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EDITORIAL PEER REVIEWED | OPEN ACCESS

# Robotic heart surgery

Jeffrey E Everett

The daVinci robotic platform (Name of Manufacturer, Country) was introduced to cardiac surgery in the 1990's and was granted FDA approval in 2002 for mitral valve repair [1]. The initial enthusiasm about lesser invasiveness was met with much skepticism as the procedures involved longer operative as well as cardiopulmonary bypass times [2]. The procedures are technically different, using unique cannulation strategies, myocardial protection, video visualization, and lack of haptic feedback. For a procedure with inherent multiple steps, introducing a new paradigm naturally caused angst. The learning curve for such procedures is real and involves every facet of the case including anesthesia, perfusion, bedside assistant and scrub nurse. If all team members do not buy in, these cases can be long and frustrating. Many early adopters saw these negatives and moved away from the robotic platform. The daVinci found its home in urology, gynecology and more recently general thoracic surgery. Over the years Intuitive developed newer generations with the Xi becoming available in 2014. The overhead boom allows rotation that avoids external conflicts with patients' body, a serious hindrance with the earlier models. Other improvements over the years included a fourth robotic arm, which was perhaps the most important advancement for mitral valve cases. An atrial lift retractor was introduced for the fourth arm, which is a dynamic instrument fully under the surgeon's control. This allows exposure to the subvalvular apparatus and full exposure of the entire valve and annulus. The tenfold optical magnification and three-dimensional dual cameras allows a view not replicated by surgical loupes or standard thoracoscopic cameras. The wristed instruments can now be introduced through 7 mm ports and can reproduce every motion needed to cut, sew and tie. The lack of tactile feedback is easily overcomed by visual clues on the tissue and sutures. As the platform has advanced there has been a migration back to use in cardiac surgery [3]. Large medical centers including Cleveland Clinic and Mayo Clinic have become proponents of robotic mitral valve repair. The Society of Thoracic Surgeons database shows that the robotic approach is very safe with regard to mortality. It has also proven that there is no increase in stroke, which was a concern from early reports. There is a slight cost increase with the robotic approach, but this is usually offset by decreased length of stay and reduced blood transfusions. As the learning curve passes, the incremental costs of the robotic procedure further decreases. After a year of moderate use, the daVinci becomes cost neutral compared to the traditional sternotomy approach.

Robotic program development, however, must be done methodically and with caution. The results must be on par with the traditional approach with regard to safety and excellent repair rates. The robotic approach is never an excuse to accept anything less. To start the surgeon must have experience in mitral valve repair. The robot is simply a tool and is only as good as the surgeon behind the console. Next, there must be sufficient volume. Interestingly only 13% of centers performing mitral valve repair exceed ten cases per year [4]. Studies reveal that surgeons performing over twenty-five mitral procedures have superior results to those with lower volume [5]. Familiarity with peripheral cannulation and wire skills are also helpful. A busy practice will help compress the learning curve which is approximately 30–50 cases. Team training includes representatives from anesthesia, perfusion and scrub technicians. The bedside assistant plays a critical role as the surrogate surgeon as the lead physician resides at the controlling console. This role can be performed by a physician assistant or second surgeon depending on their skill set. The core team should be limited to one or two per role until the learning curve is surpassed. Only then should other members be added. Early case selection is critical. A thorough echocardiogram defining the valve, annulus and subvalvular structures is essential. A CT angiogram to assess for vascular access should be considering for operative planning. Early cases should be limited to straight forward posterior leaflet pathology. Long operative and cardiopulmonary bypass times should be anticipated. Patients must have the physiologic reserve to tolerate the longer duration.

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Not only cardiac function, but renal, hepatic, and respiratory systems should be normal. Extremes in body habitus should be avoided as should re-operative cases. As the team progresses, more advanced cases may be undertaken. The dynamic atrial lift retractor will facilitate use of neo-chords for both anterior and posterior leaflets.

Mitral valve surgery has been the largest growth area in cardiac surgery. Last year alone, over 12,475 mitral valve repairs were performed in the United States. Despite proven safety and durability of surgery, percutaneous options continue to evolve. The MitraClip (Name of Manufactures, Country) has shown to be an option for high-risk patients and will likely encroach on surgical repairs. Percutaneous valve replacements will soon enter the marketplace bringing even more competition. Minimally invasive surgery must advance to remain a viable option. The reduced hospitalization and recovery, and proven results will be the key to continued surgical success. Last year approximately 14% of mitral valve repairs were done robotically. Though isolated to limited centers, patient demand will drive further growth. We have adopted port access approach for our robotic mitral valves, which has resulted in a median length of stay of three days. Perhaps even more beneficial is the lack of physical restrictions at discharge. The patients have been able to return to full activity and work much sooner compared to both mini-thoracotomy and sternotomy approaches. Repair rates have also been higher which we feel is secondary to the enhanced exposure, which is often better than open cases.

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## REFERENCES

1. Chitwood RW Jr. Robotic mitral valve surgery: Overview, methodology, results, and perspective. Ann Cardiothorac Surg 2016;5(6):544–55.
2. Verrier ED. Editorial (pro) re minimally invasive port-access mitral valve surgery. J Thorac Cardiovasc Surg 1998;115(3):565–6.
3. Bonatti J. Minimally invasive cardiac surgery—from early steps to consolidation. Indian J Thoracic Cardiovasc Surg 2018;34(Suppl 2):84–5.
4. Roubelakis A. Current surgical trends and interventions in mitral surgery. E-Journal of Cardiology Practice 2018;16(29).
5. Chikwe J, Toyoda N, Anyanwu AC, et al. Relation of mitral valve surgery volume to repair rate, durability, and survival. J Am Coll Cardiol 2017;69(19):2397–406.

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## Author Contributions

Jeffrey E Everett – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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The corresponding author is the guarantor of submission.

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All relevant data are within the paper and its Supporting Information files.