Truly Endoscopic Robotic mitral valve repair

The new frontier

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Disclaimers

Consultant & Medical Advisory Board Member, Edwards Lifesciences

Consultant, Verb Surgical/Ethicon/J&J

Consultant, Medtronic

Proctoring & Case Observation Host, Intuitive Surgical
Wake Up!! An Absolute Tsunami of Catheter-Based MV Interventions Coming Your Way!

Edge-to-edge approaches
- Evalve MitraClip
- Mitvalve
- Mitralign Bident
- GDS Accucinch
- Valtech Cardioband
- Quantum CardioCor
- Micardia enCor

Direct annuloplastic approaches
- Mitralis
- Tendyne
- Millipede

MV replacement
- CardiAQ
- EndoValve
- Valtech Cardiovalve
- ValveXchange
- Lutter Valve
- Neovasc
- Medtronic
- Edwards

In patients with leaflet dehiscence leaflet plication
- NeoChord
- Cardiosolutions Mitra-Spacer
- TransCardiac Mitraflex
- Mardil BACE

“Thank you for calling. Please hold – on as tight as you can.”
But……A Renaissance in Robotic Surgery is Underway
Randomized Comparison of Percutaneous Repair and Surgery for Mitral Regurgitation: 5-Year Results of EVEREST II

C. Freedom From MV Surgery or Reoperation

<table>
<thead>
<tr>
<th>Patients At Risk</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Group</td>
<td>0</td>
</tr>
<tr>
<td>178</td>
<td>136</td>
</tr>
<tr>
<td>Control Group</td>
<td>80</td>
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A New Value Equation in Cardiac Surgery

Quality + Safety + Patient Experience = Value

Invasiveness + Cost
The Evidence for Robotic MV Repair

- 216 patients, longer CPB times, shorter LOS, high repair rate, no deaths

Robotic Mitral Valve Repair for Simple and Complex Degenerative Disease: Midterm Clinical and Echocardiographic Quality Outcomes
- 487 patients, 41% complex repair, 5 year freedom from MR 94.6%

The Expanding Role of Endoscopic Robotics in Mitral Valve Surgery: 1,257 Consecutive Procedures
- 1,257 Patients; 93% Repair, 0.9% Mortality

Quality of life after early mitral valve repair using conventional and robotic approaches
- 202 patients, Earlier return to work, improved QOL

Value of Robotic Assisted Surgery for Mitral Valve Disease
- 1,290 Patients, Earlier return to work; equivalent cost

A population-based analysis of robotic-assisted mitral valve repair
- 50K MV Repairs; similar mortality/ complications, ↓ LOS, same cost

Emulates Open Techniques
Applicable to Complex Pathologies
Equivalent or Superior Quality
Improves Patient Experience
Safe & Effective
Cost Effective & Safe
Early Recovery Is Important to Many

Return to work (%)

Follow-up (months)

HR 2.6
P<0.001

36
31
18
9

36
36
6
2

Robotic

Open MVRep

Value of Robotic Assisted Surgery for Mitral Valve Disease
Robotic Repair is as Durable as Open Repair

Robotic Mitral Valve Repair for Simple and Complex Degenerative Disease: Midterm Clinical and Echocardiographic Quality Outcomes

Robotic Mitral Valve Repair Cost Less Than Open Surgery

Mitral Valve Case Average Cost Comparison

Increased OR Expense Offset by Decreased LOS

Non-Robotic

Robotic

Other
Respiratory Therapy
Critical Care
Lab
Pharmacy
Anesthesia
Cardiovascular Surgery
Surgical Services
Patient Care Services

Mayo Clinic, Courtesy of Kevin Hennessey Administrator, Department of Cardiac Surgery
There is a Learning Curve……
But It Can Be Shortened Through Training & Preparation.....

Learning curve analysis of total operative time. Logarithmic regression: $b = -0.360$.  

Can the Learning Curve of Totally Endoscopic Robotic Mitral Valve Repair Be Short-Circuited? 

Yaffee, David W.; Loulmet, Didier F.; Kelly, Lauren A.; Ward, Alison F.; Ursomanno, Patricia A.; Rabinovich, Annette E.; Neuburger, Peter J.; Krishnan, Sandeep; Hill, Frederick T.; Grossi, Eugene A.  
Traditional Approach: 
Median Sternotomy
“Car Port” Mitral Valve Repair-The original “conservative” approach-1960’s
Which is really minimally invasive?

