood goes, only the pump sucker is needed at the table while the patient is anticoagulated.

Growing evidence suggests that appropriate management of perioperative surgical blood along with the combination of advanced devices and improved biocompatible surfaces can reduce the sources of bioincompatibility, resulting in improved patient outcomes. Using the Dideco ***Avant*** with PhISIO coating and a $SMAR_XT$ coating tubing pack offers the latest innovation in cardiopulmonary products.

For more information, contact your COBE Cardiovascular Representative, or ***request more information*** through our website.