SCIENTIFIC LETTER

MINIMALLY INVASIVE VIDEO-ASSISTED CARDIAC SURGERY

ABSTRACT

Technological advances and expertise have allowed progress towards surgical treatment through mini-invasive techniques.

Video surgery has been tracing the progress of all surgical specialties, being introduced as part of the arsenal of cardiac surgery treatment. Despite the technique's benefits, it is not considered a gold standard due to technical complexity. A retrospective observational study was carried out of our experience (n = 89) in minimally invasive video-assisted cardiac surgery by right mini-thoracotomy, including various procedures, mostly mitral valve surgeries. Fifteen complications were reported, with no in-hospital mortality.

This approach has been successfully incorporated into our treatment armamentarium, and it is a safe and effective procedure.

Keywords: *cardiac surgery, video-assisted mini-invasive, mini-thoracotomy.*

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INTRODUCTION

Traditionally, cardiac surgery was performed through a complete median sternotomy, which provides generous surgical exposure of most of the heart's structures. This approach allows all cardiac procedures to be performed effectively and safely[1].

Since the advent of closed chest cardiopulmonary bypass techniques, reduction of incision size and tissue manipulation has become possible; this has allowed some procedures to be performed by partial sternotomy or thoracotomy[2].

Video-assisted surgery has gained ground in all surgical specialties and has shown, in some cases, results similar to those of conventional surgery, with a decrease in surgical trauma. Video-assisted cardiac surgery has advanced in specific procedures. However, it has not yet become the gold standard treatment, despite demonstrated advantages over the conventional approach, due to technical complexities that make it challenging to reproduce[3-5].

This article aims to perform a descriptive analysis of our experience in mini-invasive cardiac surgery using video-assisted right mini-thoracotomy.

METHODOLOGY

A descriptive and retrospective observational analysis was performed to present the initial experience of a video-assisted right mini-thoracotomy cardiac surgery program at the Instituto Cardiovascular de Rosario (ICR). All patients operated on through right mini-thoracotomy, with extracorporeal circulation, from the beginning of our program in 2019 until July 2024 were analyzed and included. The ICR cardiovascular surgery database was used. Patient selection was randomized; we began with surgeries of low complexity, excluding patients who would likely benefit more from the outcome than the method (i.e., those in whom valvuloplasty was expected to be superior to replacement). As we gained experience, we included all patients who could be treated with this technique.

All patients underwent right femoral arterial and venous cannulation through an oblique incision coincident with the inguinal crease. In cases where the right cavities were approached, a bicaval cannulation was performed (*Figure 1*). In most patients, a small 3- to 8-cm right thoracotomy was performed in the fourth intercostal space (on some occasions, in the third intercostal space), with three 1-cm working ports for the camera, Chitwood clamp, and cavity aspirator. Traction sutures were also placed (*Figure 2*). In all patients, a guide with a transesophageal echocardiogram was used for cannulation, surgical outcome assessment, and measurement of extracorporeal circulation output.

