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Video-assisted cardiac surgery: results from a pioneer project in Brazil

Cirurgia cardíaca videoassistida: resultados de um projeto pioneiro no Brasil

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Abstract

Objective: **To demonstrate the possibilities of the use of videothoracoscopy in cardiac surgery using cardiopulmonary bypass (CPB).**

Methods: **Between February 2006 and November 2008, 102 patients underwent consecutively minimally invasive video-assisted cardiac surgery. The cardiac pathologies approached were: mitral valvopathy (n=56), aortic (n=14), interatrial communication (IC) (n=32), six patients presented associated tricuspid insufficiency and 12 presented atrial fibrillation. The age ranged from 18 to 68 years and 57 were female. The surgical approach was: femoral arterial and venous cannulation, minithoracotomy ranging from four to six centimeters (cm) at the level of the 3° or 4° right intercostal space (RICS), depending on the pathology of the patient, between anterior axillary line and hemiclavicular line, submammary or right periareolar groove through the right breast and thoracoscopy.**

Results: **The surgical procedures were: plasty (n=20) or mitral valve replacement (n=36), aortic valve replacement (n=14), atrioseptoplasty using pericardial patch (n=32), tricuspid valve repair with rigid ring (n=6) and surgical correction of atrial fibrillation with radiofrequency (n=12). There were no complications during the procedures. There was no conversion to thoracotomy in neither case. Two patients developed atrial fibrillation in the postoperative period. There was an episode of stroke seven days after the hospital discharge and one death (0,9%) due to systemic inflammatory response syndrome (SIRS).**

Conclusion: **This study demonstrates the coverage of pathologies that are possible to be approached by video-assisted cardiac surgery with cardiopulmonary bypass being a safe and effective procedure with low morbimortality. Minimally invasive video-assisted cardiac surgery is already a reality in Brazil, demonstrating excellent aesthetic and functional results.**

Descriptors: **Minimally invasive surgical procedures, methods. Video assisted thoracic surgery. Heart valves, surgery. Congenital Heart defects, surgery. Atrial fibrillation/therapy.**

Resumo

Objetivo: **Demonstrar as possibilidades da utilização da videotoracoscopia na cirurgia cardíaca com circulação extracorpórea (CEC).**

Métodos: **Entre fevereiro de 2006 e novembro de 2008, 102 pacientes foram submetidos consecutivamente a cirurgia cardíaca minimamente invasiva videoassistida. As doenças cardíacas abordadas foram valvopatia mitral (n=56), aórtica (n=14), comunicação interatrial (n=32), seis pacientes apresentavam insuficiência tricúspide associada e do grupo total, doze tinham fibrilação atrial. A idade variou de 18 a 68 anos, sendo 57 pacientes do sexo feminino. O método**

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cirúrgico constou de canulação arterial e venosa femoral, incisão de quatro a seis centímetros (cm) ao nível do 3° ou 4º espaço intercostal direito (EICD), dependendo da doença do paciente, entre as linhas axilar anterior e hemiclavicular direita, sulco mamário ou periareolar direita e toracoscopia.

Resultados: **Os procedimentos cirúrgicos compreenderam: plastia (n=20) ou troca valvar mitral (n=36); troca valvar aórtica (n=14); atriosseptoplastia com remendo de pericárdio bovino (n=32); plastia valvar tricúspide com anel rígido (n=6); e correção cirúrgica da fibrilação atrial por radiofrequência (n=12). Todas as cirurgias foram realizadas sem intercorrências. Não houve conversão para toracotomia. Dois pacientes evoluíram com fibrilação atrial no pós-operatório. Houve um (0,9%) episódio de acidente vascular cerebral, sete dias após a alta hospitalar, e um óbito (0,9%) decorrente de síndrome da resposta inflamatória sistêmica (SIRS).**

Conclusão: **Este trabalho demonstra a abrangência de afecções possíveis de serem abordadas pela videocirurgia cardíaca com CEC, sendo um procedimento seguro, eficaz e com baixa morbidade e mortalidade. A cirurgia cardíaca minimamente invasiva videoassistida já é uma realidade no Brasil, demonstrando excelentes resultados estéticos e funcionais.**

