Rev Bras Cir Cardiovasc 2012;27(2):290-5

Initial experience with Pomerantzeff´s technique for reduction of the size of giant left atrium

Experiência inicial com a técnica de Pomerantzeff para redução do tamanho do átrio esquerdo gigante

Jocerlano Santos de Sousa[1], Pablo Maria Alberto Pomerantzeff[2], Carlos Manuel de Almeida Brandão[3], Lisandro Azeredo Gonçalves[4], Marcos Gradim Tiveron[5], Marcelo Luiz Campos Vieira[6], Flavio Tarasoutchi[7], Noedir Antônio Groppo Stolf[8]

DOI: 10.5935/1678-9741.20120046

RBCCV 44205-1383

Abstract

Introduction: **The most common indication for surgical correction of giant left atrium is associated with mitral valve insufficiency with or without atrial fibrillation. Several techniques for this purpose are already described with varying results.**

Objective: **To present the initial experience with the tangential triangular resection technique (Pomerantzeff).**

Methods: **From 2002 to 2010, four patients underwent mitral valve operation with reduction of left atrial volume by the technique of triangular resection tangential in our service. Three patients were female. The age ranged from 21 to 51 years old. The four patients presented with atrial fibrillation. Ejection fraction of left ventricle preoperatively ranged from 38% to 62%. The left atrial diameter ranged from 78mm to 140mm. After treatment of mitral dysfunction, the left atrium was reduced by resecting triangular tangential posterior wall between the pulmonary veins to avoid distortion of the mitral valve or pulmonary veins anatomies, reducing tension in the suture line.**

Results: **Average hospital stay was 21.5 ± 6.5 days. The mean cardiopulmonary bypass time was 130 ± 30 minutes. There was no surgical bleeding or mortality in the postoperative period. All patients had sinus rhythm restored in the output of cardiopulmonary bypass, maintaining this rate postoperatively. The average diameter of the left atrium was reduced by 50.5% ± 19.5%. The left ventricular ejection fraction improved in all patients.**

Conclusion: **Initial results with this technique have shown effective reduction of the left atrium.**

Descriptors: **Mitral valve/surgery. Atrial fibrillation. Heart valve diseases.**

1. Residency in general surgery, cardiovascular surgery resident at the Heart Institute, Hospital das Clínicas, School of Medicine, University of São Paulo (HC-InCor-USP), São Paulo, Brazil.
2. Associate Professor of Cardiovascular Surgery, School of Medicine, University of São Paulo (USP), Director of the Surgical Unit of InCor-Heart Valve Diseases HCFMUSP, Sao Paulo, Brazil.
3. Doctor of Medicine FMUSP; Physician Assistant at the Surgical Unit of InCor-Heart Valve Diseases HCFMUSP, Sao Paulo, Brazil.
4. Medical doctor and preceptor of the residency program in cardiovascular surgery FMUSP, São Paulo, Brazil.
5. Cardiovascular Surgeon, Sao Paulo, Brazil.
6. Postdoctoral degree at Tufts University NEMC in Boston, Massachusetts, United States; Physician Assistant in the Department of Echocardiography, InCor-HCFMUSP, Sao Paulo, Brazil.
7. PhD, Medical Assistant of the Clinical Division of InCor-HCFMUSP, Sao Paulo, Brazil.
8. Full Professor of Cardiovascular Surgery, FMUSP, Director of Surgery Division of InCor-HCFMUSP, São Paulo, SP, Brazil.

Study conducted at the Heart Institute, Hospital das Clínicas, School of Medicine, University of São Paulo (HC-InCor-USP), São Paulo, Brazil.

