

## Y-incision aortic root enlargement in a double valve replacement through subaxillary vertical thoracotomy

*Subaksiller vertikal torakotomi ile çift kapak replasmanında Y-insizyon aort kökü genişletmesi*

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### ABSTRACT

Aortic root enlargement procedures are used to implant a larger aortic valve. Median sternotomy may cause complications, including dehiscence and mediastinitis. Cosmetic concerns of median sternotomy are minimized with minimally invasive approaches. Although the subaxillary vertical incision is not a conventional minimally invasive approach, it is favored since the incision is hidden in the subaxilla, and the thoracic integrity is preserved. Herein, we demonstrated that Y-incision aortic root enlargement can be safely performed in double valve replacement through subaxillary vertical thoracotomy in a 63-year-old female patient with better cosmetic outcomes and without compromising the replaced mitral valve.

**Keywords:** Aortic stenosis, aortic valve, heart valve prosthesis, minimally invasive surgery, mitral valve.

Aortic root enlargement (ARE) techniques are used to prevent patient-prosthesis mismatch in a narrow aortic root. Aortic root enlargement techniques may be associated with increased perioperative mortality; however, patient-prosthesis mismatch may lead to long-term consequences, such as heart failure and reduced survival.<sup>[1]</sup>

Median sternotomy in obese patients may cause dehiscence and infectious complications, which may lead to mediastinitis.<sup>[2]</sup> On the other hand, minimally invasive techniques are being used to overcome cosmetic concerns. Although the subaxillary vertical incision is not a true minimally invasive technique, it is preferred since the incision is concealed under the armpit, and the absence of sternotomy preserves the integrity of the thorax. Herein, we presented a case of double valve

### ÖZ

Aort kökü genişletme prosedürleri daha büyük bir aort kapağı yerleştirmek için kullanılmaktadır. Medyan sternotomy; dehissans ve mediastinit gibi komplikasyonlara neden olabilir. Median sternotominin kozmetik kaygıları minimal insizyon yaklaşımlarla azaltılmaktadır. Subaksiller vertikal insizyon geleneksel bir minimal invaziv yaklaşım olmamasına rağmen, insizyon subaksillada gizlendiğinden ve torasik bütünlük korunduğundan tercih edilir. Bu yazıda, 63 yaşında bir kadın hastada subaksiller vertikal torakotomi yoluyla çift kapak replasmanında Y-insizyon aort kökü genişletmesinin daha iyi kozmetik sonuçlarla ve değiştirilen mitral kapaktan ödün verilmeden güvenli bir şekilde yapılabileceği gösterildi.

**Anahtar sözcükler:** Aort darlığı, aort kapağı, kalp kapağı protezi, minimal invaziv cerrahi, mitral kapak.

replacement through a subaxillary vertical incision in addition to the Y-incision ARE.

### CASE REPORT

A 63-year-old female patient was admitted with dyspnea. Transthoracic echocardiography revealed severe aortic and mitral regurgitation, which was subsequently confirmed by transesophageal echocardiography. The ejection fraction was 60%. The patient was obese, with a body mass index of 36.3 kg/m<sup>2</sup> and a body surface area of 2.03 m<sup>2</sup>. Coronary angiography revealed no coronary lesion. The double valve replacement was scheduled through the right subaxillary vertical incision as it provides better exposure and cosmetic results. A written informed consent was obtained from the patient.

