Commentary: Robotic mitral repair: The “new gold-standard” that requires more gold

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The past 2 decades have witnessed gradual worldwide adoption of robot-assisted surgery using da Vinci surgical systems (Intuitive Surgical). According to the statistics posted on the company’s website, 6730 da Vinci surgical systems had been installed as of the end of 2021, including 4139 in the United States, 1199 in Europe, and 1050 in Asia. Compared with surgeons in several other subspecialties, cardiac surgeons have not been among the most frequent users of robotic technology to date. With the exception of harvesting the internal mammary artery, for instance, the advantages of using robotic systems for surgical coronary revascularization remain uncertain.1,2 In contrast, robot-assisted mitral valve repair has shown remarkable early and midterm results when performed by expert surgeons at centers of excellence for valve surgery,2,5 including the Cedars-Sinai group.6 In this issue of The Journal of Thoracic and Cardiovascular Surgery, Rowe and colleagues7 from this group provided another important piece of evidence supporting the use of robotic technology in complex mitral valve repair. With a repair rate of 99% and a 5-year freedom from greater than moderate mitral regurgitation rate of 92%, their 16-year experience of robotic mitral repair in 110 patients with Barlow’s disease is simply outstanding. Combined with other institutional reports cited in the article by Rowe and colleagues,7 few would disagree with Dr Marc Gillinov’s remark at a recent American Association for Thoracic Surgery Global Grand Rounds Webinar, stating that the robotic approach represents the “new gold-standard” for mitral valve repair.

Nonetheless, in the field of cardiovascular surgery, most people consider that the gold-standard should be routinely applied to every patient by every surgeon, such as grafting internal mammary artery onto the left anterior descending coronary artery during surgical myocardial revascularization, or performing mitral valve repair for degenerative mitral regurgitation. Interestingly, the debate regarding the gold-standard approach for mitral valve repair is not new.8 The traditional gold-standard is repair under direct vision via midline sternotomy, which is still the predominant method used worldwide. It is believed by many “mitral surgeons,” if not all, that without a multicenter, prospective, randomized clinical trial comparing the robotic with the conventional sternotomy approaches, “the cheese is not going to move.”8 Indeed, most published reports on robotic mitral repair have been from Western countries, undertaken in carefully selected patients, and performed by expert mitral surgeons. This explains why the number of centers in the United States that routinely conduct such procedures are still much less than expected, despite 4139 da Vinci surgical systems actually being available in the country. In fact, in total 1037 patients underwent robotic mitral valve surgery from 2005 to 2020 at Cedars-Sinai Medical Center,7 which averages 1.25 cases per week. In 27 European centers over a recent 4-year period (2016-2019), only 626 isolated

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CENTRAL MESSAGE
Robotic mitral repair is costly, and yet not for every patient or every surgeon. This “new gold-standard” is to be compared with its engaging competitor—the endoscopic minithoracotomy approach.
robotic mitral repair operations were carried out. These real-world figures did reflect the difficulties involved in establishing this “new gold-standard.”

If we consider developing countries, such as China, we might appreciate this “new gold-standard” issue from a different perspective. To the best of our knowledge, 275 da Vinci surgical systems have been installed in mainland China to date (ie, the numbers in Hong Kong, Macau, and Taiwan are not included). Among more than 310,000 surgical procedures carried out using these robotic systems between 2007 and 2021, only approximately 3400 (1.1%) were cardiac surgeries, of which more than 900 were mitral valve procedures (personal communication, Intuitive Foundation). Focusing on the more recent annual number of cardiovascular surgeries performed in mainland China, however, a sharp increasing trend in the use of endoscopic mitral valve surgery via minithoracotomy was evident between 2018 and 2020 (Table 1). Moreover, the number of endoscopic mitral procedures continued to increase despite the negative influence of the COVID-19 pandemic in 2020, whereas the overall number of valvular operations was greatly reduced (Table 1). It is clear that the number of endoscopic minithoracotomy mitral valve procedures (approximately half of them were mitral repair) in China was significantly greater than the number of mitral valve operations performed using the robotic approach.

Obviously, by avoiding sternotomy, the 2 minimally invasive approaches share many similarities in their clinical outcomes, such as quicker recovery (shorter hospital stay) and better cosmesis (improved patient satisfaction). The cost includes not only the “measurable” purchasing cost of the robotic system and the additional maintenance and surgical disposable costs, but also the “invisible” costs, such as that of the steady learning curve of the entire robotic surgery team. In fact, it is generally estimated that at least 100 to 150 cases are needed before the surgical team can overcome the “time-consuming phase” of robotic mitral valve surgery.

In an attempt to convincingly confirm the “new gold-standard” approach for mitral valve repair, should we continue to compare the cost-effectiveness of the 2 minimally invasive approaches by conducting another multicenter randomized clinical trial? It is a difficult question that will likely remain unanswered for years. However, most of us probably know the final answer already—the cheese will be moved, eventually.

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