Overview

- Patient selection
- Pre-operative evaluation
- Room set-up & patient prepping
- Necklines
- Patient positioning
- Incision placement
- Cannulation
- Mitral valve exposure & repair
- Atrial closure, de-airing & decannulation
- Video
- Q&A
Patient Selection
MI MVR Patient Selection

All patients with isolated mitral valve disease should be considered

• MV replacement
  – Removes MV repair issues

• MV repair with ring only
  – Less complicated
  – Only deals with single plane of mitral annulus

• MV repair with resection +/- chord replacement (complex repairs)
MI MVR Contraindications

• Relative
  – Tortuous iliac vessels or Grade I–II aortic atheroma (CTA or PE)
  – Moderate or severe peripheral or aortic atherosclerosis
  – History of thoracic trauma (chest adhesions, fractured ribs, etc.)
  – Persistent left SVC (must use antegrade cardioplegia only)

• Absolute
  – Ascending aortic dilatation > 4 cm
  – Severe aortic regurgitation
  – Aneurysm of ascending aorta
  – Aortic stent
  – Grade III–IV aortic atheroma
  – Patients contraindicated to CPB

These contraindications are the viewpoints and opinions of Dr. William Ryan. For Edwards approved contraindications, please see product instructions for use (IFUs.)
Pre-operative Evaluation
Patient History

- Past surgeries
  - Anastomoses
  - Adhesions
  - Pleural space

- Disease entities
  - Coronary disease and peripheral artery disease
Patient Screening

- Detection of vascular disease or anomaly
  - Catheterization history
- Chest x-ray
- Angiogram run-offs
- Cross-sectional imaging of peripheral arterial tree
  - Spiral CT, MRI
Iliac Vessels

Normal vs. Moderate Atherosclerosis
Iliac Vessel Variations
CT Angiography
Room Set-up and Patient Positioning
OR Set-up

- Heart/lung machine
- Anesthesia
- Back table
- Echo
- Hemodynamic monitor
- Video monitor
- C-arm
Hemodynamic Monitor

Set-up
- Right radial/brachial
- Left radial/brachial
- Aortic root
- PAP
- Coronary sinus pressure

Overlap

Left Arm

Right Arm

Aortic Root Pressure
EndoClamp Aortic Catheter
Patient Prepping

- Placement of external defibrillator pads
- Induction of anesthesia
- Endotracheal tube placement
- TEE probe inserted
- Patient positioned and prepped for neckline placement
Intra-operative TEE
TEE Survey Examination

- Evaluate
  - Size and grade of atheromatous plaque
  - Ascending and descending aorta
  - Size of ascending aorta – use of balloon
  - Presence of ASD or PFO
  - Aortic valve for degree of insufficiency
  - Ventricular function
  - Coronary sinus – size and position
Anesthesia Placement of EndoVent Pulmonary Catheter and Coronary Sinus Catheter
EndoVent Pulmonary Catheter

- Assists in decompressing the heart
- Removes blood from the pulmonary artery
- Designed to maintain a dry operative field
Coronary Sinus Catheter

- Occludes coronary sinus
- Delivers retrograde cardioplegia
- Monitors coronary sinus pressure
Patient Positioning
Avoid dislodging of coronary sinus catheter
- Ensure balloon is inflated

Patient placed supine towards right side of table
- Longitudinal roll under right scapula/chest wall
- Achieve 20-30 degree lift

Patient’s legs remain straight – both groins exposed
Patient Positioning

- Right arm is tucked but supported by table
- All lines, stopcocks, and leads are secured
- Right shoulder is supported with bolster
Patient Draping

Elevate breast with incise drape
Incision Placement
Right Thoracotomy

• Evaluate x-rays & CT
  – Heart positioning
  – Intercostal space/point of entry incisions
    • 4th or 5th acceptable

• Incisions
  – Working port
  – Scope
  – CO₂
  – Atrial retractor handle
  – Suture retraction
Working Port
Graduation of Incision