Correspondence address: Jocerlano de Sousa Santos.
1645/23 Alameda Franca Street, Jardim Paulista - Sao Paulo, Brazil
Zipcode: 01422-001
E-mail: jocerlanosousa@hotmail.com

Article received on October 25th, 2011
Article accepted on January 15th, 2012

Abbreviations, Acronyms & Symbols	
LA	Left atrium
GLA	Giant left atrium
EC	Extracorporeal Circulation
Imp. Dis of ABP	Important disfunction of aortic biological prosthesis
AF	Atrial fibrillation
LVEF	Left ventricle ejection fraction
Fail	Failure
LA Resection	Triangular tangential resection of the left atrium
AvR	Aortic valve replacement
MvR	Mitral valve replacement
MbPf	Mitral biological prosthesis fracture

Resumo

Introdução: **A mais comum indicação de correção cirúrgica de átrio esquerdo gigante está associada à insuficiência da valva mitral, com ou sem fibrilação atrial. Diversas técnicas para este fim já estão descritas com resultados variáveis.**

Objetivo: **Apresentar a experiência inicial com a técnica da ressecção triangular tangencial (Pomerantzeff).**

Métodos: **De 2002 a 2010, quatro pacientes foram submetidos a operação da valva mitral com redução do volume do átrio esquerdo pela técnica da ressecção triangular tangencial em nosso serviço. Três pacientes eram do sexo feminino. A idade variou de 21 a 51 anos. Os quatro pacientes encontravam-se com fibrilação atrial. A fração de ejeção do ventrículo esquerdo no pré-operatório variava de 38% a 62%. O diâmetro do átrio esquerdo variou de 78 a 140 mm. Após o tratamento da disfunção mitral, o átrio esquerdo foi reduzido por meio de ressecção triangular tangencial da sua parede posterior, entre as veias pulmonares, para evitar distorções anatômicas do anel mitral ou veias pulmonares, reduzindo a tensão na linha de sutura.**

Resultados: **Tempo médio de internação hospitalar foi de 21,5 ± 6,5 dias. O tempo de circulação extracorpórea médio foi de 130 ± 30 minutos. Não houve sangramento cirúrgico ou mortalidade no período pós-operatório. Todos os pacientes tiveram o ritmo sinusal restabelecido na saída de circulação extracorpórea, mantendo esse ritmo no pós-operatório. O diâmetro médio do átrio esquerdo foi reduzido em 50,5 ± 19,5%. A fração de ejeção do ventrículo esquerdo melhorou em todas as pacientes.**

Conclusão: **Os resultados iniciais com essa técnica têm demonstrado redução efetiva do átrio esquerdo.**

Descritores: **Valva mitral/cirurgia. Fibrilação atrial. Doenças das valvas cardíacas.**

INTRODUCTION

Giant left atrium (AEG) is defined by most authors by the diameter of the cavity above 6.5 cm, although there is not a consensus, since some authors consider it its size ranging from 6-10 cm [1]. For Kawazoe et al. [2], the definition of this pathology is dependent on two echocardiographic findings: 1) left atrial (LA) greater than 65 mm and 2) signal compression of the posterobasal left ventricular cavity between the increased left atrial and left ventricular cavity.

The increase in atrial volume associated with the consequent possibility of compression of the bronchi, lungs or the left ventricle leads to a significant cardiopulmonary dysfunction, increasing the risk of a sudden death, justifying the need for better assessment and surgical intervention [1].

According to the literature, the most common indication for surgery in cases of GLA is one associated with mitral valve insufficiency, with or without atrial fibrillation (AF). Several techniques for this purpose already described, as the LF plication, varying according to the technique of the approched atrial wall, the autotransplantation of the spiral partial heart resection and the association with the Maze procedure to any technique in order to treat AF.

We present our initial experience with a tangential triangular resection described by Pomerantzeff et al.

METHODS

Between 2002 and 2010, four patients underwent mitral valve surgery in combination with reduction of LA volume by the technique of tangential triangular resection at the Heart Institute, Hospital das Clinicas, School of Medicine, University of Sao Paulo. Three patients were female and one of them male. Ages ranged from 21 to 51, with an average of 37.25 years. In a patient, the congenital etiology was severe with mitral and tricuspid valve insufficiency and with GLA. In the other three, the etiology of mitral valve disease was rheumatic, in which one case was reoperation for mitral biological prosthesis replacement, and another case for second reoperation for intra-aortic and mitral prostheses replacement.

In one patient, there was mitral valve repair (posterior annuloplasty), and the other three, the mitral valve was replaced by biological prosthesis. The four patients were in AF rhythm, with oral anticoagulant therapy. Ejection fraction of left ventricle in the preoperative period ranged from 38 to 62%. The LA diameter ranged from 78 to 140 mm, measured by transthoracic echocardiography (Table 1). In all patients, the access to the LA is given by the conventional approach; however, an abnormal atrial growth has made access it more difficult in a patient, since the LA would be all over the cavity, displacing all other structures.

