

## Chordal cutting for severely restricted mitral anterior leaflet

### *Ciddi restriksiyonu olan mitral anterior liflet için kordal ayırma*

Serkan Ertugay<sup>1</sup> Tahir Yağdı<sup>1</sup>

Ege University Medical Faculty, Department of Cardiovascular Surgery, Izmir, Turkiye

#### ABSTRACT

Functional mitral regurgitation (MR) is usually caused by cardiomyopathy. Herein, we present chordal cutting and ring annuloplasty due to severely restricted anterior leaflet. Seventy-seven years old, male patient suffering shortness of breath had the diagnosis of severe mitral regurgitation and coronary artery disease. Preoperative echocardiography showed reduced ejection fraction and severe central jet due to tethering of secondary chordae. Restricted chordae were resected by transverse aortotomy, saphenous graft bypass was done, and semi-rigid ring was implanted. Postoperative echocardiography showed no residual regurgitation, excellent mobility of anterior leaflet. Chordal cutting seems to be an effective technique to treat functional MR caused by the restriction of anterior leaflet.

**Keywords:** Functional mitral regurgitation, chordal cutting, mitral repair.

#### ÖZ

*Fonksiyonel mitral yetmezlik sıklıkla kardiyomiyopatiye bağlıdır. Bu makalede, mitral anterior liflette ciddi restriksiyon nedeniyle kordal ayırma ve ring annüloplasti uygulanan hasta sunulmaktadır. Yetmiş yedi yaşında, erkek hasta, nefes darlığı şikâyeti ile tetkik edilip, ciddi mitral yetmezliği ve koroner arter hastalığı tanısı almıştır. Preoperatif ekokardiyografi'de sekonder kordadaki restriksiyona bağlı ciddi santral mitral yetmezlik jeti ve düşük sol ventrikül ejeksiyonu saptanmıştır. Restriktif kordalar transvers aortotomi ile mitral kapağa tutunduğu bölgeden kesilerek ayrıldı, safen ven grefti ile koroner baypas uygulandı ve mitral annülüse semi-rigid ring implante edildi. Postoperatif ekokardiyografi'de rezidü mitral kaçak gözlenmezken anterior liflet hareketinin gayet iyi olduğu görüldü. Kordal ayırma işlemi, özellikle anterior lifletin ciddi restriksiyonuna bağlı fonksiyonel mitral yetmezliği düzeltmek için uygulanabilecek etkin bir teknik gibi görünmektedir.*

**Anahtar Sözcükler:** Fonksiyonel mitral yetmezlik, kordal ayırma, mitral tamir.

#### INTRODUCTION

The term of 'Functional or Secondary' defines mitral regurgitation (MR) in the absence of mitral valve pathology caused by cardiomyopathy, either ischemic or non-ischemic, result in displacement of papillary muscles. The selection of the treatment is a debate for the Heart Team. The common procedure was to perform

downsized ring annuloplasty till the publication of the update of valve guideline (1). The prospective randomized study, referred to the statement, showed recurrent moderate-to-severe MR in the ring group (2). Today, this recommendation led the surgeons to replace the valve instead of repair.

Corresponding author: Serkan Ertugay  
Ege University Medical Faculty, Department of  
Cardiovascular Surgery, Izmir, Turkiye  
E-mail: serkanertugay80@gmail.com  
Application date: 10.11.2021 Accepted: 11.03.2022

Not only to avoid implantation of valve prosthesis, but also to prevent recurrence of MR, many of valvular or subvalvular repair techniques were experienced in addition to downsized ring annuloplasty. Chordal cutting is one of the techniques proposed firstly by Messas et al, to improve mobility of the anterior leaflet in order to increase the length of coaptation (3). To date, it has been performed effectively by some surgeons and satisfactory results have been achieved. (4)

Herein, our aim is to present chordal cutting in combination ring annuloplasty for ischemic MR due to severely restricted anterior leaflet.

