

Robotic mitral valve repair: The steps to success



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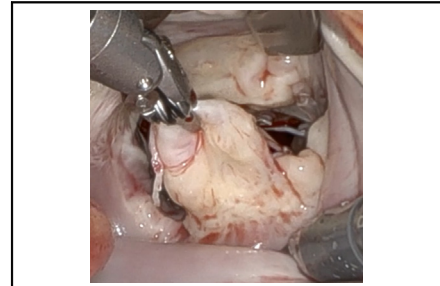
Video clip is available online.

PATIENT SELECTION

Patient selection is a critically important step in robotic mitral valve repair. Technically, nearly all mitral patients can have robotic surgery, yet not all should. The highest priority is to provide a safe, effective operation. To that end, we recommend adherence to a strict selection algorithm. As experience grows, some patients with relative contraindications to a robotic approach may be undertaken, as long as excellent outcomes are maintained (Video 1).^{1,2}

ECHOCARDIOGRAPH ASSESSMENT

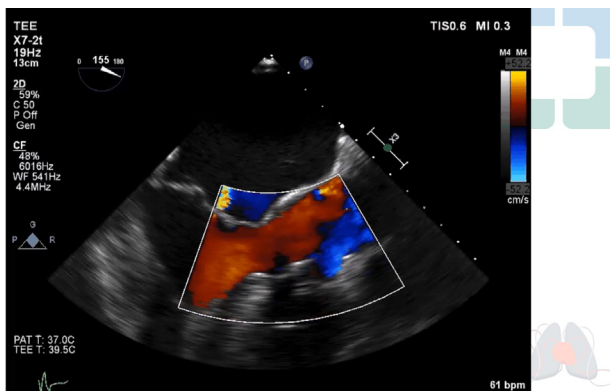
The surgeon and cardiologist review the intraoperative transesophageal echocardiograph to confirm that no contraindication to robotic surgery is present, make final assessment of need for concomitant procedures, fully



Examination of mitral valve before repair using robotic assistance.

CENTRAL MESSAGE

A successful robotic mitral valve repair depends on patient selection and an organized, stepwise approach in the operating room.



VIDEO 1. Patient selection and dangerous traps. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

characterize the mitral pathology, and estimate the risk of systolic anterior motion (Video 2).

GENERAL SETUP

The patient is intubated with preparations for single-lung ventilation. The right internal jugular vein is doubly accessed with central line and micropuncture access to allow for percutaneous venous cannulation. The right side is elevated slightly, and the right arm is flexed. Landmarks are marked (Video 3).

INCISIONS

The femoral vessels are initially exposed to provide final confirmation of suitability for peripheral cannulation. Once confirmed, the access incision is made in the fourth

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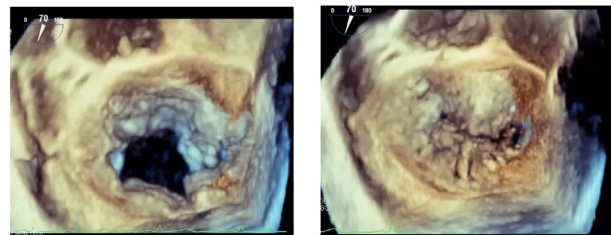
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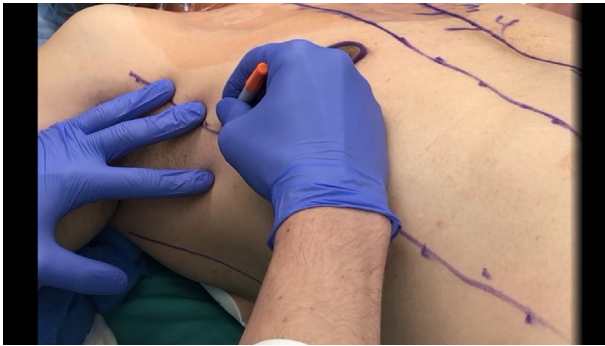
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VIDEO 2. Intraoperative transesophageal echocardiogram assessment. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).



VIDEO 3. Marking and positioning with diagram. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

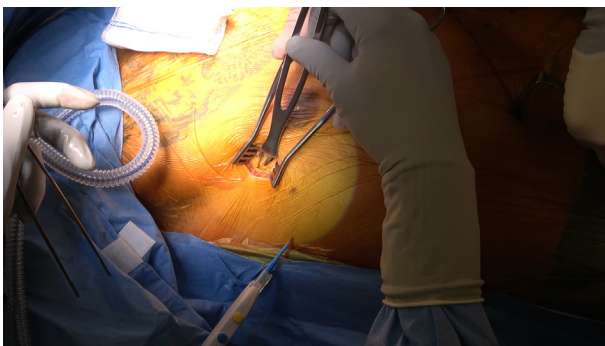
interspace and trocars are placed about the access incision. A soft tissue retractor is placed. Either 1 or 2 14-gauge angiocaths are placed to allow for the exteriorization of pericardial stay sutures (Video 4).

