

## Mechanical mitral valve thrombosis and giant left atrial thrombus: Comparison of transesophageal echocardiography and 64-slice multidetector computed tomography

Mekanik mitral kapak trombozu ve dev sol atriyum trombüsü: Transözofageal ekokardiyografi ve 64 kesitli bilgisayarlı tomografi bulgularının karşılaştırılması

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We report on the use of multidetector computed tomography (MDCT) in the diagnosis of prosthetic heart valve thrombosis and a giant left atrial (LA) thrombus extending into the LA appendage (LAA), in comparison with findings of transesophageal echocardiography (TEE). A 52-year-old woman with an eight-year history of mechanical mitral valve (MMV) replacement presented with progressive dyspnea. The electrocardiogram (ECG) showed atrial fibrillation. Transesophageal echocardiography showed severely increased MMV gradients and decreased MMV area. Two thrombi were identified on the atrial aspect of the MMV, one restricting the motion of the lateral leaflet, and the other localized on the septal side of the valve ring. Two other thrombi were also visualized, one in the LA and the other in the LAA, measuring 4.3x1.3 cm and 2.1x1 cm, respectively. ECG-gated 64-slice contrast-enhanced MDCT depicted a thrombus, involving both atrial and ventricular aspects of the MMV, and also a giant thrombus, 8.3x2.4 cm in size, in the LA extending into the LAA. The patient underwent redo-mitral valve replacement, LA thrombectomy, and LAA ligation, and was discharged uneventfully. The size and localization of thrombi in the LA and on the explant MMV matched to the findings of MDCT. In this case, MDCT was superior to TEE in showing the precise nature of both MMV thrombosis and the integrated thrombus involving the LA and LAA.

**Key words:** Atrial appendage/radiography; echocardiography, transesophageal; heart atria/radiography; heart valve prosthesis; thrombosis/diagnosis; tomography, X-ray computed.

Bu yazıda, prostetik kapak trombozu ve sol atriyum apandisine uzanım gösteren dev sol atriyum trombüsünün tanısında çokkesitli bilgisayarlı tomografinin (ÇKBT) kullanımı, transözofageal ekokardiyografi (TÖE) ile karşılaştırmalı olarak sunuldu. Sekiz yıl önce mekanik mitral kapak replasmanı yapılan 52 yaşındaki kadın hasta ilerleyici nefes darlığı ile başvurdu. Elektrokardiyografide atriyum fibrilasyonu görüldü. Transözofageal ekokardiyografide mekanik mitral kapakta (MMK) artmış gradiyent ve kapak alanında azalma ile birlikte, MMK'nin atriyum tarafında, biri lateral yaprakçığın hareketini kısıtlayan, diğeri ise kapak halkasının septal tarafında iki trombüs izlendi. Ayrıca, sol atriyumda ve sol atriyum apandisinde boyutları sırasıyla 4.3x1.3 cm ve 2.1x1 cm olan iki trombüs vardı. Elektrokardiyografi tetiklemeli, 64 kesitli kontrastlı ÇKBT ise, MMK'nin hem atriyum hem de ventrikül taraflarını tutan bir trombüs ve sol atriyum apandisine uzanım gösteren dev sol atriyum trombüsü (8.3x2.4 cm) gösterdi. Mekanik mitral kapak replasmanı, sol atriyum trombektomi ve sol atriyum apandisine ligasyon uygulanan hasta sorunsuz bir şekilde taburcu edildi. Sol atriyumdaki ve çıkarılan MMK'deki trombüslerin boyutları ve yerleşimi ÇKBT ile yapılan değerlendirmelere uygundu. Sunulan olguda, hem MMK'deki hem de sol atriyum ve apandisindeki bütünleşik trombozların gerçek özelliklerinin ortaya konmasında ÇKBT, TÖE'den daha üstündü.

