What is a Minimally Invasive Aortic Valve Replacement

The procedure described here is a minimally invasive direct vision approach for aortic valve replacement. The procedure is performed through a 6 cm right anterior thoracotomy.

Potential Benefits of Minimally Invasive AVR

- Reduced trauma and pain
- Statistically decreased blood loss and transfusion requirements

Decreased wound infection

- Statistically reduced recovery time and more rapid return to work
- Better cosmetic results and improved patient satisfaction
- No difference in morbidity and mortality
- Facilitates redo surgery
- Avoids sternal wound complications
- Statistically reduced incidence of wound infections

NOTE: The views and techniques expressed herein and in the training are the views of Dr. Moront. This information is provided as a general resource, but is not intended to constitute medical advice or in any way replace the independent medical judgment of a trained and licensed physician with respect to any individual patient needs or circumstances. Please see the “Instructions for Use” for all product indications, contraindications, precautions and adverse events.
1. PATIENT SELECTION
Exclusion criteria
• Severely calcified ascending aorta
• Prior sternotomy or cardiac surgical procedure

2. ANESTHESIA TECHNIQUE
• Double lumen endobronchial tube
• Swan-Ganz® pulmonary artery catheter
• Transesophageal echocardiography (TEE)
• Radial and femoral arterial lines
• Defibrillation patches

3. PATIENT POSITIONING
• Right infrascapular roll
• Prep and drape in usual fashion

4. CANNULATION
• Performed prior to thoracotomy
• Left femoral artery and vein cannulation are performed utilizing a Seldinger technique
  (only limited exposure is required to identify the anterior aspect of the vessels)
• Perform arterial cannulation first, the cannula should never be forced and should advance easily
• Insert femoral venous guideware from the femoral vein into the superior vena cava (SVC) utilizing transesophageal echocardiography (TEE) guidance
• Verify wire location in SVC prior to passing cannula (very important)
• Ultimately, the femoral venous cannula tip should be in the lower right atrium

5. INCISION AND EXPOSURE
• 6 cm right anterior thoracotomy
• The costochondral rib junction, usually of the inferior rib is divided
• Excess pericardial fat is removed from the pericardium, being careful not to injure the phrenic nerve
• The pericardium is opened over the ascending aorta and the pericardium is pulled up greatly improving aortic and right atrial exposure
6. CARDIOPLEGIA CANNULATION

- Place a pledgeted suture in the right atrial appendage for retrograde cardioplegia cannulation
- The Medtronic MICS retrograde auto-inflate cannula (MiR CSP®) is used and prepared by placing a gentle bend on the MICS retrograde cannula, accentuating the steerable deflection of the cannula
- Utilizing TEE guidance, the coronary sinus is visualized and the MICS retrograde cannula (MiR CSP) is gently advanced into the coronary sinus

Performing retrograde cardioplegia cannulation prior to venous cannulation makes the retrograde cannulation much easier.

LV vent can be placed prior to institution of cardiopulmonary bypass or once on bypass through the right superior pulmonary vein in a standard fashion.

7. INSTITUTE CARDIOPULMONARY BYPASS

- Identify the level of the aortotomy relative to the origin of the right coronary artery (1.5 cm above RCA origin)
- Systemically cool the patient’s body temperature to 36°C (non circulatory arrest cases)
- Cross clamp the ascending aorta directly through the right anterior thoracotomy
- Administer antegrade and retrograde cardioplegia in a standard fashion
- Flood the operative field with CO² at 2-3 liters/minute to minimize intra-cardiac air

8. AORTOTOMY

- Open the aorta in a standard fashion
- Retract ascending aorta superiorly and then place 3 stay sutures at the top of the valve commissures to optimize aortic root exposure
9. VALVE REPLACEMENT

- Inspect the valve and perform replacement as needed
- Administer cardioplegia intermittently per normal routine
- Utilize standard replacement techniques. Refer to the “Instructions for Use” which accompany Medtronic heart valve repair and replacement products. Use only those sizers/obturators designed for the product being implanted. Product implant guides available upon request.

10. CLOSING

- Close the aortotomy in a standard fashion. Stop LV venting as the aortotomy closure is being completed.
- Place a single RV pacing wire and tunnel it out the anterior chest wall via the left parasternal space. Place a skin grounding wire.
- Vent the aortic root, fill the heart and ventilate the lungs to aggressively de-air the left ventricle and aorta
- Remove the cross clamp
- Defibrillate the heart as needed utilizing the defibrillations patches
- Once the heart is beating begin ventilation and also cardiac ejection. TEE is used to assess the presence of intra-cardiac air and to determine when it is completely evacuated. TEE is also used to assess the aortic valve replacement.