CANNULATION

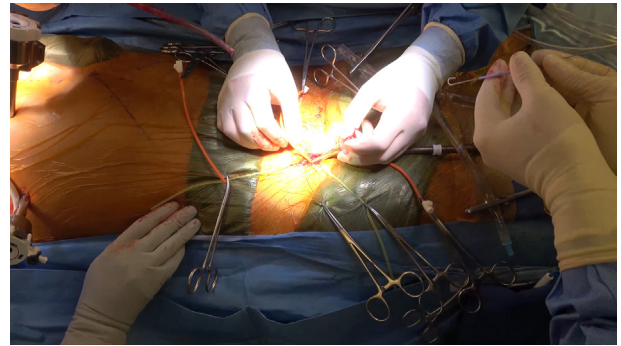
Purse-string sutures are placed in the vessels and after heparinization, the patient is peripherally cannulated using transesophageal guidance. Once on bypass, the pericardiotomy will be created, either via direct vision through the working port or with robotic instruments (Video 5).

PERICARDIOTOMY

The pericardium is incised and pericardiotomy is created. Pericardial stay sutures are placed. The inferior stay sutures are exteriorized through angiocaths to allow for pericardial retraction. Care should be taken not to place excessive tension on these sutures to avoid phrenic nerve palsy. If a Chitwood clamp is used, a long antegrade cardioplegia cannula is placed in the ascending



VIDEO 4. Femoral exposure and chest incisions. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).



VIDEO 5. Preparation for bypass. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

aorta and secured and the Chitwood clamp is passed into the thoracic cavity (Video 6).

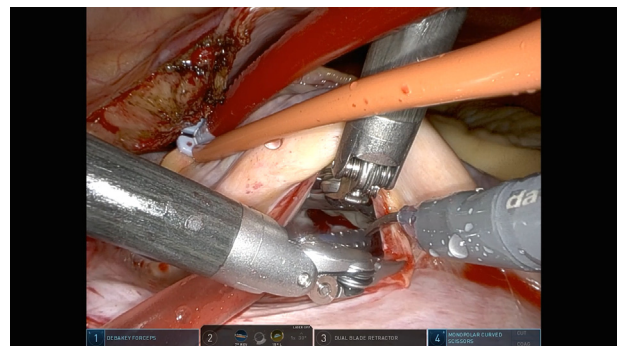
EXPOSURE

After cardioplegic arrest, a left atriotomy is made. The atrial lift is placed and positioned to expose the valve and valve analysis is carried out (Video 7).

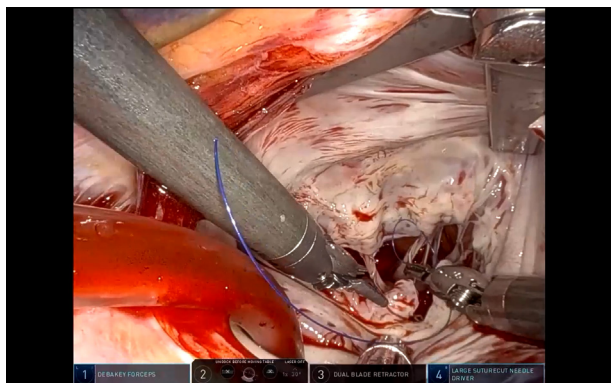
REPAIR

A triangle is excised that includes the prolapsing free edge of the posterior leaflet right to the middle of P2. An interrupted suture aligns the free edges of the leaflet. After this interrupted suture, 1 or more sutures are run down to the annulus then back up to the free edge. The final step is to ensure that there is a smooth surface of coaptation at the free edge.³

For neochords, we use preknotted CV-4 GoreTex sutures (W. L. Gore & Associates) buttressed with a felt pledget on the papillary muscle. In general, we use 2 sets of neochords for posterior leaflet prolapse, particularly when it is



VIDEO 6. Atriotomy and valve examination. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).



