Echocardiography and surgical techniques for retrograde cardioplegia-coronary sinus cannulation during minimally invasive cardiac valve surgery

Overview

The use of retrograde cardioplegia has become a standard during valvular heart surgery and often is essential for the successful performance of minimally invasive cardiac valve surgery.

Successful cannulation of the coronary sinus for retrograde cardioplegia, in minimally invasive procedures, routinely requires transesophageal echocardiographic (TEE) guidance and a coordinated effort between the operating Cardiac Surgeon and the Cardiac Anesthesiologist. Consistent TEE visualization of the coronary sinus is clearly the most critical factor for successful coronary sinus cannulation.

The intent of this monograph is to serve as a brief instructional guide for both the Cardiac Surgeon and the Cardiac Anesthesiologist in the placement of a new retrograde cardioplegia cannulae specifically designed for minimally invasive valve surgery. These innovative retrograde cardioplegia cannulae have both a steerable and deflectable tip greatly facilitating proper coronary sinus cannulation.

Additional care and caution may be necessary due to the unique adaptations required for minimally invasive techniques.

Extreme caution should be exercised while introducing the cannula into the coronary sinus. Do not force the cannula into the coronary sinus as this may cause vessel damage.
Coronary Sinus Cannulation for Minimally Invasive Mitral Valve Procedure - Right Anterior Thoracotomy

Michael G. Moront, MD

Setup: Performed following successful femoral cannulation and full heparinization.

Place pledgetted 4-0 prolene purse-string suture placed into the mid-body of the right atrium.

Keep the MICS Retrograde Thoracotomy cannula straight and introduce the cannula into the right atrium angling the cannula toward the patient’s left hip.

Be attentive to the TEE where the coronary sinus is demonstrated. The tip of the MICS retrograde cannula is now deflected by sliding the handle control toward the coronary sinus.

Advance the tip gently into the coronary sinus and slide cannula forward off of the introducer. If using an auto-inflate cannula, as the coronary sinus is engaged and the cannula enters the coronary sinus the balloon will deform confirming initial placement.

Advance the cannula until the entire balloon is within the coronary sinus. The retrograde cannula position should be confirmed by TEE in the left atrio-ventricular groove.
Management Techniques

Ashraf F. Banoub, MD

Sinus Cannula

Transesophageal echocardiographic technique, guided insertion of retrograde cardioplegia coronary sinus cannula after completion of the comprehensive intraoperative TEE exam, concentrate on acquiring optimum views of the structures that would assist the surgeon in placing the retrograde cardioplegia cannula. Acquiring the images well in advance of the surgeon requesting TEE guidance ensures that optimum imaging can be obtained in a timely fashion.

The TEE probe is placed in the mid-esophagus, the multiplane array at 0º and the four-chamber view is obtained with the apex of the image at the top of the screen so that basal cardiac structures are at the top of the screen and the apical structures are at the bottom of the screen (1).

Extreme retro-flexion of the probe is occasionally necessary to bring the coronary sinus into view (2). This maneuver can sometimes be challenging especially if the cardiac motion is rapid and vigorous. Cessation of mechanical ventilation for a brief duration or gentle manual ventilation may allow better views to be obtained.

Slight right or left angulation of the TEE probe tip is sometimes required to view the opening of the coronary sinus into the cavity of the right atrium and to show the coronary sinus cannula as it is introduced towards the coronary sinus (3).

The X-plane feature on the TEE allows simultaneous longitudinal and cross-sectional view of the coronary sinus (4) and assists in confirming proper position of the cannula into the coronary sinus (5).

Setup: Performed following successful femoral cannulation and full heparinization. Pull up the aorta to the left and superiorly which assists with exposure of the right atrium.

Place pledgetted 4-0 prolene in the upper right atrial free wall for coronary sinus cannulation.

Prepare the MICS Retrograde cannula by first placing a gentle 30º curve above, but close to, the catheter tip deflection point. Deflecting the cannula tip can be done either before placing into the atrium or once in the atrium to accomplish the angle needed to enter the coronary sinus.

Cannulate the right atrium with the MICS Retrograde cannula and then turn your attention to the TEE.

With the coronary sinus demonstrated on TEE, gently advance the tip into the coronary sinus and slide cannula forward off of the introducer. As the retrograde catheter enters the coronary sinus, the auto inflate balloon will deform. The deformation of the balloon confirms engagement within the coronary sinus. Gently advance the retrograde catheter into the sinus until the retrograde balloon resides completely within the coronary sinus.

Confirm the position of the retrograde catheter by TEE in the coronary sinus and left atrio-ventricular groove.

Coronary Sinus Cannulation for Minimally Invasive Aortic Valve Procedure - Mini Upper Sternotomy

Michael G. Moront, MD

Setup: Performed following successful femoral cannulation and full heparinization.

Pull up the aorta to the left and superiorly which assists with exposure of the right atrium.

Place pledgetted 4-0 prolene in the upper right atrial free wall for coronary sinus cannulation.

Prepare the MICS Retrograde cannula by first placing a gentle 30º curve above, but close to, the catheter tip deflection point. Deflecting the cannula tip can be done either before placing into the atrium or once in the atrium to accomplish the angle needed to enter the coronary sinus.

Cannulate the right atrium with the MICS Retrograde cannula and then turn your attention to the TEE.

With the coronary sinus demonstrated on TEE, gently advance the tip into the coronary sinus and slide cannula forward off of the introducer. As the retrograde catheter enters the coronary sinus, the auto inflate balloon will deform. The deformation of the balloon confirms engagement within the coronary sinus. Gently advance the retrograde catheter into the sinus until the retrograde balloon resides completely within the coronary sinus.

Confirm the position of the retrograde catheter by TEE in the coronary sinus and left atrio-ventricular groove.
The 13 Fr MiRCSP™ cannulae are available in manual- or auto-inflate models and achieve traditional cardioplegia delivery flow rates.

<table>
<thead>
<tr>
<th>Catalog Code</th>
<th>French Size</th>
<th>Description</th>
<th>Overall Length</th>
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<tbody>
<tr>
<td>94113 TDT</td>
<td>13 Fr</td>
<td>Tip Deflecting Thoracotomy manual-inflate cuff</td>
<td>12.5 in (31.8 cm)</td>
</tr>
<tr>
<td>94533 TDT</td>
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1. Data on file at Medtronic

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

For more information contact your local Medtronic Sales Representative or call Customer Service toll-free at 1-800-328-1357

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