Table 1. Surgical data.

Case	1	2	3	4
Sex	F	F	F	M
Age (years)	21	51	36	41
Diagnosis	Tricuspid insuff; Mitral insuff; GLA	Mitral insuff; AEG; Insuf. trisúspide	Insuf. mitral; GLA	Rup. MiBio; GLA; Sig. Dys. Aobiop
Etiology	Congenital	Rheumatic	Rheumatic	Rheumatic
Surgery	Mitral valve repair; plástica de valva tricuspid valve plast; LA tang	Mitral valve replacement; De Vega tricuspid valve repair; LA tang	Mitral valve replacement; De Vega tricuspid valve repair; LA triang	3rd AoV Rep (Biop Nº23) + MiV Rep (Bioprosthesis Nº27); LA triang
Length of hospital stay	15 days	28 days	15 days	20 days
N° Surgery	1st	1st	2nd	3rd
Preoperative rhythm	AF	AF	AF	AF
Postoperative rhythm	Sinus	Sinus	Sinus	Sinus
Preoperative LVEF	40%	62%	45%	38%
Postoperative LVEF	61% (2009)	66%	60%	46%
LA preoperative diameter	140 mm	134 mm	78 mm	85 mm
LA postoperative diameter	60 mm	40 mm	55 mm	60 mm
LA reduction rate	57%	70%	30%	30%

LA = left atrium; GLA = giant left atrium; AF = atrial fibrilation; LVEF = LVEF; Insuff. = insufficiency; LA triang = left atrium tangencial triangular resection; Rup. MiBio = rupture of the mitral bioprosthesis; Sig. Dys. Aobiop = significant dysfunction of aortic bioprosthesis; AoV Rep = aortic valve replacement; MiV Rep = mitral valve replacement

All patients underwent surgery with extracorporeal circulation (EC) and moderate hypothermia (28 ° C). EC was conventionally performed with cannulation of the aorta and superior and inferior vena cava. Myocardial protection was achieved with hypothermic blood cardioplegic solution. The LA was opened by conventional atriotomy (Figure 1). It was followed by operation with the mitral valve (Figure 2) and the treatment of dysfunction of the same (such as plastic or replacement). Then, the left atrium was reduced by means of tangential triangular resection of the posterior wall between the pulmonary veins, to avoid distortion of the mitral annulus or pulmonary veins anatomies, and then, reduce the tension on the suture line (Figures 3-6).

