Complicated versus complicated

Scott Goldman, MD

From the Structural Heart Program, Lankenau Heart Institute, Wynnewood, Pa.

Disclosures: S.G. is a consultant to St Jude Medical, Edwards Lifesciences, and Abbott.

Received for publication March 30, 2018; accepted for publication April 5, 2018; available ahead of print May 17, 2016.

Address for reprints: Scott Goldman, MD, Lankenau Medical Center, 100 Lancaster Ave, Suite 280, Wynnewood,

PA 19096 (E-mail: goldmans@mlns.org).

J Thorac Cardiovasc Surg 2018;156:1048-9

0022-5223/\$36.00

Copyright © 2018 by The American Association for Thoracic Surgery

<https://doi.org/10.1016/j.jtcvs.2018.04.006>

Scott Goldman, MD

Central Message

Application of “complicated” minimally invasive and robotic procedures for mitral valve disease avoids “complicated” ICU and hospital care and avoids a “complicated” recovery from surgery.

See Article page 1040.

In this issue of the *Journal*, Coyan and colleagues¹ report on a series of patients who underwent robotic mitral valve repair or replacement (RMVR). These patients were compared with a contemporary group of patients who had their mitral valves repaired or replaced through a sternotomy (surgical mitral valve repair or replacement). Experienced mitral valve surgeons performed all 328 consecutive procedures, 118 of which were performed with the robot. More than 80% of the patients had a repair. Coyan and colleagues¹ were able to propensity match 182 patients.

Coyan and colleagues¹ observed similar overall hospital costs between the patients undergoing RMVR and those undergoing surgical mitral valve repair or replacement. Interestingly, activity-based cost accounting² was applied to include direct, semidirect, and indirect costs. The total cost also included depreciation of the robot.

The overall outcomes were excellent and similar in each group with respect to mortality and freedom from recurrent mitral regurgitation. The patients undergoing RMVR were more likely to be extubated in the operating room (74.7% vs 18.7%; $P < .001$), to spend less initial time in the intensive care unit (ICU; 27 hours vs 31 hours; $P = .004$), to have less total ICU time (27.5 hours vs 34.0 hours; $P = .003$), and to have a shorter postoperative length of stay (5 days vs 7 days; $P < .001$). There were also trends toward less blood use and toward fewer rehospitalizations in the RMVR group.

Although the overall hospital costs were similar, the significantly shorter ICU and hospital lengths of stay have an unaccounted-for impact on health care costs. There are several factors to be considered. One is the ability to receive transfers of new patients to the ICU or step-down unit in beds freed up by this decreased use in the RMVR group. Another is the potential for an improved work environment for the ICU staff because of the lower intensity level of the patients undergoing RMVR.

At my institution, the cardiothoracic ICU has many very high-acuity level patients. We have patients receiving extracorporeal membrane oxygenation and Impella

(Abiomed, Inc, Danvers, Mass) support. We have a robust aortic surgery program that includes patients who have had hypothermic circulatory arrest. Performing valve surgery in a way that allows a lower acuity level course improves the overall work environment.

According to Society of Thoracic Surgeons data, only 14.5% of mitral valve operations are being performed with minimally invasive or robotic techniques,³ and 11% of mitral valve repairs are performed with the robot.³ There is as of now a single commercially available device for nonsurgical repair of the mitral valve, the MitraClip (Abbott Vascular, Santa Rosa, Calif). In data from the STS/ACC TVT Registry,⁴ 2952 patients were examined for the acute outcome; of these, 92.8% had postprocedural mitral regurgitation of 2 or less. In-hospital mortality was 2.7%, and most patients were discharged home (85.9%) after a median 2-day hospitalization. The median age of the patients was 82 years, 56% were men, 85% had New York Heart Association class III or IV heart failure, and 93% had grade III or IV mitral regurgitation.⁴ In our experience these patients recover in the cardiac catheterization laboratory and have no ICU stay.

