

Minimally Invasive Aortic Valve Replacement: Is It Now the Best Surgical Approach?

Guillermo Reyes, Corazón M. Calle

Guillermo Reyes, Corazón M. Calle, Department of Cardiac Surgery, Hospital Universitario La Princesa, c/Diego de Leon 62, 28006 Madrid, Spain

Correspondence to: Guillermo Reyes, Head of Department, Cardiac Surgery, Hospital Universitario La Princesa, c/Diego de Leon 62, 28006 Madrid, Spain.

Email: guillermo_reyes_copa@yahoo.es

Telephone: +915202268

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ABSTRACT

Full sternotomy aortic valve replacement has been the gold standard for the treatment of severe aortic stenosis. Now transcatheter aortic valve implantation is becoming a new procedure that has shown its efficacy in a high risk population with aortic stenosis. Minimally invasive aortic valve replacement, using a 7-9 centimeters incision with an upper sternotomy tries to obtain the advantages and open surgical field and the less aggression of transcatheter procedures. We review the pros and cons of the minimally invasive aortic valve replacement updating the information obtained in the literature.

Key words: Minimally invasive cardiac surgery; Mini-sternotomy; Aortic valve disease

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EDITORIAL

The increase in the prevalence of cardiovascular diseases along with the higher life expectancy is an important issue that will make us do our best to counteract the increase in the aortic valve pathology. The aortic valve disease increases its prevalence with age. Being 3% in the population of major or equal to 65 years old and more than 7.4% in those over 85 years old^[1] it is a real challenge for the health community system. Traditionally the conventional approach to the aortic valve replacement has been the full sternotomy. However the rapid development and improvement of novel surgical techniques has facilitated the use of minimally invasive approaches in heart valve surgery with surgical outcomes at least as good as those of conventional surgery^[2]. The technological evolution that the cardiological world is living in the last years is impressive, especially since the introduction of the transcatheter aortic valve implant (TAVI). This novel approach is now a real option for those patients with severe symptomatic aortic stenosis in non surgical patients due to high surgical risk^[3]. The age as a unique factor has ceased to be a contraindication for valve replacement. There are many studies that have shown very good surgical results in elderly population and also good results regarding the quality of life in this population^[4,5].

Nevertheless, only 20 % of patients over 80 years old are referred for aortic valve replacement, despite of the high mortality in non-treated patients, probably due to the concomitant pathology that commonly appear in this subgroup of patients, as renal failure, lung disease, etc.^[6-8].

Minimally invasive cardiac surgery (MICS) has recently become more popular as numerous technical advances have been created in the last years. The growing interest towards laparoscopic surgery in general has stimulated the search of minimally invasive techniques for their use in cardiac surgery since Cosgrove described the first MICS in 1996^[9]. Posteriorly multiple retrospective studies have reported long patient's series under MICS^[2,10,11]. Other studies have compared MICS with full sternotomy surgery^[12].

The conclusion is that MICS even in high risk patients is a feasible way for AVR^[13].

The recent interest in this type of surgery of minimal approach is based on the theory MICS results in less postoperative pain, less bleeding and blood transfusions, short length of stay in the ICU and total length of stay, improvement in pulmonary function, preservation of integrity and stability of thorax, fast functional recovery, cosmetic benefits and economic cost reduction^[11,14,15]. However other authors believe that small incisions limit the exposure of the rest of the heart, increasing the difficulty of the surgery with more intraoperative complications^[16], although the conversion into complete sternotomy can be done rapidly when necessary. Other disadvantage of MICS would be the increase in the surgical time^[11] and the learning curve is necessary to carry out this technique.

Not only elderly people may benefit from MICS. Also other group of patients can benefit from a minimally invasive approach for AVR as young patients. In this group of patients the cosmetic benefit might be more important. Many of these patients may need another heart surgery in the future. A partial sternotomy could make redo surgeries less complicated due to less cardiac tissue adhesions.

Many surgical options have been described for AVR through a minimally invasive approach. Upper mini-sternotomy, transverse sternotomy, limited sternotomy with incision in J, sternotomy in L reverse and limited right thoracotomy^[12,17,18]. The most common approach is the partial superior sternotomy, as it provides annular exposure similar to the conventional approach. All types of AVR can be performed in a minimally invasive way. Also other types of surgery like the replacement of ascendant aorta aneurisms or even Bentall procedures^[19]. Although many studies suggest less postoperative morbidity and a faster recovery^[10,11,17] this remains controversial^[20].

A decisive factor of the technical difficulty and clinical results in the MICS procedures that require cardiopulmonary bypass (CPB) is the cannulation technique. Nowadays surgical cannulas have diminished its diameter size and are made of more flexible materials. Similar improvements in the transesophageal echography have allowed to confirm the placement of cannula and secure an adequate deaeration. Also the use of carbon dioxide in the surgical field has reduced the risk of air embolism^[17].

Performing surgery without the exposure afforded by a median sternotomy prompted the development of alternative methods of CPB access. The arterial access can be achieved via central aortic cannulation or peripheral cannulation via femoral or axillary arteries. Numerous disadvantages have been reported with peripheral arterial cannulation including a higher incidence of vascular complications and cerebrovascular accidents compare with central cannulation^[21]. Venous cannulation has similarly experienced numerous variations, with vacuum-assisted drainage directly via the right atrium or with bicaval access, achieving superior vena cava and inferior vena cava cannulation, either directly or percutaneously from the femoral or internal jugular veins^[22].

Along with the increase in complex surgeries in the present moment, different types of cardioplegia have been created and its use has been extended to minimally invasive surgeries. From one hand the del Nidocardioplegia solution (haematic 1: 4) designed originally for pediatric population that is now gaining popularity in the field of adult cardiac surgery specifically for those patients of advanced age and with depressed ventricular function^[23]. On the other hand, the solution available for organ preservation Custodiol, that is being used since recently as a cardioplegic solution in a single dose and offers a myocardial protection during the time lapse up to three hours without

interruption^[24], but still require large random studies to determine its efficacy for myocardial protection in cardiac surgery and for myocardial preservation in heart transplantation. Also, hemodilution of patient is described with Custodiolcardioplegia due to the great volume of fluid used with this type of solution.

Despite the highly encouraging results from minimally invasive valve surgery, the criteria are both surgeon and patient dependent and on a case-by-case basis. The surgeon must use the technique that in his opinion will provide best results and with that he will feel more comfortable. For example, MICS may be specially helpful in obese patients and high risk patients for wound infections. However, obesity can also be difficult to have a good view of the surgical field, needing full sternotomy in some cases^[2]. Patients requiring other cardiac concomitant procedures cannot be performed through a MICS^[25,26].

Minimally invasive cardiac surgery for AVR has significantly improved over past decades and it will be paradigm for the future of cardiac surgery, especially in terms of costs-benefits. Although the data are limited, require future confirmation with randomized prospective studies comparing MICS with conventional technique.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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