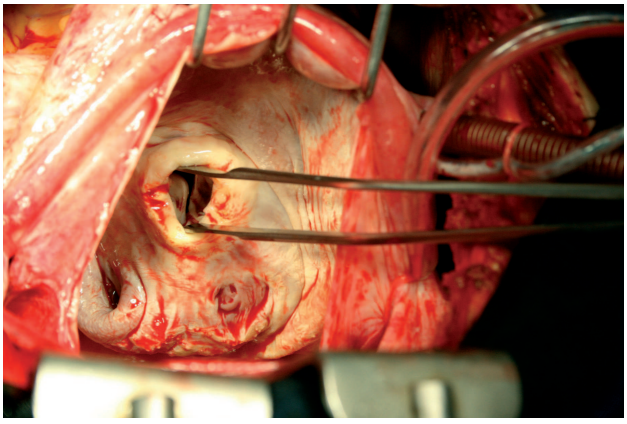

Fig. 2 - Exploration of the mitral valve

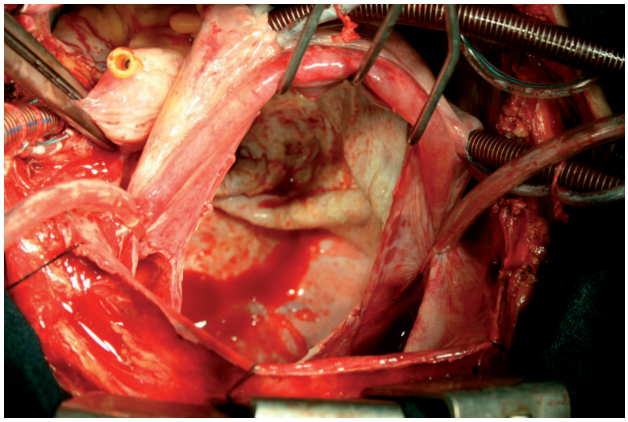

Fig. 1 - Left atriotomy showing the increase of the cavity

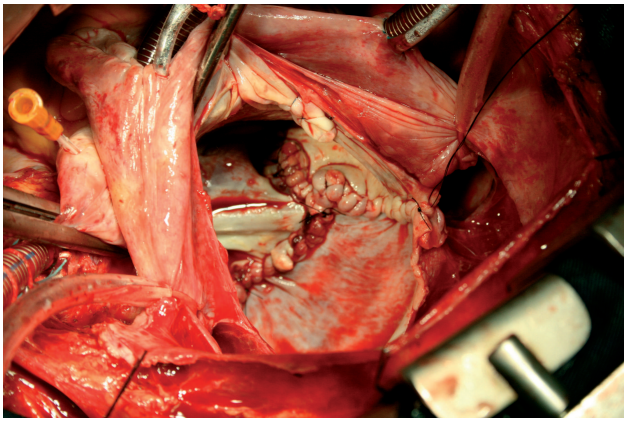

Fig. 3 - Left atrium tangencial triangular resection

Fig. 4 - Atrial tissue resected

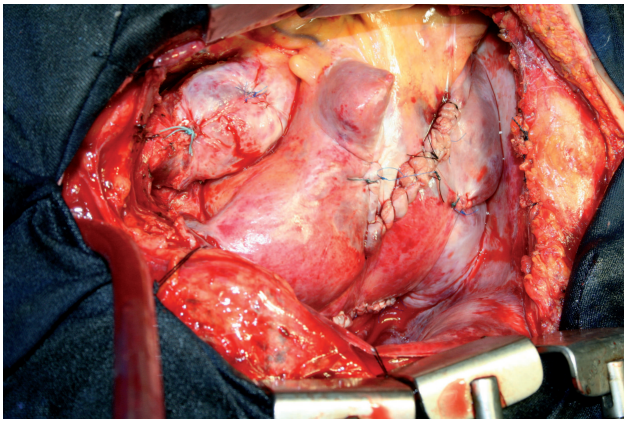

Fig. 6 - Final aspect of the procedure after cessation of Extracorporeal Circulation

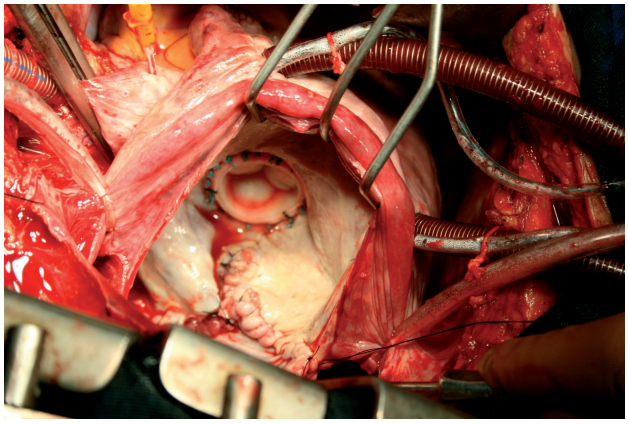

Fig. 5 - Final aspect of the resection

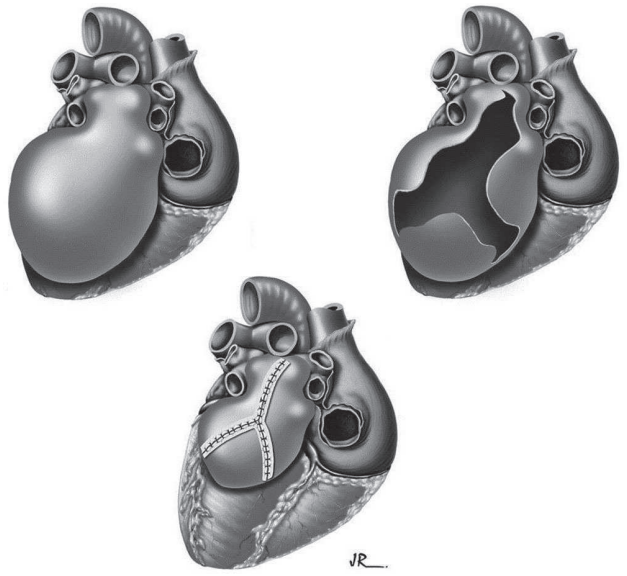

Fig. 7 - Schematic drawing of the reconstruction

Figure 7 schematically illustrates the reconstruction technique.

