



Medtronic

RESTING HEART[®] SYSTEM



A new way of looking at arrested heart surgery



THE MEDTRONIC RESTING HEART® SYSTEM

An integrated, low-prime, closed-to-air arrested heart system with tip-to-tip Carmeda® BioActive coating and unique, advanced cannulae options.

WHEN YOU:

- Minimize manipulation of vessels, especially the aorta.^{20,50,51}
- Prevent excessive hemodilution.^{43,44,45,46}
- Choose to approach a procedure with minimally invasive techniques.^{1,2,3}
- Reduce emboli at the source.^{57,58,59,60}
- Reduce contact activation and complement activation.^{61,62}
- Optimize venous return.^{52,53,54}

YOU WILL:

Address many of the issues associated with traditional arrested heart procedures and your patient will have a greater chance of coming off bypass with a higher hematocrit and without homologous blood product exposure.^{43,44,45,46}

Combine these improved techniques with new technology results in a Resting Heart® System procedure that offers all the benefits of a motionless heart and addresses the factors associated with on-pump patient morbidity.





CARDIAC SURGERY IS CHANGING

Off-pump procedures, drug-eluting stent technology, sicker, older, less-stable patients, shifting referral patterns: all are factors reshaping your practice. Whether you are a proponent of beating-heart revascularization growth or not, its use begs the question:

CAN TRADITIONAL ARRESTED HEART SURGERY BE FURTHER IMPROVED?

While it is true that arrested heart is recognized as having the most thoroughly documented long-term patient outcomes when it comes to patient mortality, the data from beating heart suggests there may be room for improvement in arrested heart surgery-related morbidities. Peer-reviewed literature indicates the composite CABG morbidity/mortality can be up to 13.4%.⁵⁵

Now Medtronic, a pioneer in new technologies for cardiac surgery, introduces a new way of thinking about heart bypass surgery—and the technology is here to take your procedures to the next level.



NEW VISION FOR ARRESTED HEARTS

The Medtronic Resting Heart® System offers a new approach to reducing cardiac surgery morbidity



TEAMWORK



TECHNIQUE



- **Using closed-to-air systems** to eliminate an air-blood interface that can activate blood.^{1,2,3}
- **Minimizing hemodilution** and circuit surface area by using low-prime circuits, retrograde autologous priming (or RAP) techniques, and strategies for fluid management^{43,44,45,46} to reduce bleeding with higher postoperative hematocrits.
- **Coating blood-contacting surfaces with Carmeda®* BioActive surface** (a heparin bioactive surface) that mimics critical characteristics of vascular endothelium to provide thromboresistance and biocompatibility.^{24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40}
- **Sequestering shed and suctioned blood** to prevent the development of systemic inflammatory response and keep air, lipids and particulate emboli from being introduced into the patient's circulation.^{1,2,3,4}
- **Optimizing anticoagulation** using a heparin management system that identifies patient-specific heparin and protamine requirements.^{1,2,3,4,2}
- **Realize potential savings from a reduction in blood product usage.**⁵⁶

TODAY'S ENABLING TECHNOLOGIES

IT STARTS WITH ADVANCED CANNULAE

Cannulation is where the system begins to address the factors of historical arrested heart procedures. Medtronic designed all these cannulae to maximize effectiveness with minimal change in surgical technique. Medtronic brings this same, technique-friendly philosophy to keeping your patient's heart still, perfused and in a resting state. There are new advanced Medtronic DLP[®] cannulae for:

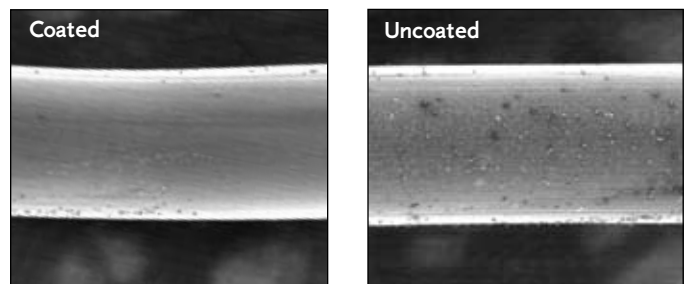
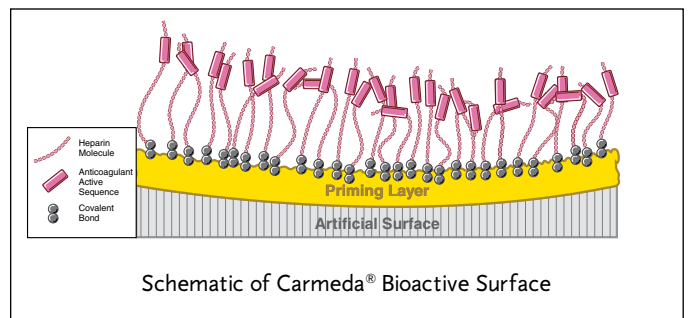
- Better integration of cannulation and perfusion technique in the aorta and the axillary artery.
- Dispersing flow and velocity with aortic cannulation.
- Directly measuring arterial pressure.
- Easier priming without kinking or twisting.
- Better optimized venting of the left ventricle.



CARMEDA[®] BIOACTIVE SURFACE COATED-CANNULAE, TIP TO TIP

The Medtronic[®] Resting Heart[®] System reduces the risk of blood contact activation because it is coated with Carmeda[®]* BioActive Surface throughout. Carmeda[®] BioActive Surface mimics critical properties of the vascular endothelium.^{24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40}

Carmeda[®] BioActive Surface is the gold standard in biosurfaces for extracorporeal circuits, with extensive published research documenting its benefits for thromboresistance and biocompatibility.



Cellular deposits on hollow fiber with Carmeda[®] BioActive surface coating and without.

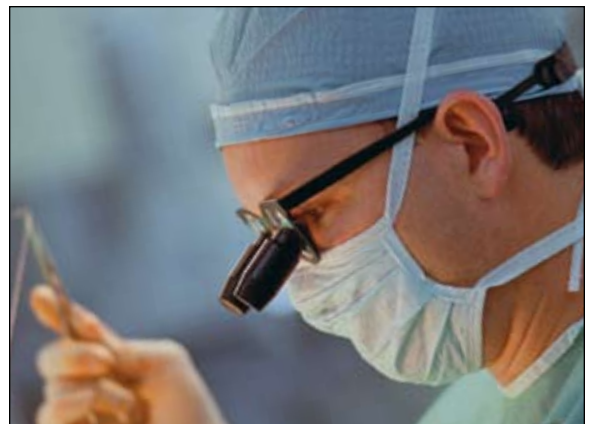
NEW ENABLING TECHNOLOGY



REAL-TIME FEEDBACK ABOUT CONDITIONS IN FRONT OF THE SURGEON

The AAR-1000 Active Air Removal device provides an opportunity to further impact your patient's morbidity.

- If air is entrained in the venous line, the AAR-1000 Active Air Removal device alerts the team with visual and audible alarms so the condition can be quickly remedied.
- Two pairs of ultrasonic air/fluid level sensors in the Venous Air Removal Device (VARD) detect the presence of air in the upper portion of the device.
- If air enters the VARD through the venous return line, bubbles will be detected and visual and audible indications of venous air being removed are evident. The air is automatically removed from the VARD until its sensors detect no remaining air/blood mixture in the upper area of the device, and then return to normal setting.



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