• Advantages
  – Less rib retraction
  – Smaller incision = less tissue damage

• Disadvantages
  – Pain
  – Recovery time

• Retraction devices
  – Soft tissue retractor
  – Rib retractor
• Incision size limitation – atrial retractor blade

• Advantages
  – Soft tissue retractor
  – Pain

• Disadvantages
  – Surgeon comfort level

• Retraction devices
  – Soft tissue retractor
Soft Tissue Retractor
Sizing & Inserting
Rib Retractor Use

- When to use
- Choosing the right configuration for your patient
Working Port
Graduation of Incision

Retraction devices
- Rib retractor

Advantages
- Surgeon comfort level
- Direct visualization
- Large working port

Disadvantages
- Excessive rib retraction
- Pain
- Recovery time
MIVS Instruments

- Narrow, *long-shafted* instruments
  - Ergonomic, in-line handles
  - Optimize tactile feedback and balance
- Lightweight and balanced
  - Designed to reduce fatigue
- Sizes and lengths specifically designed for MIVS procedures
Femoral Venous Cannulation
QuickDraw Venous Cannula

- Low profile, wire-wound design facilitates efficient venous drainage
  - 65 cm length
  - Sizes: 22 Fr and 25 Fr
QuickDraw Venous Cannula

- Cannula kit includes:
  - Connector hub
  - Introducer
    - 22 Fr – 1 piece introducer
    - 25 Fr – 2 piece introducer
  - .038 in x 180 cm j-tip guidewire
  - Percutaneous insertion kit
    - 5 mL syringe
    - 18 gauge insertion needle
    - 3 dilators: 8 Fr, 12 Fr, and 16 Fr
QuickDraw Venous Cannula

- Connector Hub
- Alignment Markers
- 3/8” Barbed Connector
- Clamp Site
- Tapered 2-tiered Introducer
- Depth Markings
- Wire-reinforced Drainage Holes
- QD25 Cannula Body

Introducer

- QD25 Cannula Body
- Depth Markings
- Wire-reinforced Drainage Holes
- Tapered 2-tiered Introducer
QuickDraw Venous Cannula

Important Tips

• Avoid dislodging of coronary sinus catheter
  – Inflate coronary sinus catheter balloon prior to QuickDraw venous cannula placement

• If at any time increased resistance is felt upon insertion of guidewire, dilators, introducer or cannula, investigate cause before continuing
Consider 25 Fr if BSA > 1.6
(if vessel will accommodate cannula size)
Importance of Guidewire

- Prevent cannula from entering:
  - Right atrial appendage
  - PFO into the left atrium
  - Right ventricle

Bicaval TEE view

- Guidewire slightly beyond desired cannula tip position
QuickDraw Venous Cannula
Anticipate Depth

Anticipated cannula insertion depth noted
QuickDraw Venous Cannula
Cannula Insertion

- **Assistant**
  - Grasp guidewire, hold stationary
  - Maintain guidewire position

- **Surgeon**
  - Advance cannula/introducer into position

- **Final placement**
  - 2-3 cm into SVC
QuickDraw Venous Cannula
Cannula Insertion

• Slowly withdraw guidewire into introducer
  – Hold cannula in place
• Remove guidewire/introducer assembly while holding cannula in place
• Clamp cannula at clamp site
• Backbleed to remove air from cannula
• Connect $\frac{3}{8}''$ venous drainage line
  – Need $\frac{3}{8}''$ to $\frac{1}{2}''$ connector if using $\frac{1}{2}''$ venous line
• Remove clamp prior to initiating CPB
• Secure cannula to patient
• Confirm heart decompressed
  – TEE
  – Direct inspection
QuickDraw Venous Cannula
Troubleshooting