The LA edges were sutured with the reinforcement of bovine pericardium in two patients, due to the friability of the tissues. In one patient, the tricuspid valve repair was performed through a right atriotomy bicuspidization. The patients had different follow-up periods ranging from 30 days to 8 years after surgery, in which all patients underwent intraoperative transesophageal echocardiography and transthoracic echocardiography before hospital discharge and outpatient care.

RESULTS

The average hospital stay was 21.5 ± 6.5 days. The EC average time was 130 ± 30 minutes. There was no mortality in the postoperative period. There were not any cases of postoperative bleeding that required surgical rapprochement. All operated patients had sinus rhythm restored since the end of the EC, and maintained that pace in the postoperative follow-up period. The atrium diameter was reduced by 50.5 ± 19.5% after surgery. The ejection fraction of left ventricle significantly improved in all patients. The patient who has 8 years of follow-up remains an ejection fraction of 62%, and preoperative was 40%. There were no thrombi in the LA through the transthoracic echocardiography during the follow-up period. The cardiac area on chest radiographs showed a significant reduction in postoperative evaluation.

All patients had improvement in New York Heart Association Functional Class. The pathological examination of surgical specimens showed atrial wall replacement with fibrous myocardial hypertrophy, diffuse and focal myocytolysis of the cardiomyocytes, and fibromuscular thickening of the endocardium in all operated cases.

DISCUSSION

The first description of GLA was made in 1849 [3] and in 1967, the first management of GLA in symptomatic patients was reported as successful.

The exact etiology of GLA remains unknown, despite the strong association with chronic rheumatic disease of the mitral valve, with consequent increase of intracavitary pressure and higher pressure and dilation of the chamber, and left ventricular failure, chronic atrial fibrillation and left-right shunts (patent ductus arteriosus, ventricular septal defect, etc.). [1]. There are also isolated reports of GLA, where the inherent weakness of the atrial wall may be responsible for changes.

According to Di Eusanio et al. [4], 19% of patients undergoing mitral valve surgery have GLA, demonstrating how common this abnormality is, therefore, besides the correction of valve dysfunction, we should also reduce the size of the LA. These patients usually have a long history of mitral valve disease, atrial fibrillation, palpitations, chest pain, dyspnea, hoarseness due to compression of the laryngeal nerve (Ortner syndrome) or other respiratory or hemodynamic complications. Several studies have described the correlation between the atrial diameter and atrial volume, proving that the blood stasis in the cavity leads to the formation of thrombi causing thromboembolic phenomena [5].

The main organs affected by the LA increase are bronchial and lung lobes, causing respiratory dysfunction, and esophagus, causing dysphagia, or it also may compress the descending thoracic aorta, occurring asymptomatically.

The occurrence probability of intracavitary thrombus in patients with GLA associated with AF undergoing mitral valve surgery is increased [6].

The idea that mitral valve surgery alone will result in remodeling and atrial size reduction is considered wrong by most studies. The LA size is an independent predictor factor for thromboembolism [7] and for morbidity and mortality [8].

The main indications for surgery of the GLA are for those patients with indication of mitral valve surgery in cases of intra or extracardiac compression, presence of thrombi or thromboembolic events in association with Maze surgery. It is reported that patients who undergo radiofrequency surgery associated with reduced LA are more successful on the reversal to sinus rhythm than those patients who are treated with radiofrequency [1].

The plication of the posterior wall of the LA or-annular, the heart partial autotransplantation [9], the spiral resection of the atrial wall [10] and the association with the Maze procedure for any technique in order to treat AF are most common procedures in the current treatment of GLA. The unsatisfactory reduction of the size of LGA, the great time of EC, the failure of surgical treatment of AF or postoperative bleeding are potential possibilities in those proceedings. Overall mortality in surgery of the LGA associated with mitral valve surgery varies from 8% to 23% [1].

