

## Minimally invasive multi-vessel coronary artery bypass grafting and concomitant mitral valve replacement via bilateral mini-thoracotomy: An alternative to sternotomy

*Bilateral mini torakotomi ile çoklu damar koroner arter baypas greftleme ve beraberinde mitral kapak replasmanı: Sternotomiye alternatif bir yöntem*

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### ABSTRACT

Minimally invasive methods continue to become increasingly common in cardiac surgery. In particular, the utilization of thoracotomy in multi-vessel coronary bypass grafting and valve surgery has accelerated, but sternotomy is still applied in combined pathologies. A 76-year-old male patient underwent multi-vessel coronary artery bypass grafting and mitral valve replacement without sternotomy using bilateral mini-thoracotomy, as the patient was old, frail, and had many comorbid factors. In conclusion, this minimally invasive approach can decrease all postoperative complications, accelerate patient recovery, and achieve good cosmetic results.

**Keywords:** Mini-thoracotomy, mitral valve replacement, multi-vessel coronary artery bypass grafting.

Multi-vessel coronary artery bypass grafting (CABG), one of the most frequent cardiac surgeries currently, has become more comfortable with the novel techniques developed in recent years.<sup>[1]</sup> This technique can be performed only with the left anterior mini-thoracotomy and yield very successful results in isolated cardiac surgery cases. However, sternotomy is still applied for combined cardiac pathologies.

In this article, we present the successful surgical results achieved with bilateral mini-thoracotomy

### ÖZ

Minimal invaziv yöntemler, kalp cerrahisinde giderek daha yaygın hale gelmeye devam etmektedir. Özellikle çoklu damar koroner arter baypas greftleme ve kapak cerrahisinde torakotomi yönteminin uygulanması hız kazanmış olmasına rağmen, kombine patolojilerde halen sternotomi uygulanmaktadır. Yetmiş altı yaşında bir erkek hastaya yaşlı, düşkün ve birçok eşlik eden hastalığı olması nedeniyle sternotomiszik bilateral mini-torakotomi ile çoklu damar koroner arter baypas greftleme ve mitral kapak replasmanı yapıldı. Sonuç olarak, bu minimal invaziv yaklaşım, ameliyat sonrası tüm komplikasyonları azaltabilir, hasta iyileşmesini hızlandırabilir ve kozmetik açıdan daha iyi sonuçlar sağlayabilir.

**Anahtar sözcükler:** Mini-torakotomi, mitral kapak replasmanı, çoklu damar koroner arter baypas greftleme.

without sternotomy, even in combined cardiac pathologies.

### CASE REPORT

A 76-year-old male patient was admitted to our hospital with chest pain, shortness of breath, and fatigue. His arterial blood pressure was 120/80 mmHg and pulse was 86/min. Physical examination showed no abnormalities. Laboratory findings were normal. Transthoracic echocardiography (TTE) was performed

