

Editorial

Minimally Invasive Cardiac Surgery: A Safe Alternative for Aortic Valve Replacement?

Cirugía cardíaca mínimamente invasiva: ¿una alternativa segura para pacientes que requieren recambio valvular aórtico?

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Over the past 50 years, surgical aortic valve replacement with cardiopulmonary bypass has been the most widely employed strategy for the treatment of symptomatic aortic stenosis. Advances in prosthetic technology have contributed to improvements both in valve design and in the techniques used in surgical implantation. More recently, minimally invasive surgery for aortic valve replacement has undergone a change in the paradigm used since its introduction 2 decades ago. When first instituted, traditionalist surgeons rejected techniques of this type because of safety concerns due to the reduced surgical exposure as compared to the standard approach. However, as a result of subsequent development, innovation, and surgical refinement in this area, the operative outcomes are similar or even superior to the success achieved using traditional management. For these reasons, minimally invasive surgery has become a safe and effective treatment that reduces complications and increases patient satisfaction.¹ However, to date no prospective, randomized, multicenter studies have compared the minimally invasive technique with the standard procedure, as would be desirable. Endeavors that enable the retrospective comparison and analysis of the results from different centers specialized in this area are essential.

In the article published in the *Revista Española de Cardiología*, Paredes et al.² present a retrospective analysis that compares the surgical outcomes of patients who underwent minimally invasive aortic valve replacement with those resulting from the performance of full sternotomy. The technique used by the authors for minimally invasive aortic valve replacement is that which is most widely accepted by other professionals: ministernotomy with a J-shaped incision from the sternal notch to the third or fourth right intercostal space.

The comparative analysis was based on the medical records of 615 patients treated between 2005 and 2012. A minimally invasive approach was used in 83 of these patients. The criteria for evaluating the outcome of the procedure included, among other

aspects, the in-hospital mortality, the length of the postoperative hospital stay, and the rate of complications, as well as the reinterventions.

In their study, the authors demonstrated excellent results with the minimally invasive technique and emphasize the nearly 0% in-hospital mortality. In contrast, the mortality rate in patients treated by full sternotomy was significantly higher, close to 5%. The authors are especially cautious about attributing this phenomenon only to the surgical technique because the number of patients treated with the minimally invasive approach is smaller than that of the control group. Another important factor that influences the clinical outcome is patient selection. When implementing a new technique, it is feasible to first select the patients with less severe morbidity. This often makes it difficult to compare one technique with another. Paredes et al. demonstrate, by means of the logistic EuroSCORE, that there are no significant differences between the two groups, although a trend toward lower risk was observed in the minimally invasive group. At present, the mortality rate associated with minimally invasive aortic valve replacement ranges between 1% and 5%.³ It is noteworthy that the majority of the studies carried out conclude that in-hospital mortality is an independent factor of the implantation technique.¹ This means that both surgical approaches are safe. However, the minimally invasive technique offers important advantages in terms of the rate of complications, the length of the hospital stay, the costs of hospitalization, and quality of life. The authors observe a lower incidence of reinterventions due to bleeding in the minimally invasive group, probably because the surgical trauma is less severe. The results presented coincide with the experience of the Cohn group in Boston, who reported a 2.6% reintervention rate due to bleeding.⁴ Another positive effect is the reduction in the number of blood transfusions, which are recognized as an additional risk factor for patients.⁵ At present, only 50% of the patients who undergo aortic valve replacement with the minimally invasive technique require blood transfusions.⁴ To this we can add another important finding of the present study: the reduction in the incidence of respiratory complications in the group with minimally invasive surgery. The authors also reported that none of their patients developed pleural effusion or respiratory failure and, moreover, there were fewer respiratory tract infections. This is due to less postoperative pain from J-incision ministernotomy compared with full sternotomy, meaning that fewer analgesics

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are consumed and the wellbeing of the patients is enhanced. On the other hand, greater sternum stability permits mobility and the patients are able to return to their daily activities sooner. In addition, the patients can receive more effective respiratory physiotherapy, with the resulting reduction in respiratory complications. This also translates into significantly fewer days in the intensive care unit and shorter total hospital stay and postoperative rehabilitation. This, together with the significant contribution to patient wellbeing, also reduces costs considerably.

Another important aspect of the present report involves surgical infections. There is a clear trend toward a decrease in wound complications in patients treated using the minimally invasive technique, a finding that is confirmed by the review of the scientific literature, which demonstrates that patients who undergo minimally invasive procedures have a lower incidence of postoperative infections and mediastinitis.⁶ Although one of the major criticisms of the minimally invasive technique is the difficulty of de-airing, with an increase, at least theoretically, in the incidence of neurological events, the authors demonstrate in their study a decrease in these events in the minimally invasive group. However, we should point out that, in contrast to the control group (traditional treatment), continuous carbon dioxide insufflation was utilized in minimally invasive surgery, a circumstance that clearly favors the treated patients since carbon dioxide is a factor that facilitates air removal. To maximize patient safety during de-airing, the use of transesophageal echocardiography is recommended to enable the visualization of the flow of bubbles in the cardiac chambers and aorta.

In their report, the authors demonstrate excellent in-hospital outcomes. However, despite this success, the question arises: what can be said about the intermediate and long-term results of minimally invasive aortic valve replacement? Mihaljevic et al. performed follow-up in 1000 patients who underwent minimally invasive surgery. The survival rates at 1, 3, and 5 years after the intervention were 98%, 94%, and 82%, respectively.⁷ These authors then compared the outcomes with those of patients who had undergone full sternotomy. In that group, the survival rates at 1, 3, and 5 years were significantly lower: 94%, 90%, and 86%, respectively. Fewer cases of infection, sepsis, and blood transfusion and shorter hospital stays were observed, especially in patients over 70 years of age.⁸ This is important because, considering the demographic changes in developed countries, these positive outcomes are observed in increasingly older patients, with a high rate of comorbidity and greater surgical risk.⁹ The challenge for modern cardiac surgery is to adapt to these changes, developing effective, minimally invasive techniques capable of reducing complications without compromising patient safety.

Considering the rising costs of the health care systems, minimally invasive techniques can also contribute to savings in financial resources. Despite the fact that transcatheter aortic valve implantation has broadened the options for the treatment of aortic stenosis, this therapy continues to be reserved for high-risk patients who are not candidates for surgical intervention with cardiopulmonary bypass.¹⁰ As an alternative, the new Perceval S valve (Sorin, Biomedica; Saluggia, Italy) has recently been introduced. It consists of a bovine pericardium prosthesis mounted on a nitinol stent, and combines the safety and efficacy of the most widely used valves with the benefits of transcatheter techniques.¹¹ The valve is implanted in accordance with the traditional procedure using cardiopulmonary bypass, but initially it requires only 3 sutures to position the prosthesis. The process of securing

the valve is completed with the unfolding of a stent in the aortic annulus.¹² The initial results of the TRITON trial show that this novel technique contributes to reducing the aortic clamp and cardiopulmonary bypass times, which further improves the outcome of the intervention.¹¹ In our research center, we are using this new type of valve together with J-incision hemisternotomy as the standard technique for aortic valve replacement in elderly patients with aortic stenosis. Looking toward the future, we consider that, for patients under 60 years of age, tissue engineered valves would be an excellent alternative due to their lower degenerative potential.^{13–15}

Finally, it is fitting to point out that the standard approach currently used in Europe for aortic valve replacement in elderly patients with aortic stenosis who do not have coronary artery disease is admirably described in the Paredes et al.² study published in the *Revista Española de Cardiología*.

CONFLICTS OF INTEREST

None declared.

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