Descritores: **Procedimentos cirúrgicos minimamente invasivos/métodos. Cirurgia torácica vídeo-assistida. Valvas cardíacas/cirurgia. Cardiopatias congênitas/cirurgia. Fibrilação atrial/terapia.**

INTRODUCTION

With the constant evolution of heart surgery, new techniques and technologies have been applied in order to make the surgical procedures ever safer and less invasive. A new chapter is beginning to be written with the introduction of video-assisted minimally invasive heart surgery, making it possible the surgical approach of various surgical heart diseases through ever smaller incisions, reducing the aggression to the organism. This results in a minor surgical trauma, leading to better patient evolution without compromising the surgical outcome [1]. The aim of this study is to demonstrate the possibilities of using video-assisted heart surgery with CPB in our country.

METHODS

Between February 2006 and November 2008, 102 patients underwent video-assisted minimally invasive heart surgery consecutively. All patients undergone this technique were included in this study. This study was approved by the Ethics Committee of Hans Dieter Schmidt Hospital of Joinville. Patients were informed about the surgical possibilities as for the accomplishment of the procedure and they opted for minimally invasive surgery, and signed written informed consent.

In an initial phase (first 40 cases) elective patients without previous heart or thoracic surgery were included, with ejection fraction above 55% and weight over 50 kilograms (kg). Exclusion criteria were: dilatation of the ascending aorta, obese patients, patients with peripheral artery disease and chest deformities. In patients with mitral valve disease, we excluded those with moderate-to-severe aortic insufficiency. The complementary preoperative exams requested were: electrocardiogram, ches x-ray, transthoracic and transesophageal echocardiogram, ultrasound of the carotid arteries, abdominal, iliac and femoral arteries. In patients with suspicion of some obstruction of peripheral arteries, angiotomography of the thoracoabdominal aorta was requested. Special care was taken at the time of cardiac catheterization, avoiding puncturing the femoral vessels, giving preference to puncture of the radial artery and complete aortography was performed during the exam. After the first 40 cases, we included patients with an ejection fraction below 55%, emergencies, reoperations and obese patients.

The age ranged from 18 to 68 years, and 57 patients were female (55.8%). The mean ejection fraction was 52.16 ± 14.57%. Most patients (80.4%) were in functional class II or III according the New York Heart Association (Table 1).

Table 1. Preoperative clinical data

Data	Mean ± SD	n	%
Age	50.2 ± 11.6 years	102	100
Gender			
Male		45	44.2
Female		57	55.8
NYHA Functional class			
I		12	11.7
II		28	27.5
III		54	53
IV		8	7.8
Ejection fraction	52.1± 14.5 %		
Previous heart surgery		10	9.8
Euroscore	1.6 ± 0.5%		
AF		12	11.7

SD = Standard deviation; n = number; % = percentage; NYHA= New York Heart Association; AF = Atrial fibrillation

The heart diseases approached were: mitral (n=56) aortic valve (n=14), interatrial communication (IAC) (n=32) of which 28 patients presented ostium secundum type IAC and four sinus venosus type IAC with partial anomalous drainage of the pulmonary veins. As associated pathologies, six patients presented tricuspid regurgitation, whereas four were associated with mitral valve disease and two with IAC and twelve patients presented chronic atrial fibrillation (AF), whereas 10 in the mitral valve disease group and two in the IAC group. Ten patients had undergone previous heart surgery (Table 2).

Table 2. Operative findings

Data	n	%
Total	102	100
Mitral valve lesion	56	54.9
Double lesion	30	29.4
Stenosis	2	1.9
Insufficiency	24	23.5
Associated tricuspid insufficiency	4	3.9
AF	10	9.8
Etiology		
Rheumatic	22	21.5
Degenerative	18	17.6
Prosthesis dysfunction	6	5.8
Repair dysfunction	4	3.9
Native valve endocarditis	2	1.9
Secondary to myocardiopathy	4	3.9
Aortic valve lesion	14	13.7
Double lesion	8	7.8
Stenosis	2	1.9
Insufficiency	4	3.9
Etiology		
Rheumatic	8	7.8
Bicuspid	4	3.9
Degenerative	2	1.9
IAC	32	31.3
Ostium secundum	28	27.4
Sinus venosus	4	3.9
Associated tricuspid insufficiency	2	1.9
AF	2	1.9

n= number; %= percentage; AF= atrial fibrillation; IAC= interatrial communication