There are other transcatheter and transapical mitral therapies in or near pivotal clinical trials. These include CardioBand (Valtech Cardio, OrYehuda, Israel), Pascal (Edwards Lifesciences, Irvine, Calif), Harpoon (Edwards Lifesciences), and NeoChord (NeoChord, Inc, St Louis Park,

Minn). Intrepid (Medtronic, Minneapolis, Minn), CardiAQ (Edwards Lifesciences), and Tendyne (Abbott Vascular) are transcatheter mitral valve replacements that are in or near pivotal trials.

Surgical treatment of mitral valve repair remains the criterion standard, as demonstrated by the excellent outcomes by the Cohan and colleagues.¹ Nonsurgical approaches for the treatment of mitral valve disease, however, will create pressure on us as surgeons to provide a less-invasive surgical treatment for the mitral valve.

There may never be a randomized, controlled trial of minimally invasive mitral valve surgery versus a sternotomy approach. The propensity matching in this study does shed some light on the differences, however, and in my interpretation, it clearly favors the minimally invasive and RMVR options.

Why have less-invasive surgeries for mitral valve disease not been more widely adopted? It has been more than 20 years since minimally invasive and robotic valve surgery^{5,6} were introduced. There are specific pitfalls related to minimally invasive surgery and RMVR; however, as demonstrated by Cohan and colleagues¹ and clearly described by surgeons with significant experience,⁷⁻⁹ these can be avoided. Is it because these procedures are perceived to be more complicated?

What is complicated about minimally invasive and robotic surgery? These procedures do require a team that is familiar with the equipment and techniques that are unique to them. But is not having such a team helpful in all cardiac operations? In my experience, these operations are a series of steps that can be learned and applied. This is not much different from sternotomy mitral valve repair or replacement, albeit some steps are different.

Application of these “complicated” minimally invasive and robotic procedures to patients with mitral valve disease avoids “complicated” ICU and hospital care, and it avoids a “complicated” recovery from surgery. This will become increasingly important as surgery competes with less effective transcatheter mitral valve therapies. In their report, Cohan and colleagues¹ demonstrate that a minimally invasive mitral valve program, including the use of the robot, is highly beneficial to patients at no financial burden to the hospital.

References

1. Cohan G, Wei LM, Althouse A, Roberts HG, Schauble D, Murashita T, et al. Robotic mitral valve operations by experienced surgeons are cost-neutral and durable at 1 year. *J Thorac Cardiovasc Surg*. 2018;156:1040-7.
2. West TD, Balas EA, West DA. Contrasting RCC, RVU, and ABC for managed care decisions. A case study compares three widely used costing methods and finds one superior. *Healthc Financ Manage*. 1996;50:54-61.
3. Badhwar V, Rankin J, He X, Jacobs J, Gammie J, Furnary A, et al. The Society of Thoracic Surgeons mitral repair/replacement composite score: a report of the Society of Thoracic Surgeons quality measurement task force. *Ann Thorac Surg*. 2016;101:2265-71.
4. Sorajja P. NCDR Registry data provides insights on MitraClip outcomes in U.S. Presented at: ACC.17 American College of Cardiology 66th Annual Scientific Session and Expo; March 18, 2018; Washington, DC.
5. Carpentier A, Loulmet D, Aupècle B, Kieffer JP, Tournay D, Guibourt P, et al. Computer assisted open heart surgery. First case operated on with success. *C R Acad Sci III*. 1998;321:437-42. French.
6. Cosgrove DM III, Sabik JF, Navia JL. Minimally invasive valve operations. *Ann Thorac Surg*. 1998;65:1535-9.
7. Ailawadi G, Agnihotri AK, Mehall JR, Wolfe JA, Hummel BW, Fayers TM, et al. Minimally invasive mitral valve surgery I: patient selection, evaluation, and planning. *Innovations (Phila)*. 2016;11:243-50.
8. Wolfe JA, Malaisrie SC, Farivar RS, Khan JH, Hargrove WC, Moront MG, et al. Minimally invasive mitral valve surgery II: surgical technique and postoperative management. *Innovations (Phila)*. 2016;11:251-9.
9. Lehr EJ, Guy TS, Smith RL, Grossi EA, Shemin RJ, Rodriguez E, et al. Minimally invasive mitral valve surgery III: training and robotic-assisted approaches. *Innovations (Phila)*. 2016;11:260-7.