

*How to do it? / Nasıl yapılır?*

## Mitral ring annuloplasty by biological material

*Biyolojik materyalle mitral ring anuloplasti*

Erkan Kuralay 

Department of Cardiovascular Surgery, Alife Hospital, Ankara, Türkiye

### ABSTRACT

Mitral annuloplasty is an integral part of mitral valve repair. Several types of techniques have been described for mitral annuloplasty. The autologous pericardium is used for mitral annuloplasty to allow mitral annular flexibility. Complete mitral ring annuloplasty is done using a D-shaped bovine pericardium. Classical annuloplasty sizers are utilized for the sizing and shaping of bovine pericardium. Biological material covers all parts of the mitral annulus and allows annular flexibility.

**Keywords:** Bovine pericardium, mitral annuloplasty, ring.

### ÖZ

Mitral anuloplasti kapak tamirinin tamamlayıcı parçasıdır. Mitral anuloplasti için çeşitli teknikler geliştirilmiştir. Mitral annulus flexibilitésinin korunması hedeflenerek mitral anuloplasti için otolog perikard kullanılmaktadır. Tam mitral ring anuloplastisi D-şeklinde bovin perikard kullanılarak yapılmaktadır. Bovin perikardın ölçme ve şekillendirilmesi için klasik anuloplasti ölçekleri kullanılmaktadır. Biyolojik materyal mitral anulusun her tarafını kaplar ve anulus hareketlerine izin verir.

**Anahtar sözcükler:** Bovine perikardı, mitral anuloplasti, ring.

It is well known that the annuloplasty ring is commonly used to reduce annular dilatation to achieve better leaflet coaptation and stabilize repairs on leaflets or the subvalvular apparatus.<sup>[1,2]</sup> Despite the considerable advances in prosthetic ring technology, it is likely that such rings may restrict valve dynamics, particularly in the posterior leaflet, and lead to the anatomical bicuspid valve working as functionally as a unicuspid valve in most cases.<sup>[1-3]</sup> Posterior annuloplasty by C-shaped autologous pericardium was introduced by Salati et al.<sup>[1]</sup> The effectiveness of posterior annuloplasty formed by C-shaped autologous pericardium or bovine pericardium has been proved by several studies.<sup>[2-4]</sup> The complete autologous pericardial D-shaped mitral ring annuloplasty technique was first depicted by Victor and Nayak.<sup>[5]</sup> Herein, we also described a complete D-shaped mitral annuloplasty technique using bovine pericardium.

### SURGICAL TECHNIQUE

A 55-year-old male patient was admitted to our department for severe mitral regurgitation and three-vessel coronary artery disease. The patient had bad oral hygiene and severe dental problems.

The dentist offered the 14<sup>th</sup> tooth's extraction and special care for gingivitis, and stated that at least 30 days was required for complete dental and oral care. We could not postpone surgery due to unstable angina symptoms. The patient was taken into the operating room. A transesophageal echocardiography probe was inserted. Both mitral annulus dilatation ( $\geq 52$  mm) and A2 scallop prolapse had caused severe eccentric mitral regurgitation. A median sternotomy was done. The left internal thoracic artery and the saphenous vein were harvested. The patient was bicavally cannulated. The vena cava was taped and snared. Distal anastomosis of the three saphenous veins and the left internal thoracic artery were done. A superior septal approach was used for the mitral valve. Eleven annuloplasty sutures (2-0 Tevdek suture) were passed through the mitral annulus. Then the leaflets were checked, and the prolapsing segment of the anterior leaflet at the A2 zone was found. An artificial chorda was implanted to the A2 zone of the mitral anterior valve. The intertrigonal distance was measured by a 32-no ring sizer. The ring sizer was placed over the bovine pericardium, and its borders were

Received: March 08, 2022 Accepted: July 22, 2022 Published online: October 31, 2022

**Correspondence:** Erkan Kuralay, MD. Alife Hastanesi Kalp Damar Cerrahisi Anabilim Dalı, 06790 Etimesgut, Ankara, Türkiye.