11. END OF PROCEDURE

- An On-Q® pain pump system is inserted into the subpleural space at the lateral aspect of the thoracotomy, and a second catheter is inserted into the neurovascular bundle of the upper rib of the thoracotomy
- Transected rib reconstructed with stainless steel four hole plate and #2 FiberWire™ suture
- Place two pericostal sutures for rib re-approximation using #2 Mersilene™ suture

HOW DO I BEGIN?

Medtronic offers peer-to-peer education for those interested in learning how to do an AVR procedure. Please contact your CardioVascular sales representative for more information.
Over 35 years of scientific innovation, resulting in more options for minimally invasive heart valve repair and replacement.

**Instruments and Disposables** as typically used by Dr. Moront

1. Prosthetic Valve – Medtronic Mosaic® Bioprosthesis
2. Reusable Instruments
   a. Minimally Invasive Rib Retractor System
   b. Minimally Invasive Atrial Retractor Set, Large Blades
   c. Minimally Invasive Flexible Aortic Clamp
   d. Minimally Invasive Knot Pusher
   e. Minimally Invasive Scissors, Curved
   f. Minimally Invasive Scissors, 30°
   g. Minimally Invasive Needle Drivers, Curved Locking (Qty. x 2)
   h. Minimally Invasive Forceps Straight, Double Action (Qty. x 2)
   i. Forceps Narrow Straight, Double Action
   j. Minimally Invasive Hook (Qty. x 2)
   k. Minimally Invasive Flush Port Adapter
   l. Minimally Invasive Instrument Tray
3. Disposable Supplies
   a. Cannulation
      - Medtronic Bio-Medicus® Multi-Stage Femoral Venous Cannula, 21 Fr, 25 Fr
      - Medtronic Bio-Medicus® Femoral Arterial Cannula
        - 17 Fr, 19 Fr, 21 Fr
      - MiRCS™ Minimally Invasive Retrograde Coronary Sinus Perfusion Cannula
   b. On-Q® pain pump system

**Bio-Medicus® Multi-Stage Femoral Venous Cannula**
Mosaic® Porcine Bioprosthesis

**Indications:** For the replacement of malfunctioning native or prosthetic aortic and/or mitral heart valves.

**Contraindications:** This device is not intended for use except as indicated. **Warnings/Precautions/Adverse Events:** Accelerated deterioration due to calcific degeneration of bioprosthesis may occur in: children, adolescents, young adults, and patients with altered calcium metabolism (e.g., chronic renal failure, hyperparathyroidism). Adverse events can include: angina, cardiac arrhythmia, cardiac dysrhythmias, death, endocarditis, heart failure, hemolysis, hemolytic anemia, hemorrhage, transvalvular or paravalvular leak, myocardial infarction, nonstructural dysfunction, stroke, structural deterioration, thromboembolism, or valve thrombosis.

For additional information, please refer to the Instructions For Use provided with the product.

**CAUTION:** Federal law (USA) restricts this device to sale by or on the order of a physician.

Bio-Medicus® Multi-Stage Femoral Cannula and Introducer and Bio-Medicus® Femoral Arterial Cannula

**Indications for Use:** These devices are to be used by a trained physician only. Cannulae are used to cannulate vessels, perfuse vessels or organs and/or connect with accessory extracorporeal equipment. The Cannula Obturator is intended to facilitate proper insertion and placement of the appropriate sized cannula within the vessel for cardiopulmonary bypass. **Contraindications:** Alone, the cannula and obturator are not medical treatment devices. There are no known contraindications for the use of the cannula other than those generally contraindicated for cardiopulmonary bypass. The cannula obturator is to be used only with the appropriate sized Bio-Medicus® Cannula. These devices are not intended for use except as indicated above.

MiRCSP™ Minimally Invasive Retrograde Coronary Sinus Perfusion Cannula

**Product Description:** The cannula consists of a wirewound silicone cannula body with a beveled tip. Two side holes are present near the tip. The back of the cannula body terminates in a locking female luer. A pressure monitoring line is an integral part of the cannula body, beginning at the tip and terminating in a 3-way stopcock with a locking female luer fitting. An inflatable balloon is located at the distal beveled tip. There are radiopaque bands located inside each end of the inflatable balloon. The inflation assembly is located at the back of the cannula body and contains a female slip luer and a one-way valve assembly. The introducer features tip deflection and rotation. Sterile, nonpyrogenic, single use. **Indications for Use:** The MiRCSP cannula is intended for use during cardiopulmonary bypass for the delivery of cardioplegia retrograde through the coronary sinus for up to six hours. It is indicated for use during cardiac surgery for median sternotomy or minimally invasive (mini-sternotomy or right thoracotomy) access using direct, echocardiographic or fluoroscopic visualization techniques. **Contraindications:** This device is not intended for use except as indicated above.

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