Large Hidden Thoracotomy?

Port Access

Totally Endoscopic Robotic
What does robotics really add?

- **Dexterity** (degrees of freedom of the robotic instruments)
- **High definition, 3D, Close Proximity Visualization**
- **Small ports** between the ribs only
Evolution of Minimally Invasive Mitral Valve Surgery

Cornell/NYP Mitral Program

Sternotomy

Hemi-sternotomy

Mini-thoracotomy

Mini-thoracotomy

Endoballoon

Mini-thoracotomy

2D Videoscopic

Robotic Assisted Mini Thoracotomy

Totally Endoscopic

Weill Cornell Medicine

NewYork-Presbyterian
Medium Alexis® soft tissue retractor: Camera port and working port one incision combined (with or without rib spreader but usually without)

Robotic MV Repair 1.0
Mini-Thoracotomy
Robotic MV Repair 2.0
30 mm Incision, No Rib Spreading

Da Vinci Xi with 8mm camera port and 30mm working port (Alexis®)
Robotic MV Repair 4.0
Da Vinci Xi with 8mm ports and 12mm working port

Largest Incision in Chest
12mm (Size of a Pinkie Finger)

4 Robotic Ports 8mm
(Diameter of a Pen)
Totally Endoscopic Mitral Valve Repair Ports

Percutaneous? Pretty Close
Requires 100% Buy-In Up Front from each of the Heads of the “5 Families”

Administration
Anesthesia
Nursing
Perfusion
Surgery
DEDICATED ROBOTIC HEART TEAM

High Performance Interdisciplinary Teamwork in Robotic Cardiac Surgery is Absolutely Essential to Safe & Successful Robotic Surgery

5 Anesthesiologists
1 Surgeon
2 Bedside Assistants
3 Scrub tech or RN
3 Circulator RN’s
5 Perfusionists

The complex teamwork required for these procedures will generally improve cardiac surgery teamwork overall

Weill Cornell/NewYork-Presbyterian Hospital Robotic Heart Team 2016
Ideal Prerequisites

- Experienced mitral valve surgeon (>20-50/year)
- Experience with minimally invasive surgery
- Access to >50 isolated mitral valve cases/year
- Support from heads of the five families
- Team skills: anesthesia line and TEE skills essential, culture of cooperation & collaboration
- First case priority for robot and OR 2 or more days/week
Overview of Basic Process to Launch a Robotic MV Repair Program

1. Program Self-Assessment for Pre-Requisites
2. Choose dedicated team members
3. Regular Planning Meetings
4. Surgeon Individual Training
5. Begin “Mock” Simulated Cases
6. Acquire Supplies & Equipment
7. Team Live Case Observations
8. Initial Case Selections
9. Proctored Initial Cases
10. Success
Steps for Mitral Valve Repair using the L.E.A.R. Technique

- IV Access and Arterial lines
- Anesthesia
- Double Lumen Tube
- TEE Probe
- Coronary Sinus Catheter
- PA Catheter

Prep & Drape

- Explore Femoral Vessels
- Right Chest Ports
- Cannulate & Place EndoClamp™
- Dock Robot

Initiate CPB

- Inflate EndoClamp™
- Cardioplegia
- Deflate EndoClamp™

Wean CPB

- Repair Femoral Vessels
- Close ports

Single Lumen Tube Exchange

- Left Atrial Closure & De-airing
- MV Repair
- Left Atriotomy

Traction sutures and Pericardiotomy

Anesthesia

Surgeon at the OR Table

Surgeon at the Robotic Console

Courtesy of Doug Murphy, MD
Cornell/NYP Robotic MVR Room Setup

- **Instrument Table**
- **Scope Warmer**
- **CT Attending Console**
- **CT Resident Console**
- **Bovie Tower**
- **Anesthesia Machine**
- **Anesthesia Attending**
- **Anesthesia Fellow**
- **Circulating Nurse**
- **Pump**
- **Perfusionists**
- **First Assist**
- **Scrub**
- **Cell Saver**

Weill Cornell Medicine + NewYork-Presbyterian
Transcatheter Cardio-pulmonary Bypass and Cardiac Arrest
Thank you!

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I WANT YOU FOR THE ROBOTIC ARMY