VIDEO 7. Repair with triangular resection. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

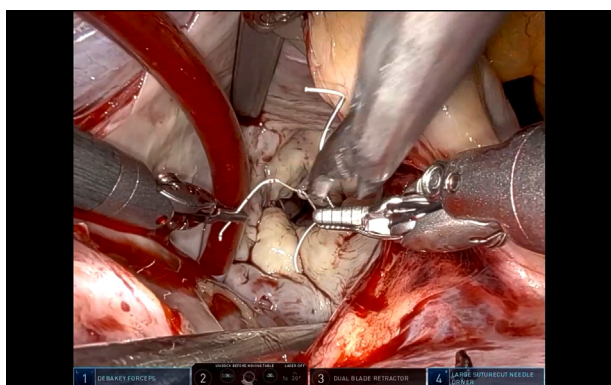
extensive. The second chord is left initially secured only with a surgeon's knot to allow for final adjustment of chordal length after the annuloplasty and valve test (Video 8).

ANNULOPLASTY

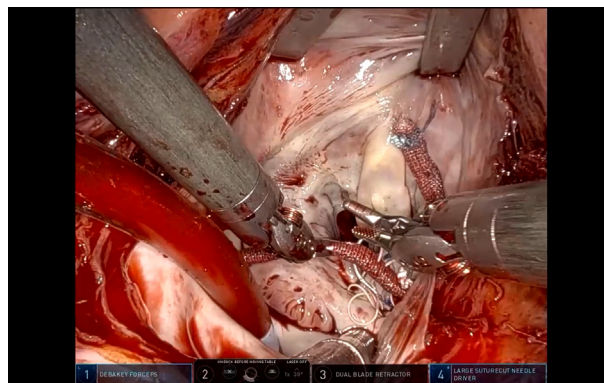
A flexible annuloplasty band is placed with a running horizontal mattress technique. Three preknotted sutures are placed: 1 from the medial trigone to the middle of the posterior annulus, 1 from here up to the lateral trigone, and 1 at the lateral trigone itself (Video 9).³

VALVE TESTING

After the repair is completed, antegrade cardioplegia is given and a power injector used to fill the ventricle with normal saline to test the valve. The ventricle is filled under pressure, and the valve is assessed to ensure no leak and robust coaptation (Video 10).



VIDEO 8. Repair with chords. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

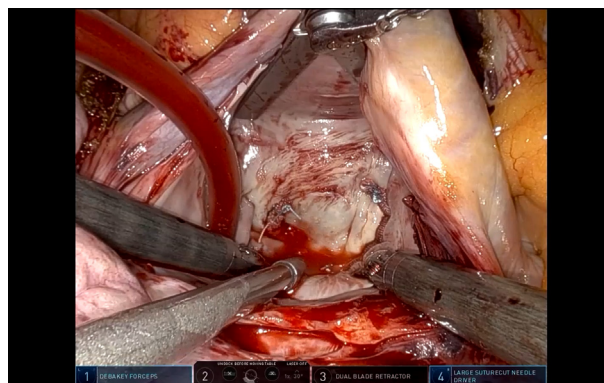


VIDEO 9. Robotic annuloplasty. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

FINAL STEPS

The atriotomy is closed with running CV-4 GoreTex³ over a basket suction placed into the left ventricle. The left side of the heart is preliminarily de-aired, aortic perfusion is restored, and the patient is weaned from bypass. Once the transesophageal echocardiograph shows that there is minimal residual air in the left ventricle, the basket suction is removed. Final de-airing takes place via the antegrade cardioplegia cannula (if a Chitwood clamp was used) or via the vent port on the endoballoon. After weaning from bypass completely, the repair is assessed on transesophageal echocardiograph. After this, the patient is briefly returned to bypass, the atriotomy suture is tied, and the atriotomy is reinforced (Video 11).

Following this, the patient is weaned from bypass, de-airing is complete, the antegrade cardioplegia cannula is removed, the aortic site is oversewn (in cases where the Chitwood is used), the patient is decannulated, hemostasis is assessed, and a chest tube is placed generally at the site of the right trocar.



VIDEO 10. Robotic repair valve testing with power injector. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).



VIDEO 11. Final steps. Video available at: [https://www.jtcvs.org/article/S2666-2507\(23\)00303-6/fulltext](https://www.jtcvs.org/article/S2666-2507(23)00303-6/fulltext).

Conflict of Interest Statement

Dr Mick serves as a consultant for Medtronic, Artivion, and Johnson & Johnson. Dr Gillinov serves as a consultant

for Medtronic, AtriCure, Edwards Lifesciences, Abbot, Artivion, Johnson & Johnson, and ClearFlow.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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