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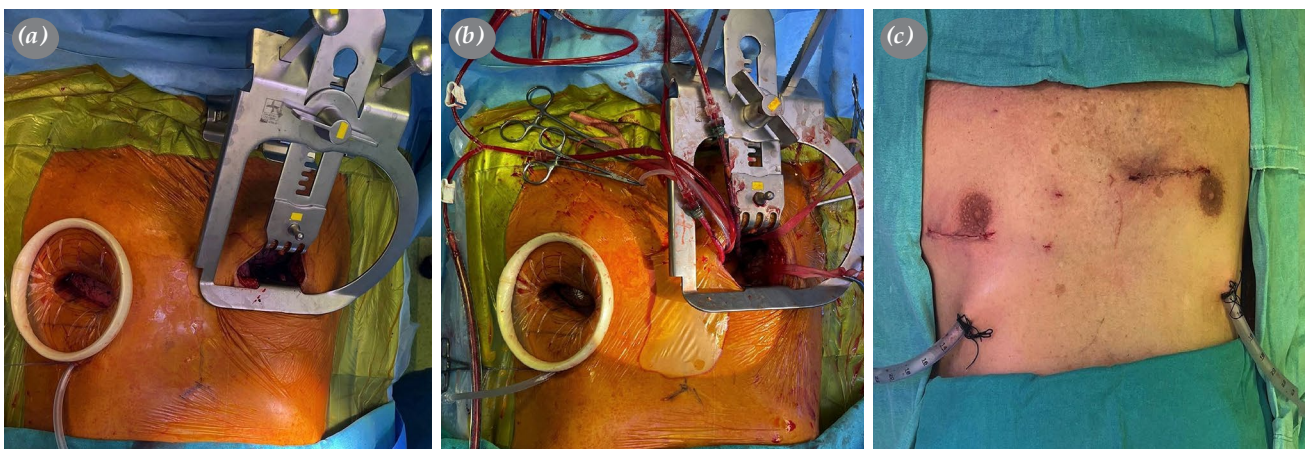
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to evaluate cardiac pathologies, and severe mitral regurgitation was detected. The patient underwent preoperative elective coronary angiography and three-vessel disease was identified. The multi-vessel CABG and mitral valve replacement were decided for the patient. The operation was planned to be performed without sternotomy, just through bilateral mini-thoracotomy, as the patient was old, frail and had several comorbidities.

A dual-lumen endotracheal tube was placed for single lung ventilation. A jugular vein cannula (DLP™, femoral arterial cannula 17-Fr; Medtronic Inc., MN, USA) was inserted percutaneously for superior caval decompression. The chest was entered through the fourth intercostal space in all patients without rib resection. A special rib retractor (Delacroix-Chevalier, Paris, France) was used for the left internal mammary artery (LIMA) harvesting (Figure 1a). Single-lung ventilation was initiated and the left thoracic artery was identified for harvesting. The LIMA was harvested as skeletonized under the direct vision. Suitable sites on the right groin were exposed for cannulation with a small incision of about 2 cm (femoral artery, femoral vein). The anterior surfaces of femoral artery and vein were prepared. Vessels were cannulated with a 19-Fr arterial cannula (Medtronic DLP, Grand Rapids, Michigan, USA) and 24-Fr venous cannula (DLP™; Medtronic Inc., MN, USA). Cardiopulmonary bypass was started at the end of harvesting to facilitate the exposure of the proximal part of LIMA. For rest of the bypasses, the great saphenous vein was harvested endoscopically with the Vasoview Hemopro 2 Endoscopic Vein Harvesting system (Maquet Cardiovascular LLC, NJ,

USA), simultaneously during LIMA harvesting. One side of the vein graft was marked with methylene blue to avoid twisting at the time of proximal anastomosis construction. The pericardium opened longitudinally from the apex to the ascending aorta, and the level of the pulmonary artery to the phrenic nerve on the left side, and from the level of the diaphragm to the phrenic nerve on the right side so that the heart could become more mobile by herniating to the left. In addition, herniation of the heart to the left allowed easy manipulation of the aorta, particularly at the right side of the sternum. The distance between the aorta and the pulmonary vein was dissected with the help of cautery and encircled with 10 mm tape.

A long antegrade cardioplegia cannula was inserted by pulling the aorta to the left with the help of the tape. The LIMA flow and route were checked. The Chitwood DeBakey Clamp (Scanlan International Inc., Saint Paul, IN, USA) was inserted through the anterior axillary line at the second intercostal space to clamp the aorta. After cardiac arrest was instituted, the heart was deviated to the right and upwards with tampon mounted long Kelly clamp by the assistant surgeon, and the pulmonary veins and vena cava were encircled with a 10-mm tape. Obtuse margin and right posterior descending artery anastomosis were completed at this position. Using the saphenous vein graft, tightness of the anastomosis was controlled by giving antegrade blood cardioplegia and regional myocardial protection was performed, as well (Figure 1b). Finally, the LIMA-left anterior descending (LAD) artery anastomosis was constructed.