The surgical approach depended on the pathology approached. In the case of mitral valve disease, video-assisted right anterolateral minithoracotomy was performed [2] (Figure 1) at an early stage and later the periareolar technique was adopted [3] (Figure 2). Patients were intubated using Carlens orotracheal tube for selective ventilation, and positioned with the right side of the chest

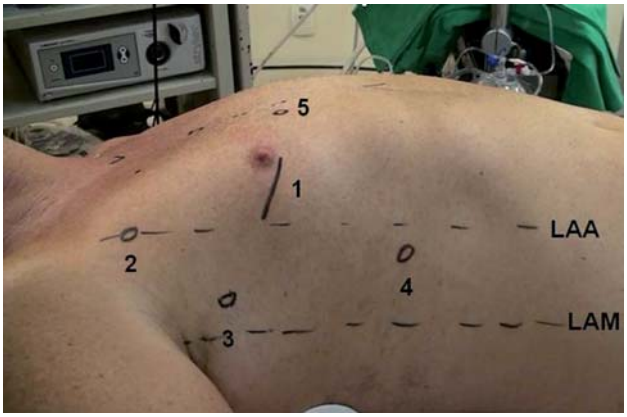

Fig. 1 - Minithoracotomy at the 4th RICS (1). Marks for auxiliary routes: 2. Route for aortic clamp, 3. Route for optics, 4. Route for the left atrial suction device and 5. Route for the left atrial retractor. MAL: midaxillary line, AAL: anterior axillary line

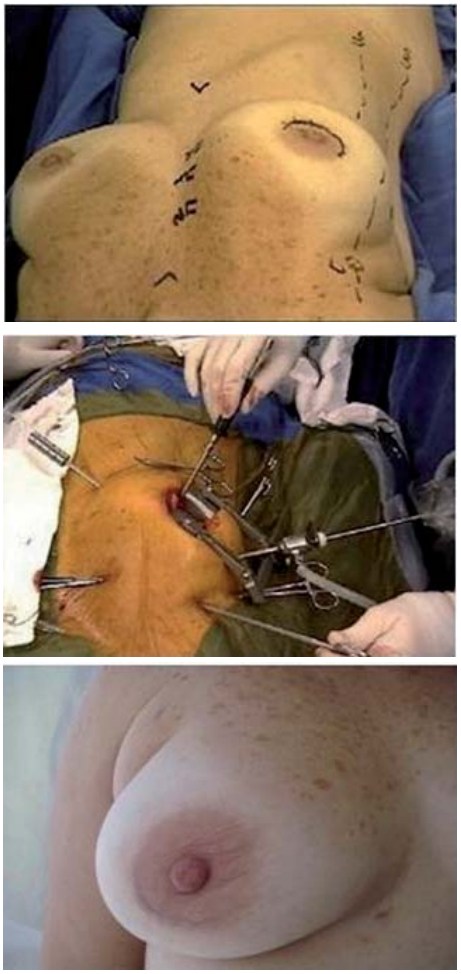

Fig. 2 - Video-assisted periareolar approach: operative and healing field appearance

elevated at 20°; the arm was positioned along the body. Disposable pads for external cardiac defibrillation were placed in the region of the right scapula and the anteriolateral left hemithorax. Incision was performed approximately four centimeters (cm), at level of the 4th right intercostal space (RICS), between the anterior axillary (AAL) and right midclavicular lines (RMCL). In the case of peri-areolar technique, the incision was performed around the nipple, approximately 50% of the inferior areolar circumference. For removal of the rib a retractor was used specifically for minimally invasive surgery (Estech, Inc.).

The right lung was selectivated. In the same intercostal space, in midaxillary line, 10-mm or 5 mm and 30º optical trocar was introduced, with entry for CO_2 insufflator. The surgical instrument used was specific for this type of procedure, consisting of clamps, needle holder and long scissors - with approximately 35 cm - for thoracoscopy. Under optical vision, the pericardium was opened two centimeters anterior to the phrenic nerve. This incision extended from the inferior vena cava to superior one. The pericardium was pulled by four points, which were exteriorized through the chest wall using a retractor/hook.