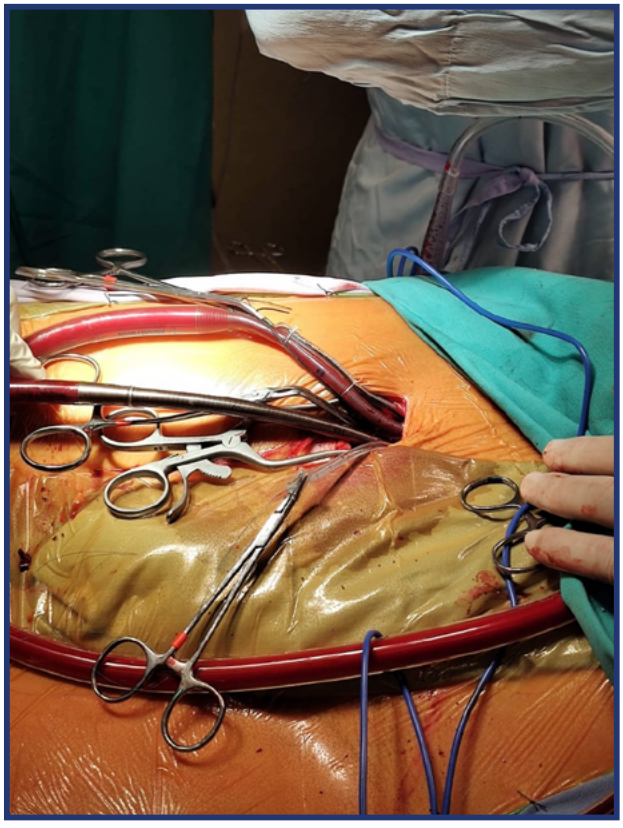

FIGURE 1. Femoral arteriovenous cannulation.

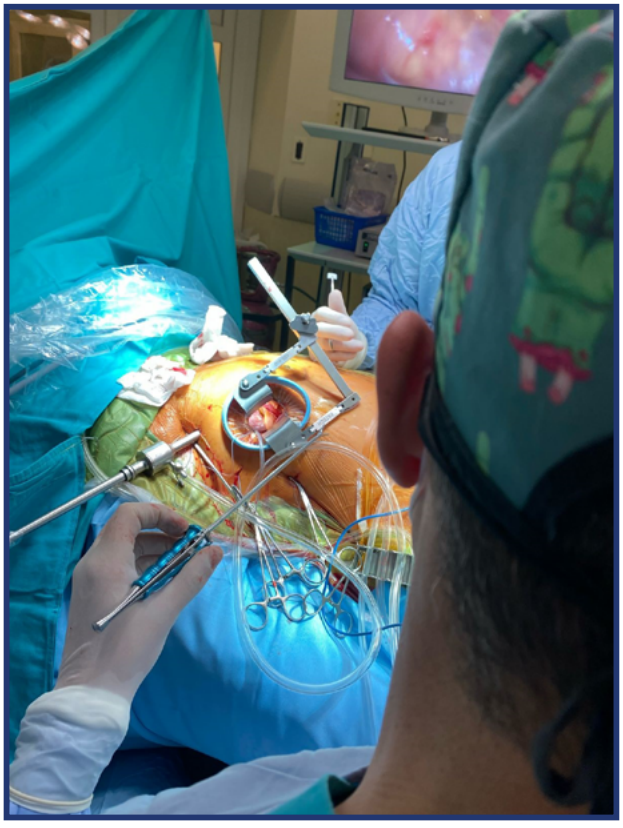

FIGURE 2. Photograph of the surgical field.

RESULTS

During this period, 89 video-assisted cardiac surgeries with extracorporeal circulation by right mini-thoracotomy were performed in our service: 54 in women and 35 in men, with an average age of 61 years (*Table 1*).

The procedures became increasingly complex, ranging from resection of benign tumors (atrial myxoma, fibroelastomas) and closure of atrial septal defects to valve replacement and valvuloplasty, culminating in combined surgeries and reoperations.

Of the total 89 cases, 75 involved mitral valve surgeries, 5 were atrial septal defect corrections, 4 were atrial myxoma resections, 3 were fibroelastoma resections, 1 was a pacemaker lead extraction, and 1 was an isolated tricuspid valvuloplasty (*Table 2*). Of the total number of ASDs, 4 were ostium secundum repairs and 1 was a venous sinus repair with anomalous pulmonary venous return associated with duplication of the superior vena cava, which was resolved by percutaneous double jugular cannulation guided by fluoroscopy. Of the fibroelastomas, 1 was located in the apex of the left ventricle and 2 in the tricuspid valve, which we were able to resect without the need to replace the valve (*Figure 3*). Of the total number of mitral surgeries, 29 replacements and 46 valvuloplasties were performed out of 58 attempts, excluding 7 cases of endocarditis, 5 reoperations, and 5 cases of mitral stenosis, resulting in a percentage of valvuloplasty attempts that were intended to be performed of 79.5%. In 16 cases, surgeries were combined with another procedure, including 8 tricuspid valvuloplasties, 1 atrial fibrillation ablation, 2 aortic valve replacements (via axillary mini-thoracotomy in the third intercostal space), 1 thymoma resection, and 4 left atrial appendage closures (*Figure 4*). On average, extracorporeal circulation (172 minutes) and clamp times (123 minutes) were prolonged but improved progressively over time.