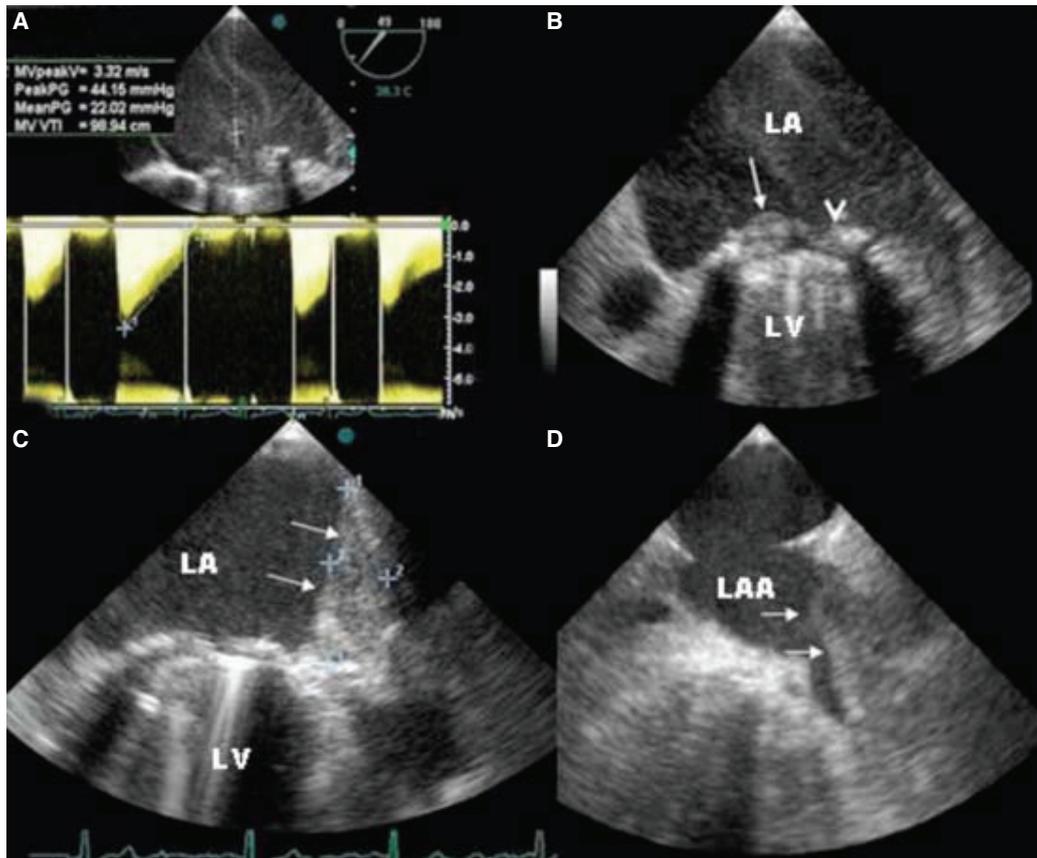
**Anahtar sözcükler:** Atriyum apandisi/radyografi; ekokardiyografi, transözofageal; kalp atriyumu/radyografi; kalp kapağı protezi; tromboz/tanı; bilgisayarlı tomografi.

Transesophageal echocardiography (TEE) has emerged as the most sensitive and specific technique for the detection of left atrial (LA) thrombi. Although initial studies suggested that TEE was better for

small LA appendage (LAA) thrombi compared to multidetector computed tomography (MDCT), these studies used standard lung protocols and older generation MDCT or electron beam computed tomog-

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**Figure 1.** (A) Transesophageal echocardiography showing decreased mechanical valve area and increased transprosthetic gradients. (B) Localization of the thrombus on the septal side (white arrow) and on the lateral side (arrow head) in the atrial aspect of the prosthesis. Two thrombi are seen (C) in the body of the left atrium (LA) and (D) as a distinct freestanding one in the left atrial appendage (LAA). LA: Left atrium; LAA: Left atrial appendage; LV: Left ventricle.

raphy scanners with inferior temporal and spatial resolution.

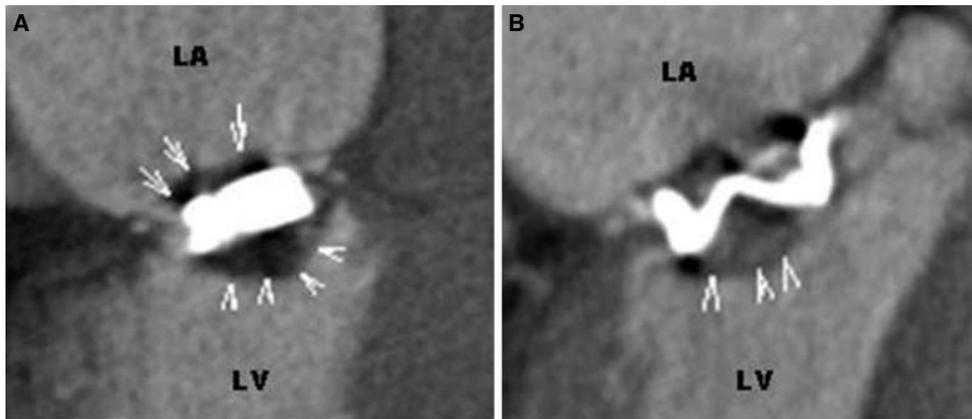
We report on a successful and accurate diagnosis of prosthetic heart valve thrombosis and associated giant LA thrombus extending into the LAA by MDCT.