According to Kosakai [11], in patients with LGA and AF undergoing mitral valve repair procedure associated with Cox-Maze III, sinus rhythm was not restored in patients with LA diameter above 8.7 cm, while patients with a diameter of less than 4.5 cm, the LA gave 100% reversion of atrial fibrillation.

So far, there is not any standard surgical technique to reduce the LA. The principles of the LA are aneurysmectomy resection and reconstruction of the cavity without distortion of the mitral valve and pulmonary veins anatomies [12].

In all cases operated in this work, the tangential triangular resection of left posterior atrial wall was carried out, following the principles of maintaining the anatomy of the atrial cavity, resulting in excellent rates of reduction of the cavity. Median sternotomy is the access of choice for reduction of the LA, especially in cases of large aneurysms, however, lateral thoracotomy or minimally invasive techniques are described in the literature [13] and use of off-pump surgical staples in isolated cases of GLA without thrombi [12].

The suture reinforcement with bovine pericardium is suggested in cases of atrial tissue with friable or chronic inflammation [14].

REFERENCES

1. Apostolakis E, Shuhaiber JH. The surgical management of giant left atrium. Eur J Cardiothorac Surg. 2008;33(2):182-90.

2. Kawazoe K, Beppu S, Takahara Y, Nakajima N, Tanaka K, Ichihashi K, et al. Surgical treatment of giant left atrium combined with mitral valvular disease. Plication procedure for reduction of compression to the left ventricle, bronchus, and pulmonary parenchyma. J Thorac Cardiovasc Surg. 1983;85(6):885-92.

3. Hewett P. Aneurysmal dilatation of left auricle with thickening and contraction of left auriculoventricular opening. Trans Pathol Soc London. 1849/1850;2-193.

4. Di Eusanio G, Gregorini R, Mazzola A, Clementi G, Procaccini B, Cavarra F, et al. Giant left atrium and mitral valve replacement: risk factor analysis. Eur J Cardiothorac Surg. 1988;2(3):151-9.

5. Matsuda H, Nakao M, Nohara H, Higami T, Mukohara N, Asada T, et al. The causes of prolonged postoperative respiratory care in mitral valve disease with a giant left atrium. Kyobu Geka. 1990;43(3):172-7.

6. Erdogan HB, Ipek G, Kirali K, Ömeroglu SN, Güler M, Isik Ö, et al. Volume reduction procedures in giant left atrium. Asian Cardiovasc Thorac Ann. 2001;9:171-5.

7. Itoh T, Okamoto H, Nimi T, Morita S, Sawazaki M, Ogawa Y, et al. Left atrial function after Cox's maze operation concomitant with mitral valve operation. Ann Thorac Surg. 1995:60(2):354-9.

8. Reed D, Abbott RD, Smucker ML, Kaul S. Prediction of outcome after mitral valve replacement in patients with symptomatic chronic mitral regurgitation. The importance of left atrial size. Circulation. 1991;84(1):23-34.

9. Lessana A, Scorsin M, Scheublé C, Raffoul R, Rescigno G. Effective reduction of a giant left atrium by partial autotransplantation. Ann Thorac Surg. 1999;67(4):1164-5.

10. Sugiki H, Murashita T, Yasuda K, Doi H. Novel technique for volume reduction of giant left atrium: simple and effective "spiral resection" method. Ann Thorac Surg. 2006;81(1):378-80.

11. Kosakai Y. Treatment of atrial fibrillation using the Maze procedure: the Japanese experience. Semin Thorac Cardiovasc Surg. 2000;12(1):44-52.

12. Pomerantzeff PM, Brandão CM, Guedes MA, Stolf NA. Tangential triangular resection: an option to treat the giant left atrium. Innovations (Phila). 2010;5(2):125-7.

13. Kiaii B, Doll N, Kuehl M, Mohr FW. Minimal invasive endoscopic resection of a giant left atrial appendage aneurysm. Ann Thorac Surg. 2004;77(4):1437-8.

14. Kalangos A, Ouaknine R, Hulin S, Cohen L, Lecompte Y. Pericardial reinforcement after partial atrial resection in idiopathic enlargement of the right atrium. Ann Thorac Surg. 2001;71(2):737-8.