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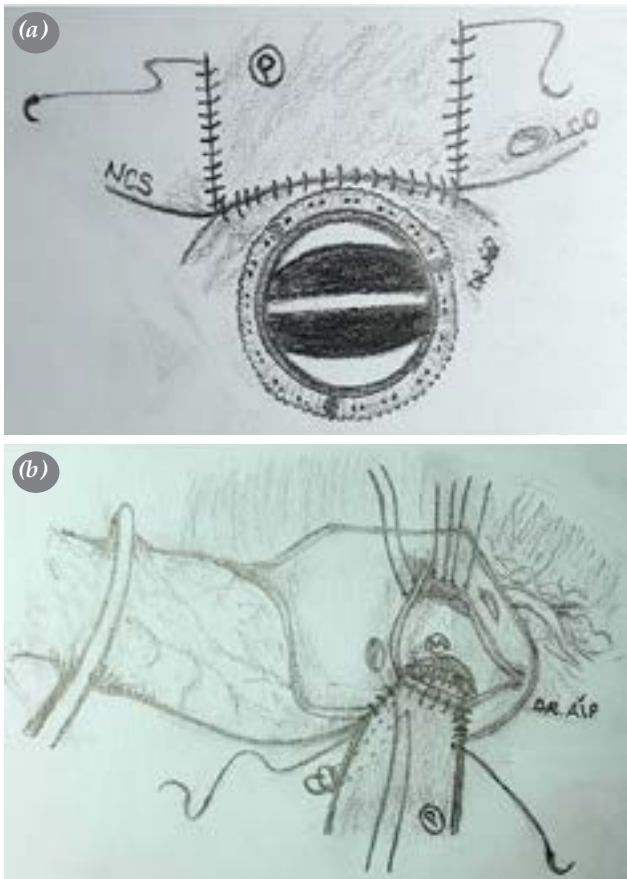


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The patient was positioned in left lateral decubitus; the right thorax and then the mediastinum were accessed through a right subaxillary vertical incision at the third intercostal space. Single-lung ventilation was used. The pericardium was suspended. The right femoral artery and vein were prepared for cannulation. Intravenous heparin was administered. Right femoral artery cannulation was done. The superior vena cava was cannulated through the thoracic incision. The cardiopulmonary bypass was initiated. The Chitwood aortic cross-clamp (Scanlan International Inc., St. Paul, MN, USA) was applied. Antegrade modified Del Nido cardioplegia was administered. A transverse aortotomy was done. The heavily calcified native aortic valve was resected, and annular calcifications were removed.

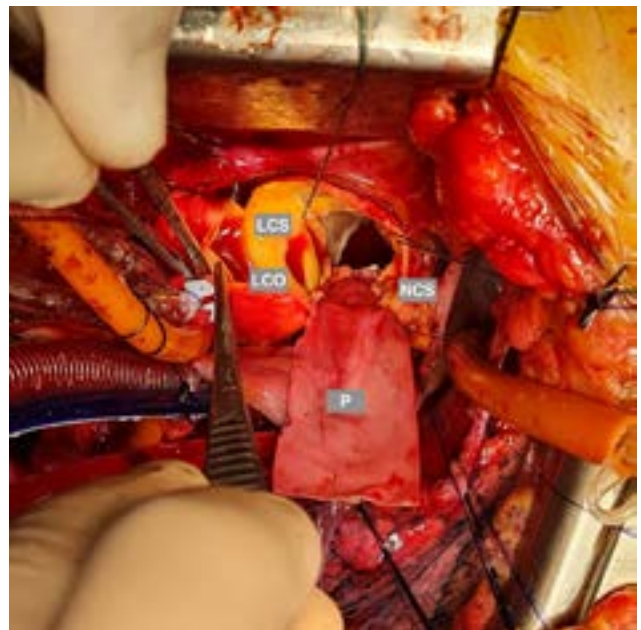
The caval snares were tightened. The left atrium was explored through the transeptal approach after the right atriotomy. The mitral valve was severely fibrotic, thickened, and retracted. Size 29 Abbott SJM Masters Series mechanical mitral valve (Abbott Laboratories, Chicago, IL, USA) was implanted with 2/0 pledgeted sutures. The interatrial septum was repaired. The aortic annulus was remeasured, and the size 19 mechanical valve did not fit. We decided to enlarge the aortic annulus with a Y-incision/rectangular patch technique described by Yang<sup>[3]</sup> to avoid patient-prosthesis mismatch (Figure 1).