After full heparinization of the patient, the cardiopulmonary bypass (CPB) was established via femoral cannulation, whereas the skin was incised in the inguinal groove preferably at right and the femoral vessels were cannulated using the Seldinger technique. For arterial cannulation was used Bio-Medicus® cannula No. 17 or 19 French (Fr) (Medtronic, Inc.) and for femoral venous line No. 19 or 21 Fr (Estech, Inc.). The venous drainage was assisted by vacuum. The patient was maintained at 28°C. For perfect positioning of the cannulas we used transesophageal echocardiogram.

Through the 2nd RICS, in the AAL, transthoracic aortic clamp (Chitwood clamp - Estech, Inc.) was introduced. Using videothoracoscopy, the ascending aorta was clamped and punctured with antegrade cardioplegia DLP® cannula (Medtronic, Inc.). In the initial phase of this study, this cannula was maintained in its place by a purse string suture of 2-0 braided polyester with Teflon, passed using a tourniquet. Cardioplegia line was exteriorized through the incision. This same line was used for subsequent aspiration of the aortic root. We used hypothermic low volume blood cardioplegia (4°C), repeated every 20 minutes. Subsequently, in order to simplify the method, we started to use HTK Solution (Custodiol ®) [4] instead of cardioplegia solution, administered in an anterograde manner, and puncture of the ascending aorta was performed with a metal needle of 30 cm (Geister, Inc.). This cardioplegia allows a ischemia time up to 180 minutes without the need for its readministration if the aortic clamping time is less than this period.

In the case of mitral valve reoperation, the aortic occlusion was achieved through the use of Endoclamp (Estech Inc.) introduced via the femoral artery. It enables the maintenance of arterial flow, administration of anterograde cardioplegia and aspiration of the aortic root to remove air from the ascending aorta [5].

The opening of the left atrium was prior to the right pulmonary veins and atrial withdrawal was performed by a specific transthoracic retractor (Estech, Inc.) passed through the 4th RICS, laterally to the region of the left internal mammary artery. With the introduction of optics in the left atrium, the mitral valve was inspected. To assist in aspirating blood from the pulmonary veins, 7-mm trocar was introduced in the 7th RICS in the AAL, through which a left atrial malleable suction device (DLP ®, Medtronic, Inc.) was passed. Then, the valve procedure was performed and then pulmonary valve ablation in cases where there was AF, using radiofrequency [6] (Cardioblator, Medtronic, Inc.).

The aortic clamping, the left atriotomy, the valve procedure and surgical ablation of AF were exclusively performed using the visualization through the video monitor. Since the opening of the left atrium, CO_2 was injected through the optical trocar, at a flow rate of 3 liters per minute, in order to decrease the possibility of air embolism. The left atrium was sutured using 3-0 polypropylene yarn, through which a left ventricular suction catheter was left and passed through valve or prosthesis to remove residual air.

Deaeration removal maneuvers of the left chambers were performed mobilizing the operating table in a Tremdlemburg and anti-Tremdlemburg position and alternating left-right side. Aspiration was performed through the aortic root and left ventricle. After inspection of the left cavities by transesophageal echocardiography, if there is no residual air, the aortic clamping was then released and the patient rewarmed.

After disconnection of CPB, femoral vessels were decannulated and heparin was reversed. The hemithorax was closed conventionally. The right hemithorax was drained through the trocar incision for introduction of optical in the cases of correction of IAC through the incision of the trocar for suction of the left atrium in other cases.

In the case where the right atrium was opened (correction of IAC and AF or tricuspid annuloplasty), two techniques for venous drainage were used: a single venous and bicaval cannulation. In the case of single venous cannulation, we used double stage femoral cannula (Estech Inc.). After ligation of the vena cavae, the right atrium was opened parallel to the interatrial septum and the cannula that passed through the right atrium was hitten behind the right atrial retractor. In cases of obese patients or those suffering IAC with anomalous venous drainage, it was decided to

cannulate the femoral vein and the right internal jugular vein (bicaval) at the same time.