• Heart not decompressed
  – Check for volume loss in chest or cannulation site
    • Consider adding volume if necessary
  – Confirm adequate EndoVent catheter flow
    • Check for kinking of EndoVent catheter
    • Aspirate and flush EndoVent catheter
    • Slightly retract catheter and recheck under TEE
  – Consider venous cannula tip occlusion due to excessive suction or malposition
    • Confirm cannula/line not kinked
    • Use TEE to reposition venous cannula
    • Reposition or move atrial retractor

• If venous drainage still inadequate
  – Consider supplemental venous drainage cannula
Femoral Arterial Cannulation
EndoReturn Arterial Cannula

- Wire-wound femoral arterial cannula
  - 21 Fr
  - 23 Fr
- Hemostasis valve
  - Allows for passage of EndoClamp aortic catheter
Cannulation for Smaller Arteries

- 19 Fr arterial cannula
  - For femoral cannulation
  - Avoids high pressure

- 19 Fr introducer sheath
  - Hemostasis valve for passage of EndoClamp aortic catheter
Femoral Arterial Cannula

Sizing

**Featured Products (from top to bottom)**
- EndoReturn arterial cannula (ER21) with EndoClamp aortic catheter (EC1001) (balloon deflated)
- EndoReturn arterial cannula (ER23) with EndoClamp aortic catheter (EC1001) (balloon deflated)
- Edwards arterial cannula (AC19)
- EndoReturn arterial cannula (ER21)
- EndoReturn arterial cannula (ER23)

* Mean value derived from *in vitro* testing performed with water at 21°C. The actual pressure gradients encountered in a clinical situation may vary from those shown, depending on perfusion techniques.
Femoral Arterial Cannula Insertion

- Prep cannula per IFU
- Guidewire
  - Verify with TEE
    - Descending aorta
- Maintain guidewire position
- Advance cannula/introducer into femoral artery
Femoral Arterial Cannula Insertion

- Properly position cannula
  - Avoid ischemia
- Secure cannula / artery
- Remove guidewire
- Withdraw introducer
  - Clear of clamp site
- Clamp cannula
• Remove introducer and connector hub
• Vent and tighten hemostasis valve
• Connect arterial tubing with EndoReturn cannula
• Remove tubing clamp
• Secure cannula to patient
EndoReturn Arterial Cannula
Final Placement

- Leave cannula exposed
- Hemostasis valve pointing up
Femoral Arterial Cannula
Important Insertion Tips

- Consider cannulating on opposite side of recent catheterization
- Do not advance if resistance is felt
  - Inability to easily advance the guidewire or cannula may indicate vascular disease or injury
  - Examine position with TEE
- Transfuse 100 mL test volume through cannula
- Observe pulsatile pressure similar to systemic pressure
  - High arterial line pressures may indicate a dissection of artery and/or placement of cannula in false lumen - immediately discontinue femoral bypass
Femoral Arterial Cannula Troubleshooting

- Hemostasis valve excessive backbleeding
  - Ensure valve closed

- Air in the CBP system
  - Purge air from cannula by backbleeding through the hemostasis valve
• Arterial line or oxygenator outlet pressure in excess of 350 mmHg
  – Attempt gentle rotation or repositioning of cannula
  – Decrease pump flow rates
  – Check for kinking of cannula and arterial line
  – Always reduce arterial inflow rate when advancing or withdrawing the EndoClamp aortic catheter
  – Pull out slack in catheter line
  – Consider repositioning of catheter
  – Consider bi-femoral or aortic cannulation with IS19
Mitral Valve Exposure
Exposure and Visualization

- Pericardium incision
  - Lengthwise incision 1 cm anterior to phrenic nerve
- Stay sutures – pericardium
Establish Cardiopulmonary Bypass
EndoClamp Aortic Catheter

- Occludes ascending aorta
- Delivers antegrade cardioplegia
- Vents aortic root
- Monitors aortic root and balloon pressures
- Designed for femoral approach