The aortotomy was the starting point for the Y-incision, extended down to the aortomitral curtain via the commissure between the left and noncoronary leaflets. The Y-incision was made to separate the left and noncoronary annuli to their respective bottoms without extending to the left muscular portion or right membranous septum. The Y-incision provided a rectangular annular defect. A rectangular bovine pericardial patch was prepared to have a width greater than the distance between the bottom of two cusps (Figure 2). The patch was sewn to the base of the Y-incision extending to the left and non-coronary annuli with a 4-0 Prolene suture reinforced by Teflon felt. The suture line at both longitudinal sides of



**Figure 1.** Drawing of the Y-incision ARE technique. **(a)** Y-incision made to separate the left and noncoronary aortic annuli and extend their respective bottoms. Aortic root enlargement with rectangular patch plasty is demonstrated in the presence of a replacement mitral valve. **(b)** Closure of aortotomy with patch plasty.

P: Pericardial patch; NCS: Noncoronary sinus; M: Mitral valve; LCS: Left coronary sinus.



**Figure 2.** Closure of Y-incision ARE using a bovine pericardial patch.

LCS: Left coronary sinus; LCO: Left coronary ostium; NCS: Noncoronary sinus; P: Pericardial patch.

the patch was sewn up to the level of the transverse aortotomy.

For aortic valve replacement, noneverting pledgeted sutures were placed at the native aortic annulus and outside-to-inside sutures (reinforced by pledget) on the patch. Size 21 Abbott SJM Regent mechanical aortic heart valve (Abbott Laboratories, Chicago, IL, USA) was implanted. The pericardial patch over the aortic valve was trimmed in fusiform shape. The suture lines on the patch were continued for closure of the transverse aortotomy. The cross-clamp time was 210 min, and the cardiopulmonary bypass time was 240 min. The postoperative course was normal. The postoperative echocardiography on the 30<sup>th</sup> postoperative day revealed that the valves were functioning normally, and no gradient was observed.

## DISCUSSION

Minimally invasive aortic valve surgery can be performed through J-sternotomy and anterolateral thoracotomy. Similarly, minimally invasive mitral valve surgery can be performed through anterolateral thoracotomy. However, these incisions have two major handicaps. First, they do not provide sufficient exposure for access to both valves. The other is a cosmetic concern, particularly in female patients with anterolateral thoracotomy, as the breast tissue is cut. In subaxillary vertical incision, access is achieved by avoiding the incision of the breast tissue and pectoral muscles. It provides better cosmetic results and also provides excellent exposure for both valves.

There are many alternative techniques for ARE. Nicks, Manouguian, and Nunez are performed through the posterior aortic annulus, whereas the Konno procedure is performed through the anterior aspect. The described posterior root enlargement techniques may not provide adequate root width, particularly in patients with a larger body surface area. The incision extends to the anterior mitral leaflet, therefore putting the replaced mitral valve at risk in the double valve replacement. The Konno procedure involves an aortoventriculoplasty procedure as the incision extends to the free wall of the right ventricle. Consequently, septal branches of the left anterior descending artery and conduction system may be damaged.<sup>[4]</sup> In the Y-incision technique, the widest aortic root can be created. Since the mitral valve annulus and anterior leaflet are not interfered with, the procedure can be performed without risking the implanted mitral valve.<sup>[5]</sup> Although Yang et

al.<sup>[5]</sup> reported favorable early outcomes, long-term outcomes are needed.

A sutureless aortic valve can be considered another alternative. However, in young patients, early valvular degeneration caused by the bioprosthesis may reduce survival. There are also potential additional risks, such as a paravalvular leak, the need for pacemaker implantation, and sutureless valve migration due to the implanted mitral heart valve. The high cost is another consideration.<sup>[6]</sup>

In conclusion, Y-incision ARE in double valve replacement through subaxillary vertical thoracotomy can be safely performed. It provides better cosmetic results and enables a larger aortic valve size without compromising the replaced mitral valve. We hope that our case report will shed light on further technical studies.

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

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