We used the Seldinger puncture techinque and introduced a venous cannula No. 16 Fr (Edwards Lifesciences). In these cases we applied bulldog forceps in the vena cavae before the right atrial opening in order to prevent air entering into the circuit. In patients with AF associated with the IAC, radiofrequency ablation of the right atrium was performed. The surgical approach used was the same approach of the mitral valve disease, excluding only the trocar for placing of the left atrial suction, and the deaeration was performed only through the aortic root with transesophageal echocardiography control [7-9].

The aortic valve disease was approached through an incision of about 6 cm, at the level of the 3rd RICS, between the right side border of the sternum and right midclavicular line [10,11]. The aortic clamping, the introduction of thoracoscopy and the establishment of CPB were performed in the same manner of the approach of the mitral valve. After opening the pericardium sac, to facilitate exposure of the aorta, stitches of 2.0 poly-filament yarn are passed into the pericardium - at the anterior region of the pulmonary artery - and traction was applied on them through the incision. The aortotomy was performed transversely near the sino-tubular junction. For better exposure of the valve, 2.0 braided polyester stitches were passed into the commissural region and traction was applied on them. Cardioplegia was administered directly into the coronary ostia using the HTK solution. The deaeration of left chambers was performed leaving a suction catheter in the aortic root and control with transesophageal echocardiography was also performed.

RESULTS

The mitral valve surgical procedures included: mitral valve in 20 cases, being performed quadrangular resection of posterior leaflet and annuloplasty using semirigid ring Carpentier-Edwards Physio Annuloplasty Ring® (Edwards Lifesciences) in 10 cases, annuloplasty using Geoform® ring (Edwards Lifesciences) in four patients, implant of PTFE neocord (Gore-Tex) for anterior leaflet and implant of semirigid ring Carpentier-Edwards Physio Annuloplasty Ring ® (Edwards Lifesciences) in six cases. Thirty-six patients underwent mitral valve replacement, and 30 bileaflet metallic prostheses were implanted and six bovine pericardium bioprosthesis. In mitral valve patients, 10 presented AF and underwent ablation of pulmonary veins by radiofrequency and four underwent tricuspid annuloplasty using rigid ring Edwards MC³ (Edwards Lifesciences).

The aortic procedures consisted of aortic valve replacement in 14 patients. Bileaflet metallic prosthesis was implanted in 10 cases and in others, bovine pericardium bioprostheis was implanted.

In 32 patients with IAC, atrial septal defect repair using bovine pericardial patch was performed. Of this group of patients, two underwent radiofrequency ablation of the right atrium and pulmonary veins because they presented AF, and two underwent tricuspid annuloplasty using rigid ring MC³ Edwards (Edwards Lifesciences). (Table 3).

Table 3. Surgical procedures

Data	n
Mitral valve disease	56
Valve repair	20
Quadrangular resection of posterior leaflet and annuloplasty	10
Annuloplasty using Geoform® ring	4
Goretex® neocord for anterior leaflet	6
Valve replacement	36
Mechanical prosthesis	30
Biological prosthesis	6
Ablation of pulmonary veins	10
Associated tricuspid insufficiency	4
Aortic valve disease	14
Valve disease	14
Mechanical prosthesis	10
Biological prosthesis	4
IAC	32
Atrioseptoplasty using bovine pericardium patch	32
Right atrial ablation and isolation of pulmonary veins	2
Associated tricuspid annuloplasty	2

n = number; IAC= interatrial communication

All surgery was uneventful. There was no conversion to thoracotomy in either case. The mean CPB and aortic clamping time for valve patients were respectively: 123.8 ± 46.2 min (85 to 210 min) and 102.41 ± 42.71 min (60 to 190 min). For patients who had undergone surgery for correction of IAC, the mean time of CPB and aortic clamping were respectively 53.1 ± 10.68 min (38 a70 min) and 39.9 ± 7.82 min (30 to 55 min). The mean volume of bleeding in the postoperative period was 201.6 ± 101.9 ml (50-450 ml). The mean time of mechanical ventilation was 8.6 ± 3.5 hours (0-13, 1h). The mean length of stay in ICU: 29.9 ± 7.8 hours (16-42 h) and the mean hospital stay was 6.5 ± 1.9 days (4-12 d).