No deaths were reported. Two surgeries were converted to complete sternotomy at the end of the procedure due to bleeding, one at the site of aortic cannulation for cardioplegia infusion and another due to injury to the anterior wall of the right ventricle in a purging maneuver. Seven patients presented with postoperative heart failure requiring assistance with inotropic drugs, and 1 of them required intra-aortic balloon counterpulsation, which resulted in prolonged hospitalization in cardiovascular recovery therapy and the general ward. Among the adverse events, 2 deep vein thromboses with minor pulmonary thromboembolism, 1 atrioventricular block requiring pacemaker implantation, 1 inguinal hematoma at the cannulation site, 1 chylothorax, and 4 right pleural effusions that resolved with pleurocentesis and 1 clotted hemothorax that required drainage by video thoracoscopy were also detected (*Table 3*). An early endocarditis requiring surgical treatment was also observed.

The average total hospital stay was 5.51 days, with an average stay in cardiovascular recovery of 2.4 days.

The aesthetic result was satisfactory in all cases, and we were able to make hidden periareolar incisions (*Figure 5*)[6].

Age (years, mean)	61 (29-83)
Sex	
Male	35
Female	54
Extracorporeal circulation time (minutes, mean)	172 (62-270)
Clamping time (minutes, mean)	123 (50-238)
Length of stay in cardiovascular recovery (days, mean)	2,4 (1-12)
Time of hospitalization	5,51 (2-22)

TABLE 1. Characteristics of the cases included in the study.

Minimally invasive surgeries	**N**
Mitral valve surgery	75
Atrial septal defect closure	5
Resection of myxomas	4
Resection of fibroelastosis	3
Removal of pacemaker leads	1
Isolated tricuspid valvuloplasty	1
Total	89

TABLE 2. Detail of types of surgeries performed.