Tel: +90 312 - 304 52 05 e-mail: erkanecce2000@yahoo.com

**Cite this article as:**

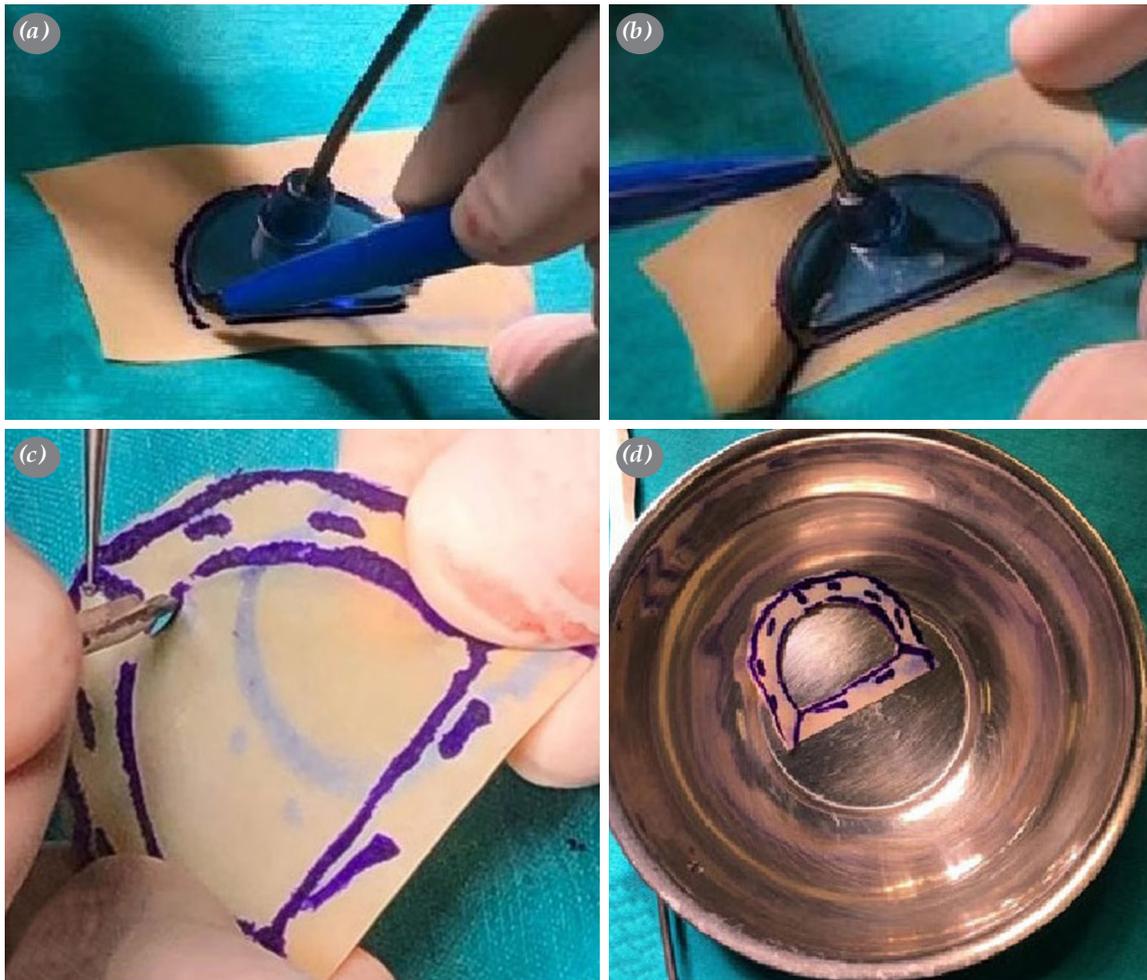
Kuralay E. Mitral ring annuloplasty by biological material. Turk Gogus Kalp Dama 2022;30(4):645-648

©2022 All right reserved by the Turkish Society of Cardiovascular Surgery.

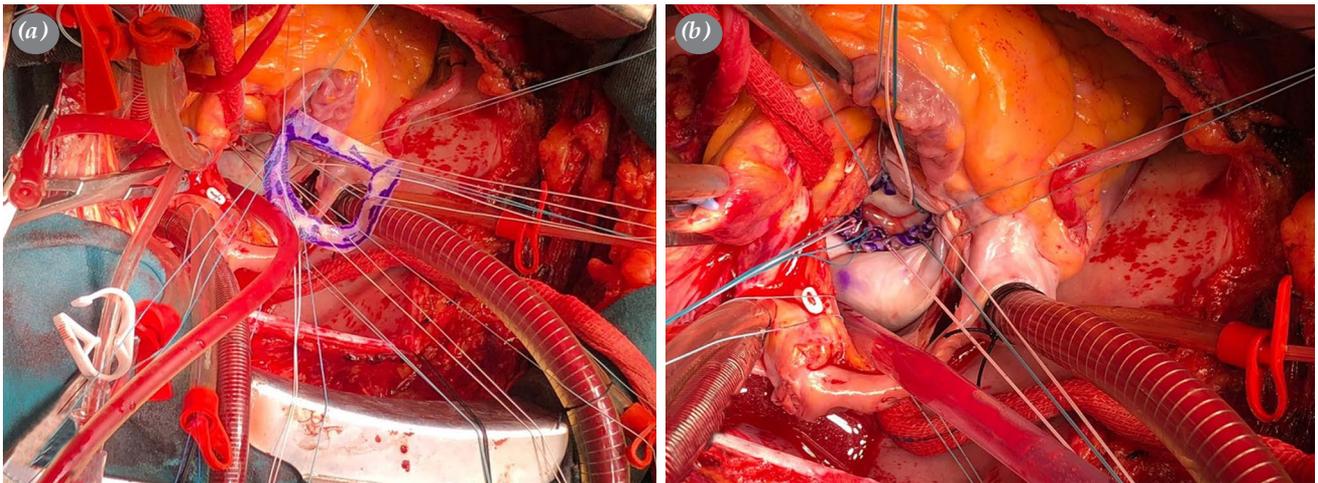
This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes (<http://creativecommons.org/licenses/by-nc/4.0/>).