Two patients developed atrial fibrillation, which was treated chemically and electrically. One of these patients remained with rhythm in AF, who presented with mitral stenosis and chronic AF. Four patients (3.9%) presented right pleural effusion requiring a new chest drainage and other six (5.8%) developed subcutaneous emphysema

limited to the upper right hemithorax. In respect to postoperative pain, 9 patients (8.8%) reported severe pain at the site of trocar used for thoracoscopy or at the site of chest tube drainage. There were no cases of reoperation for bleeding, renal failure, neurological or cognitive changes during the period of hospital stay.

All patients underwent Doppler echocardiography at discharge. In heart valve disease patients, all valves implanted (metallic and organic) were functioning normally and without paravalvular leak. In the case of mitral valve repair (n=20), valvular insufficiency was classified as absent or trivial in 18 cases and mild in two. In the patients undergone surgical correction of IAC, residual shunt was not found. There were no complications related to the healing of surgical approach or peripheral cannulation. There was an episode of stroke seven days after discharge and one death (0.9%) due to systemic inflammatory response syndrome (SIRS).

DISCUSSION

In the mid-1990s, several reports about less invasive heart surgery techniques [12-14] appear in the medical literature. The objectives are better patient recovery with less pain and postoperative complications, resulting in less hospital stay and cost reduction [15-16]. Another point is the aesthetic appearance and patient satisfaction due to reduced surgical trauma (scar) (Figure 3) [17,18]. With the advent of videothoracoscopy, there was the possibility of ever smaller incisions or absence of them [19]. There are several factors that make this technique still unusual in our country [2].

Fig. 3 - Scar of the video-assisted route for mitral valve replacement in the postoperative period

There is a need for adaptation of the surgeon and the surgical environment, as there is a change in the way we are used to working with the heart. Access to the heart chambers is restricted by the limited length of the incision, which is compensated by the use of videothoracoscopy. The handling of long instruments and indirect visualization of the operative field are some of the difficulties inherent to the method, that with increasing experience and mastery of technique, are obstacle to its implementation. Another important point is myocardial protection. Initially, we used intermittent anterograde blood cardioplegia, which added more difficulty to the method, due to the periodic interrupt for administration of cardioplegia. Recently, we adopted the use of HTK solution (Custodiol®) administered in a cold (6º Celsius) and anterograde manner, widely used for myocardial protection in heart transplantation, allowing more time to ischemia, without the need to repeat administration if the aortic clamping time is less than 180 minutes, prividing greater security to the procedure [4].

The contraindications for this method are: patients with severe deformities of the chest (pectus excavatum), peripheral artery disease, ascending aortic aneurysm and aortic valve insufficiency above ++/IV in mitral valve disease patients. In the early of our series (first 40 cases), we excluded patients with poor ventricular function, obesity, cardiac reoperations, and endocarditis. With the domain of the technique, we realized that perhaps these are the main indications of this method (high-risk patients), because there is less manipulation of the thoracic cavity, leading to less aggression to the organism. Examples of this fact are the mitral valve reoperation on which Endoclamp (Estech, inc.) [5] was used. It was only dissected an enough portion in order to achieve access to the left atrium, with no need to detach the adhesions on the aorta or myocardial surface. For this, one should require a skilled echocardiographer, because the effectiveness and safety of this device are directly related to its perfect location.

The CPB and aortic clamping time in the initial phase were longer, but decreased significantly with the familiarity with the technique. Several studies on video-assisted minimally invasive heart surgery have shown that, in spite of CPB and clamping time are longer when compared with the conventional technique via median thoracotomy, it is a safe procedure and is associated with a lower morbidity: less postoperative pain, less bleeding, time of extubation, ICU stay, and shorter hospital stay and return to activities more quickly [20-21].

In the surgical treatment of IAC and tricuspid annuloplasty, the most important point is exact route to the 4th RICS, because if the route is below, the diaphragmatic dome can affect the handling of instruments and visualization of cardiac structures, whereas the aorta is more distant, making it difficult to administer cardioplegia. In

order to ease the exposition and move the diaphragm of the operative field, it is possible to pass a 2.0 polifilamentar suture yarn in the fibrous annulus of the diaphragm and externalize it through the skin at the 7th RICS in the midaxillary line (MAL) and traction it. This makes the diaphragm to move down. Special care must be taken in order to not to deepen the point of the diaphragm, because it takes risk of hit the liver. In associated cases of partial venous drainage of the right pulmonary veins, videothoracoscopy facilitates the visualization and correction of these structures.