**Figure 1.** (a) Performing bilateral thoracotomy and placement of left thoracotomy retractor and soft tissue retractor, (b) Completion of distal anastomoses after LIMA harvesting and giving cardioplegia from the grafts, (c) Ending the operation and placing a drain on both hemithorax.

LIMA: Left internal mammary artery.

The mitral valve was reached by performing a left atriotomy via right anterolateral mini-thoracotomy incision. Mitral valve replacement was performed with a St. Jude 29 mm mechanical valve prosthesis (St. Jude Medical Inc., MN, USA), while the posterior leaflet was preserved. After the mitral valve replacement was completed and de-airing was achieved, the left atrium was closed primarily. The Chitwood® clamp was opened and the heart started to beat spontaneously. A slight traction was applied to the aorta by placing a side-biting clamp on the ascending aorta. Standard technique of running 6-0 polypropylene sutures and standard coronary instruments were used. The operation was terminated by placing a drain tube in both thoraces (Figure 1c). No complications were observed in the postoperative period. The patient was discharged on Day 6 postoperatively.

## DISCUSSION

All around the world, minimally invasive techniques have been adopted later in cardiac surgery compared to other branches. Beyond favorable cosmetic results, minimally invasive procedures are preferred due to the small size of the incision, less wound infection, less postoperative bleeding and, thus, less need for blood and blood products transfusion, and shorter intensive care and hospital stays.<sup>[2-4]</sup>

In many centers, isolated mitral valve surgeries are routinely performed with the right thoracotomy method. There are various modifications of this minimally invasive method such as video-assisted, robot-assisted or direct vision. On the other hand, coronary revascularization surgery is far behind in minimally invasive approach compared to mitral valve surgery. However, the multi-vessel CABG through thoracotomy is performed currently in limited centers and it still has not reached sufficient prevalence.

Although the efforts to improve isolated cardiac cases continue, minimally invasive approaches are used in a limited number of patients requiring concomitant cardiac surgery. In our case, we showed the feasibility of mitral valve replacement and multi-vessel CABG through bilateral thoracotomy. Bilateral thoracotomy approach was performed as described in the literature. Potapov et al.<sup>[5]</sup> presented off-pump implantation of the HeartMate 3™ (Abbott Cardiovascular, Abbott Park, IL, USA) left ventricular assist device through a bilateral thoracotomy approach in their study. Furthermore, Carozzini et al.<sup>[6]</sup> presented a bilateral mini-thoracotomy approach for minimally invasive

implantation of HeartMate 3™ in their study. Another bilateral thoracotomy approach was a case with the tracheostomy requiring isolated CABG in a patient by Legarra et al.<sup>[7]</sup> Taken together, this technique has been applied in a limited number of cases so far.

In their study, Smit et al.<sup>[8]</sup> presented mitral valve surgery and CABG with bilateral thoracotomy in a series of 12 cases. In this series, only one patient underwent three-vessel CABG. Squicciarro et al.<sup>[9]</sup> also performed CABG in addition to mitral valve repair in their series of three cases. In this study, unlike our case, they did not perform any anastomosis to the aorta. The lack of anastomosis to the aorta is a factor that makes surgery relatively easy. It can also reduce possible complications.

The role of concomitant pathologies in cardiac surgery should not be underestimated, and surgeons may encounter several concomitant pathologies in daily routine. Therefore, this approach may be a guide for the future. It may be an alternative for patients who are old and have many comorbidities, as in our case, and who are thought to be unable to tolerate sternotomy.<sup>[10]</sup>

In conclusion, except for the isolated valve or coronary cases, complicated and combined pathologies in cardiac surgery can be successfully operated with thoracotomy. This technique seems to be a preferable method in terms of its reliability, applicability, and rapid recovery. However, further large-scale studies are needed to confirm the success of this technique.

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