## CASE REPORT

### Preoperative Data

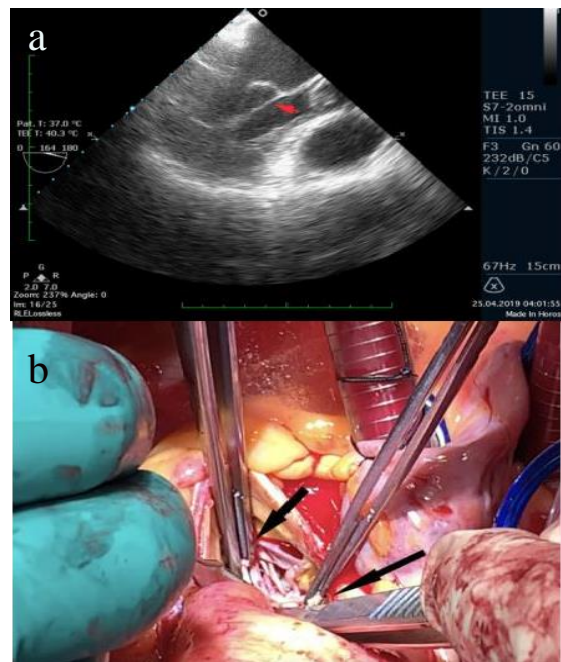
Seventy-seven years old, male patient suffering shortness of breath had the diagnosis of severe mitral regurgitation. Coronary angiogram showed only significant stenosis of obtuse margin (OM) artery. Preoperative transthoracic echocardiography showed the reduced ejection fraction (38%) due to inferior wall motion abnormality, severely regurgitated central jet due to loss of coaptation (Vena contracta:11 mm), severe pulmonary hypertension and moderate tricuspid regurgitation. The detailed analysis by intraoperative transesophageal echocardiography (TEE) revealed immobile basal segment of anterior leaflet due to severely tethered secondary chordae (bending angle  $139^{\circ}$ , coaptation depth 9 mm). The tethered secondary chordae are showed in the Figure-1a.

### Surgical technique

Patient was operated via median sternotomy. Because of distal ascending aortic calcification, femoral artery was cannulated and bicaval venous cannulation was done in standard fashion. Heart was arrested and perfused by blood cardioplegia (warm induction, cold maintenance and hot shot). Firstly, transverse aortotomy was performed for chordal cutting. Anterior mitral leaflet was examined, and restricted secondary chordae were resected carefully (Figure-1b). Then, distal anastomosis of OM was performed. Thereafter, left atriotomy was applied to expose mitral valve. Conventional examination of the mitral valve showed no pathology. Sorin Memo 3D (Sorin Biomedica Cardio S.r.L., Saluggia, Italy), No:32 semi-rigid ring was implanted in the mitral annulus by 2/0

polyester sutures. Saline Test showed no regurgitation and left atriotomy was closed. Proximal anastomosis of the saphenous vein graft was done to the aorta under aortic cross clamping. Postprocedural intraoperative TEE showed excellent mobility of anterior leaflet, sufficient coaptation height, normal aortic valve function, better left ventricle systolic function and no residual regurgitation.

Postoperative course was uneventful and pre-discharge echocardiography showed having no MR and good LV function. Patient was discharged on the day 8 and prescribed warfarin for the anticoagulation for three months.



**Figure-1.** a- Figure showing preoperative echocardiographic view. Please note severe tethering and restricted mobility of anterior mitral leaflet causing loss of coaptation (red arrow), b- Intraoperative picture showing (black arrows) the resection of tethered secondary chords.

## DISCUSSION

Ischemic mitral regurgitation (IMR) is a difficult clinical entity in terms of severity of regurgitation, indication and timing of surgery and surgical technique. Therefore, management of functional or ischemic MR requires detailed echocardiographic assessment, advanced imaging techniques evaluating viability and implementation of best surgical technique with low recurrence and mortality rate.

Prospective, randomized and multicenter study is comparing only ring annuloplasty and replacement for ischemic MR, published by Goldstein et al, have found similar early mortality in both groups, but high recurrence of MR in the repair group. This study, is referring to the cause of the change of the recommendation in the valve guideline for the treatment of IMR, have already influenced many surgeons' approach. But, as the authors self-criticize, patients were not selected based on echocardiographic parameters or the possibility of reverse remodeling which is found to be strong predictor of the durability in this study (1).