In four patients with poor ventricular function (<35% EF) and secondary mitral insufficiency, we used the annuloplasty ring Geoform® (Edwards Lifesciences), showing to be a method that leads to a rapid postoperative recovery. In obese patients we noted that the restriction on the bed is short, which enables a more rapid rehabilitation and avoid possible pulmonary and thromboembolic complications. In respect to endocarditis, two patients underwent emergency surgery because they presented acute mitral insufficiency due to mitral valve infection and presented uneventful favorable postoperative, showing to have feasible use in cases where there is only one valve compromised. In those cases, where there is acute rupture of the chordae or leaflet and the left atrium is of normal size, videothoracoscopic approach favored the exposure and handling of this valve, allowing even more complex reconstructions (Figure 4).

In a later stage, we created an unprecedented route to video-assisted minimally invasive heart surgery, combining the effectiveness of this method to a route on which manipulation of cardiac structures may be facilitated: the periareolar approach [3]. Usually, the nipple is just above the 4th RICS and it is not necessary a large incision to reach this region. This approach has been used for decades in plastic surgery, showing low rates of complications and excellent aesthetic outcome [22]. Currently, it is our approach of choice, especially for female patients, patients who present mitral valve disease, interatrial communication and AF correction, whereas we already used in 46 cases with no complications related to the incision site (Figure 2).

In aortic valve replacement, the visualization of the ascending aorta is performed more laterally, with no need of traction of the pericardium for better exposure. We believe it is extremely difficult to replace the ascending aorta and re-implantation of the coronary ostia, if it is perhaps necessary. We used in those cases where the section of the sternum should be avoided, such as: sternal bone subjected to radiotherapy or in patients who need support of crutches to walk.

Two patients developed AF in the postoperative period, who were treated with amiodarone and electrical cardioversion, and one of these was discharged in AF and was diagnosed with mitral stenosis and chronic atrial fibrillation and was maintained under oral anticoagulation. As a routine, these patients were treated and maintained in the intensive care unit (ICU) until stabilization, and this was the reason we had a patient in ICU for 42h.

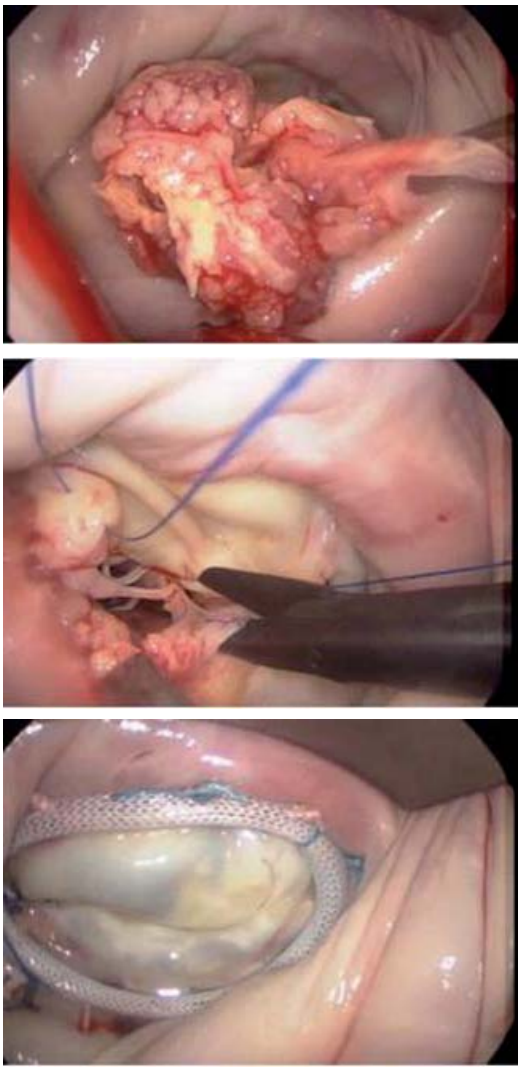

Fig. 4 - Mitral valve endocarditis: final outcome of valve repair

Four patients (3.9%) presented right pleural effusion requiring a new chest drainage, most likely due to this position and type of drain used. This was implanted into the orifice done by the optical trocar, usually in the 4th RICS. Due the fact that it is implanted in a higher position, there was the formation of the effusion. To solve this problem it was decided to place a No. 19 Blake® drain (Ethicon, Inc.) under negative suction of 15 centimeters of water (cm H_2O) toward the diaphragmatic surface and into the pericardial sac. This drain is made of silicone extremely

flexible, long and with longitudinal grooves that when associated with negative pressure presents great drainage capacity.