marked by a surgical pen (Figure 1a). A second line was drawn at a 5 mm distance. The outer part of the bovine pericardium was trimmed by scissors, and the inner part of the pericardium was cut with a scalpel (Figures 1b, c). Three vertical lines were drawn on the pericardial ring, indicating the middle of the posterior leaflet annulus and both commissure notches. Then, a transverse line was drawn at the transition points of possible annuloplasty sutures (Figure 1d). First, the sutures in both commissures and in the middle of the posterior leaflet annulus were passed through the ring. Afterward, these three sutures were stretched, and the intervals of the other annuloplasty sutures were passed in a balanced distance. Third, the pericardium ring was lowered into the mitral orifice. Finally, both commissural and the suture at the

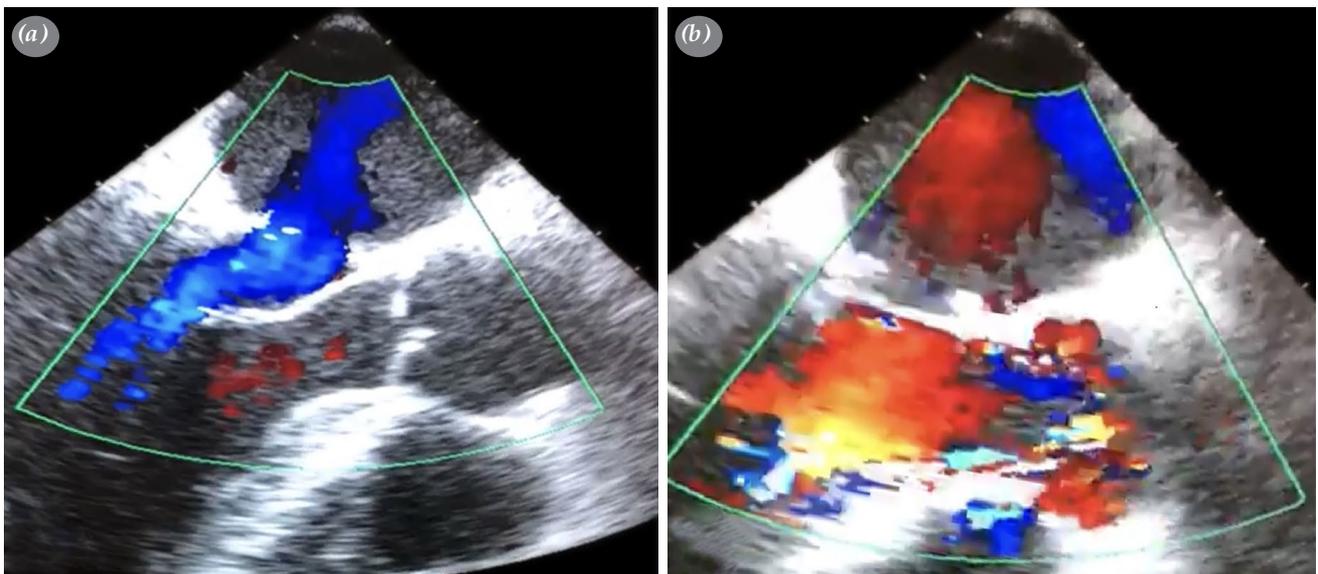
middle of the posterior annulus were ligated to avoid ring distortion (Figure 2a), And then the other sutures were ligated (Figure 2b). The saline test displayed a good coaptation, and the ink test showed a 12 mm coaptation depth. The superior septal approach was closed, the heart was deaired, and then the cross-clamp was removed. Proximal anastomoses of saphenous vein grafts were done. The patient was weaned from cardiopulmonary bypass uneventfully. Postoperative transesophageal echocardiography (TEE) examination revealed good valve coaptation without causing left ventricular outflow tract obstruction (Figure 3a, b). Acetylsalicylic acid (81 mg) and clopidogrel (75 mg) were administered during the postoperative period. The patient was discharged on the fifth day after the operation.