Many reports showed that downsized ring implantation is associated with high risk of recurrence of MR (5). Additionally, implantation of downsized ring may cause further tethering of anterior leaflet causing recurrence. Therefore, surgeons focused on the mechanism of MR and tried to restore the configuration of subvalvular components of mitral valve. Papillary muscle relocation was defined as a safe and effective technique in order to decrease leaflet tethering, revised by papillary muscle approximation later (6). Mihos et al, they have reported a meta-analysis of five studies, strong in design, which are comparing only ring and ring plus subvalvular procedures. This important report showed similar rate of complications, also better long-term efficacy in terms of recurrence of MR, reverse remodeling of LV, improved LV systolic function and less restriction of the mitral valve, in favor of ring plus subvalvular procedures (7). Another meta-analysis, defining and analyzing all subvalvular techniques, included 1093 patients, showed significantly (OR 0.27, 95% CI 0.19 to 0.38) lower rate of reoccurrence of  $2 \geq$  MR (4).

Chordal cutting (CC) is one of the additional techniques to improve leaflet mobility. The reason is to excessive tethering of anterior leaflet causing loss of coaptation. The concerns are the disruption of valvular-ventricular continuity and progressive left ventricular remodeling because of its role in maintaining LV geometry and the distribution of stress on MV. But this effect was not shown in the previous clinical studies. Borger et al, they published a comparison of CC and ring annuloplasty alone. They provided an improvement of leaflet mobility and less recurrent MR with similar rate of complication, although the high-risk patients were case in the CC group (8). Mid-term outcomes were reported by Murashira et al, which showed improved survival and low recurrence of severe MR (9).

The optimal approach will be to select the patient who will benefit from the subvalvular repair techniques. The main criteria are echocardiographic parameters such as, tethering height, tenting area, left ventricular end-systolic and end-diastolic diameters, tethering angles of the leaflets. Drake et al, in their report, they point out the importance of image-guided repair approach for myopathic disease (10).

## CONCLUSION

Chordal cutting seems to be a safe and effective technique to treat ischemic MR in selected patients such as older age, contraindication for anticoagulation, high surgical risk for valve replacement.

**Conflict of interest:** Authors have no conflict of interest to declare.

## References

1. Nishimura RA, Otto CM, Bonow RO, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2017; 135 (25): e1159-e95.
2. Goldstein D, Moskowitz AJ, Gelijns AC, et al. Two-Year Outcomes of Surgical Treatment of Severe Ischemic Mitral Regurgitation. *N Engl J Med*. 2016; 374 (4): 344-53.
3. Messas E, Guerrero JL, Handschumacher MD, et al. Chordal cutting: a new therapeutic approach for ischemic mitral regurgitation. *Circulation*. 2001; 104 (16): 1958-63.
4. Girdauskas E, Pausch J, Harmel E, et al. Minimally invasive mitral valve repair for functional mitral regurgitation. *Eur J Cardiothorac Surg*. 2019; 55 (Supplement\_1): i17-i25.
5. McGee EC, Gillinov AM, Blackstone EH, et al. Recurrent mitral regurgitation after annuloplasty for functional ischemic mitral regurgitation. *J Thorac Cardiovasc Surg*. 2004; 128 (6): 916-24.

6. Kron IL, Green GR, Cope JT. Surgical relocation of the posterior papillary muscle in chronic ischemic mitral regurgitation. *Ann Thorac Surg.* 2002; 74 (2): 600-1.
7. Mihos CG, Xydas S, Yucel E, et al. Mitral valve repair and subvalvular intervention for secondary mitral regurgitation: a systematic review and meta-analysis of randomized controlled and propensity matched studies. *J Thorac Dis.* 2017; 9 (Suppl 7): S582-S94.
8. Borger MA, Murphy PM, Alam A, et al. Initial results of the chordal-cutting operation for ischemic mitral regurgitation. *J Thorac Cardiovasc Surg.* 2007; 133 (6): 1483-92.
9. Murashita T, Okada Y, Kanemitsu H, et al. Midterm outcomes of chordal cutting in combination with downsized ring annuloplasty for ischemic mitral regurgitation. *Ann Thorac Cardiovasc Surg.* 2014; 20 (6): 1008-15.
10. Drake DH, Zimmerman KG, Hepner AM, Nichols CD. Echo-guided mitral repair. *Circ Cardiovasc Imaging.* 2014; 7 (1): 132-41.