Other six patients (5.8%) developed subcutaneous emphysema limited to the upper right hemithorax, which was treated after application of negative suction of 15 cm of H_2O in the chest drain. In respect to postoperative pain, 9 patients (8.8%) reported severe pain at the site of trocar used for thoracoscopy. These events occurred at an early stage, where we used trocars and drains were of greater caliber. Because of this problem, we made three changes: decrease of the optical trocar of 5 to 10 mm, change of the type of chest drain by a thinner and more flexible one (Blake® drain) and establishment of a patient-controlled analgesia (PCA) in endovenous infusion pump of Fentanil® at a dose of 30 micrograms per hour (µg/h), allowing, in the case of pain, the patient himself can administer a bolus of 15 µg at intervals of 10 minutes limited to the total dose of 60 µg/h. Regarding the patient-controlled analgesia in the treatment of acute postoperative pain, technological developments allowed this concept, on which the patient – in the case of feeling pain – can self-apply analgesic medication, intravenously, using a programmable pump that releases a certain amount of substance through a button.

There were no cases of reoperation for bleeding, renal failure, neurological or cognitive changes during the period of hospital stay. All patients underwent Doppler echocardiography at discharge. In heart valve disease patients, all valves implanted (metallic and organic) were functioned normally and without paravalvular leak. In the case of mitral valve repair (n=20), the valve failure was classified as absent or trivial in 18 cases and mild in two. The key point to the success of repairs was the participation of echocardiographer in pre- and transoperative period, who accomplished the valve analysis in order to identify the mechanism of failure, whereas prior to visualize the valve, it was possible to identify the kind of repair to be performed. Since the begining of this project we adopted the use of transoperative transesophageal echocardiography in a mandatory and routine manner, aiming to offer safety and effectiveness to the method.

One patient developed stroke seven days after discharge, who had been undergone repair of IAC with partial anomalous pulmonary veins drainage and surgical treatment of atrial fibrillation by radiofrequency. At readmission, the patient presented with dyslalia, which evolved into normalization. The rate was in sinus rhythm and transesophageal echocardiography did not reveal the presence of thrombi. All patients who had implantation of mechanical prostheses or correction of AF underwent a regime of oral anticoagulation. The only death (0.9%) in this series was of a patient who underwent mitral valve replacement due to SIRS, although with short times of CPB and aortic clamping (85 and 60 min respectively). In the literature we found mortality rates in video-assisted minimally invasive mitral valve surgery ranging from 1% to 3.9% [23].

In this series there were various diseases treated using this surgical technique and, despite the disparity of this group, we obtained homogeneous postoperative results. This is probably due to less surgical damage to the body. In respect to the surgical procedures, despite the restricted route, it may be accomplished both replacement as valve repair. The quality of the procedure should always come before aesthetic issues and the outcome should not be compromised [24]. According to Mack [25] there are several factors for the adoption of new technologies: the method should be effective, versatile, highly reproducible, safe, durable and have cost-benefits relationship. After we operated these 102 patients we can say that there is a learning curve, which is overcome with the domain of technology and commitment of the whole team. This was reflected in CPB and aortic clamping time, which decreased significantly since the forty case.

We believe that for an wide adoption of this technique there is need for adequate training and focused on videosurgery as well as the adequacy of the surgical environment with the incorporation of equipment enabling the fulfillment of video-assisted heart surgery.

CONCLUSIONS

This study demonstrates the range of possible diseases to be approached by video-assisted cardiac surgery with CPB, as a safe and effective procedure with low morbidity. Minimally invasive video-assisted cardiac surgery is already a reality in Brazil, demonstrating excellent aesthetic and functional results.

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