**Figure 1.** (a) Thirty-two ring sizer placed over the bovine pericardium and its borders marked by pen. (b) The two notches and the middle of the posterior sizer marked on the bovine pericardium. (c) Pericardium is trimmed and annuloplasty suture zones are marked on the D-shaped bovine pericardium. (d) Final appearance of the D-shaped bovine pericardium ring.



**Figure 2.** (a) Bovine pericardium ring lowered into the mitral orifice. Initially, the commissure and the suture at the middle of the posterior annulus are ligated to avoid ring distortion. (b) Final intraoperative appearance.



**Figure 3.** Transesophageal echocardiographic examination just after weaning from cardiopulmonary bypass. (a) Transesophageal view at diastole. (b) Transesophageal view at systole.

## DISCUSSION

The mitral valve annulus has a saddle shape in three dimensions, and it has both muscular and fibrous parts. The posterior annulus contracts and moves to the anterior annulus during the cardiac cycle, causing the annulus to change shape from circular to elliptical in systole and thus reducing the effective mitral orifice by 25 to 40%.<sup>[1-6]</sup> Posterior annuloplasty using autologous or bovine pericardium is accepted as an alternative option to the classic prosthetic ring. This technique

preserves the native annular nonplanarity and the physiological motion of the mitral valve and avoids the use of prosthetic material. Pericardial annuloplasty (both autologous and bovine) allows septalateral movements of the mitral annulus and provides good leaflet coaptation.<sup>[1-4]</sup> It is a cost-effective procedure that is particularly appealing for young patients or mitral regurgitation due to endocarditis. We preferred bovine pericardium due to the poor oral hygiene of the patient and to avoid the risk of endocarditis. The bovine

pericardium is commercially available and, in addition to being resistant to infection, is a more stiff material than autologous pericardium. Therefore, we believe that bovine pericardium can better stabilize the mitral annulus than autologous pericardium. A major concern of bovine pericardium is long-term calcification. Most surgeons may not prefer bovine pericardium due to this issue. Pomerantzeff et al.<sup>[6]</sup> used bovine pericardium to stabilize the mitral annulus and reported the freedom from reoperation rate as 59.1% in 18 years. Bovine pericardium calcification was not reported in their study.<sup>[6]</sup> We preferred a complete D-shaped bovine pericardium since the C-shaped graft can cause some sort of distortion on the mitral annulus.

In conclusion, pericardial annuloplasty would be good alternative to other ring annuloplasty techniques. However, evidence on the effectiveness and durability of pericardial annuloplasty remains uncertain, and long-term follow-up studies are needed to better understand the efficacy of this approach. We think that our technique should be in surgeons' armamentarium.

**Patient Consent for Publication:** A written informed consent was obtained from the patient.

**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Conflict of Interest:** The author declared no conflicts of interest with respect to the authorship and/or publication of this article.

**Funding:** The author received no financial support for the research and/or authorship of this article.

## REFERENCES

1. Salati M, Scrofolani R, Santoli C. Posterior pericardial annuloplasty: A physiological correction? *Eur J Cardiothorac Surg* 1991;5:226-9.
2. Scrofolani R, Moriggia S, Salati M, Fundaro P, Danna P, Santoli C. Mitral valve remodeling: Long-term results with posterior pericardial annuloplasty. *Ann Thorac Surg* 1996;61:895-9.
3. Borghetti V, Campana M, Scotti C, Domenighini D, Totaro P, Coletti G, et al. Biological versus prosthetic ring in mitral-valve repair: Enhancement of mitral annulus dynamics and left-ventricular function with pericardial annuloplasty at long term. *Eur J Cardiothorac Surg* 2000;17:431-9.
4. Bevilacqua S, Cerillo AG, Gianetti J, Paradossi U, Mariani M, Matteucci S, et al. Mitral valve repair for degenerative disease: Is pericardial posterior annuloplasty a durable option? *Eur J Cardiothorac Surg* 2003;23:552-9.
5. Victor S, Nayak VM. Truly flexible D-shaped autogenous pericardial ring for mitral annuloplasty. *Ann Thorac Surg* 1993;56:179-80.
6. Pomerantzeff PM, de Almeida Brandão CM, Albuquerque JM, Pomerantzeff PY, Takeda F, Oliveira SA. Mitral valve annuloplasty with a bovine pericardial strip--18-year results. *Clinics (Sao Paulo)* 2005;60:305-10.