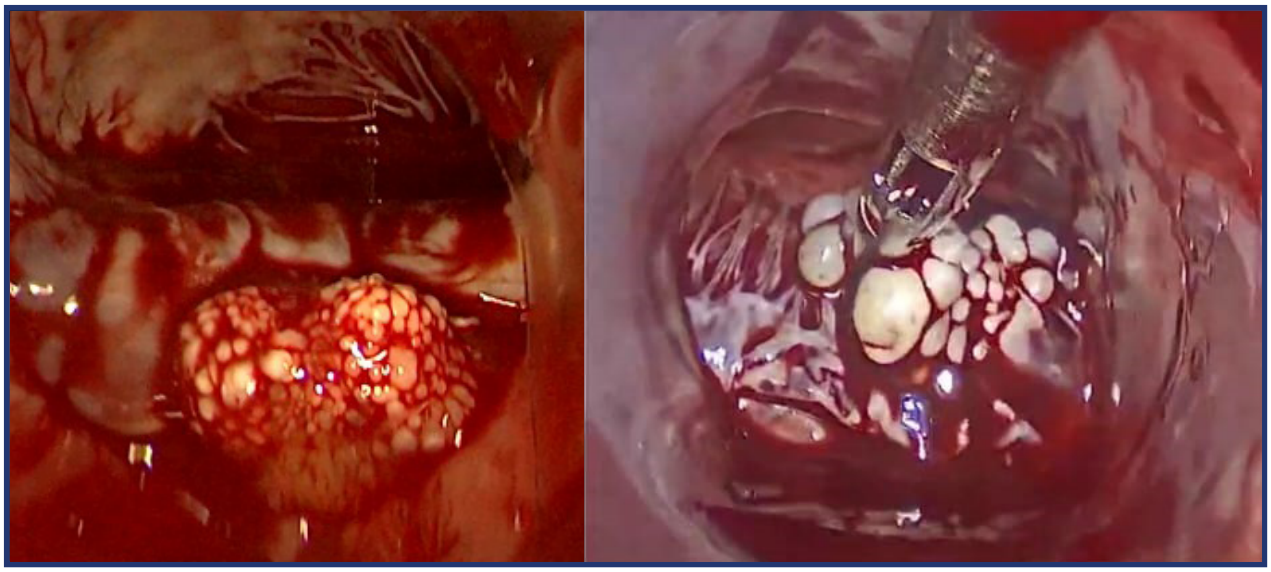

FIGURE 3. Tricuspid fibroelastomas.

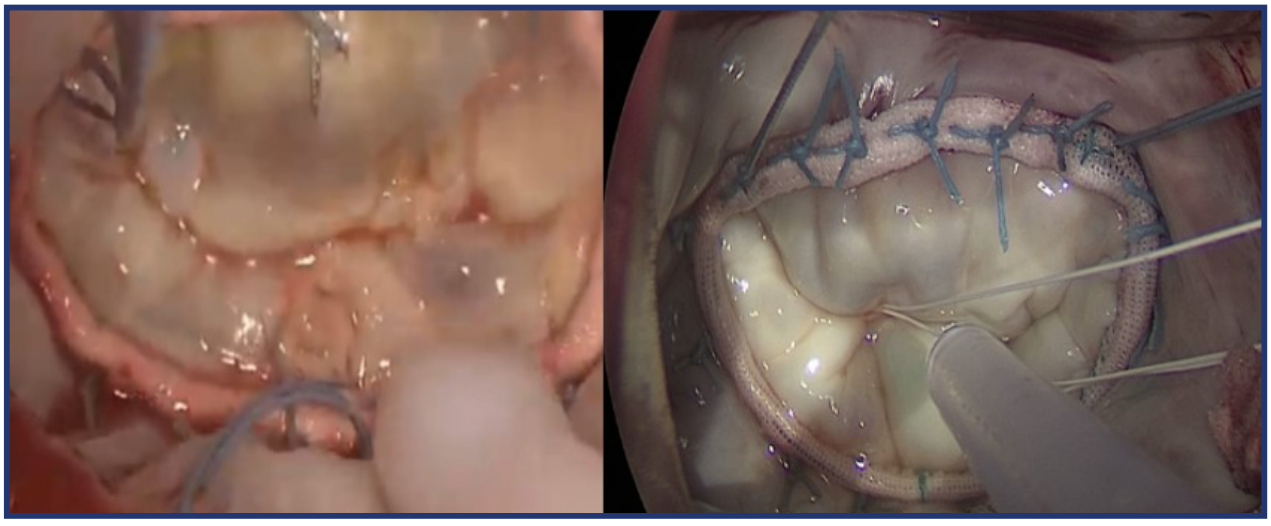

FIGURE 4. Results of mitral valvuloplasties using the quadrangular resection technique and neochord implantation.

Complications	N
Vasoplegic shock	8
Cardiogenic shock	7
Prolonged mechanical ventilation	7
Pleural effusion	4
Deep vein thrombosis	2
Diaphragmatic paresis	2
Pulmonary thromboembolism	1
Clotted hemothorax	1
Hematoma at the cannulation site	1
Early endocarditis	1
Atrioventricular block	1
Death	0

TABLE 3. Details of the complications that occurred.

FIGURE 5. Final aesthetic result in the submammary and periareolar incision.

CONCLUSIONS

The video-assisted right mini-thoracotomy approach has been successfully incorporated into our treatment options. For the past four years, this approach has been the preferred method for treating mitral and tricuspid valve disease, as well as the right and left atrial approaches.

Despite being a relatively young program, video-assisted mini-invasive cardiac surgery, which involves prolonged extracorporeal circulation and clamping times, has become a safe and effective procedure in our environment, offering numerous benefits for patients in terms of physical and aesthetic recovery.

Declarations

The authors declare no conflict of interest.

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