EndoClamp Aortic Catheter

100 cm length
Opening of Left Atrium

- **Incision**
  - Posterior to atrial groove
  - Anterior to right pulmonary veins
- **Extend incision with tissue scissors**
Exposure of Mitral Valve

- Atrial retractor
  - Incision
  - Insert atrial retractor handle
  - Fix holder to blade
- Evaluate mitral valve pathology
Mitral Valve Repair or Replacement

Repair

Sizing
Atrial Closure and De-airing
Coming Off Pump

- De-airing per institution protocol
  - CO₂
  - Trendelenberg
  - Increase perfusion flow
  - Deflated EndoClamp aortic catheter is maintained in ascending aorta
- Anesthesia verifies EndoVent and EndoPlege catheters move freely
- Placement of temporary pacing wire before balloon is deflated
- Perfusion vigorously vents the aortic root
- Ventilation resumes
- Come off pump
Decannulation
Decannulation

- Administer protamine
- Remove EndoVent and EndoPlege catheters
- Remove arterial and venous catheters per institution protocol
- Pain management considerations
  - Follow institution protocol
Clinical Outcomes
Clinical Outcomes

Mitral Valve Surgery: Comparison of Outcomes in Matched Sternotomy and Port Access Groups: The Updated Dallas Experience (William H. Ryan, et al.)

<table>
<thead>
<tr>
<th></th>
<th>Sternotomy</th>
<th>Minimally Invasive</th>
<th>p Value</th>
<th>Sternotomy</th>
<th>Minimally Invasive</th>
<th>p Value</th>
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</thead>
<tbody>
<tr>
<td>LOS (days)</td>
<td>7.4 ± 6.7</td>
<td>5.8 ± 7.1</td>
<td>&lt;0.001</td>
<td>10.0 ± 7.6</td>
<td>8.4 ± 8.3</td>
<td>0.013</td>
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<tr>
<td>Operative Mortality</td>
<td>0.6% (1)</td>
<td>0.6% (1)</td>
<td>1.00</td>
<td>10.3% (4)</td>
<td>0.0% (0)</td>
<td>0.04</td>
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<tr>
<td>Return to OR for Re-op Bleed</td>
<td>7.7% (12)</td>
<td>1.8% (3)</td>
<td>0.01</td>
<td>14.3% (5)</td>
<td>2.6% (1)</td>
<td>0.10</td>
</tr>
<tr>
<td>Vent Prolonged (&gt; 24 hours)</td>
<td>11.2% (18)</td>
<td>4.8% (8)</td>
<td>0.03</td>
<td>22.2% (8)</td>
<td>13.5% (5)</td>
<td>0.33</td>
</tr>
<tr>
<td>Mean Vent Hours</td>
<td>23 ± 80</td>
<td>18 ± 127</td>
<td>&lt;0.001</td>
<td>21 ± 41</td>
<td>16 ± 42</td>
<td>0.074</td>
</tr>
<tr>
<td>Readmit within 30 days</td>
<td>6.5% (10)</td>
<td>3.3% (5)</td>
<td>0.19</td>
<td>2.8% (1)</td>
<td>6.1% (2)</td>
<td>0.60</td>
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Minimal Incision MVR
Additional Resources
Time Saving Practices

- **Necklines**
  - Place neck catheter introducers prior to induction in holding area
  - Prepare EndoVent pulmonary catheter and coronary sinus catheter and attach contamination guards

- **Simultaneous chest exposure and groin preparation**

- **Assistant available during**:
  - Aortic occlusion period
  - Exposure and suture handling

- **Simultaneous groin closure and chest hemostasis/closure**
Resources

• thruportmivs.com
  – Webinars
  – Surgical videos
  – Computer based training modules

• Complete support for you and your team
  – Comprehensive professional education
    • Learn techniques from leading MIVS surgeons
    • Team training – live surgical case observation
  – Clinical and sales specialists
    • Provide support for you and your surgical team
Video
Q & A
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