### CASE REPORT

A 52-year-old woman with an eight-year history of mechanical mitral valve (MMV) replacement with a bileaflet prosthesis (St. Jude, No: 27) presented with progressive dyspnea of 10-day duration (New York Heart Association class II). Cardiovascular examination showed normal vital signs and moderately muffled MMV sounds. There were bilateral basal rales on lung auscultation. Examination of other systems yielded normal findings. The electrocardiogram (ECG) revealed atrial fibrillation with a heart rate of 104 beats per minute. Laboratory findings were unremarkable except for a subtherapeutic international normalized ratio of 1.4. Transthoracic and transesoph-

ageal echocardiography (TEE, Vivid 3, GE Medical Systems) showed severely increased MMV gradients (mean gradient 22 mmHg) and decreased MMV area (1.24 cm<sup>2</sup>) (Fig 1a) with dense spontaneous echocardiographic contrast in the LA and LAA. Two thrombi, one restricting the motion of the lateral leaflet, 2x1.1 cm in size, and the other on the septal side of the valve ring measuring 1x0.8 cm were identified on the atrial aspect of the MMV (Fig. 1b). Two other thrombi were also visualized by TEE, one in the body of the LA, 4.3x1.3 cm in size (Fig. 1c), and the other in the LAA, 2.1x1 cm in size (Fig. 1d).

She was scheduled for reoperation. After heart rate control with intravenous metoprolol administration, ECG-gated 64-slice contrast-enhanced MDCT was performed for the evaluation of coronary arteries, MMV, and LA before surgery, which depicted a mass, suggestive of thrombus, involving both atrial and ventricular aspects of the MMV (Fig 2), and also a giant thrombus measuring 8.3x2.4 cm in the LA



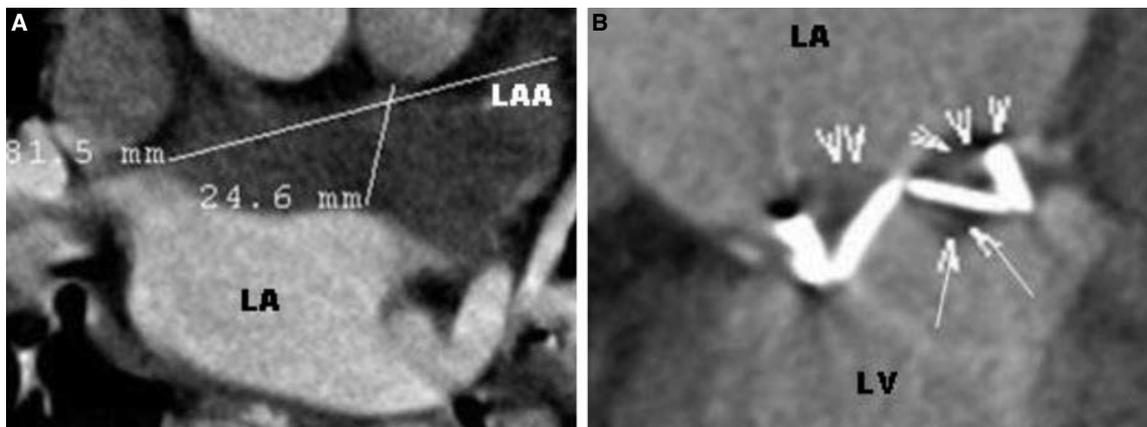
**Figure 2.** (A, B) Multidetector computed tomography depicted the thrombus involving both atrial (arrows) and ventricular (arrowheads) aspects of the prosthesis. LA: Left atrium; LV: Left ventricle.

extending into the LAA (Fig 3a). There were no significant stenoses in the coronary arteries. She underwent redo-mitral valve replacement, LA thrombectomy, and LAA ligation. The size and localization of thrombi in the LA and on the explant MMV matched to those estimated preoperatively by MDCT (Fig 3). The patient was discharged uneventfully 10 days after the operation.

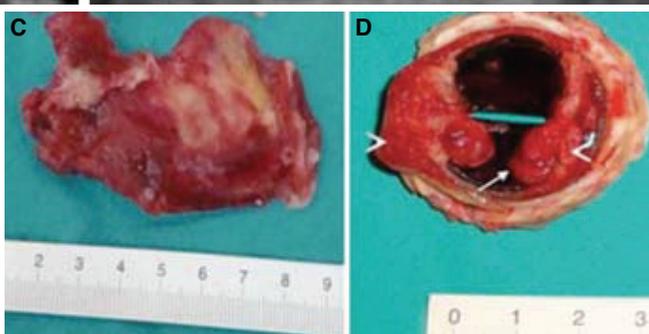
**DISCUSSION**

Prosthetic heart valve thrombosis (PHVT) is a rare but serious complication.<sup>[1]</sup> Patients may sustain sys-

temic embolism, acute pulmonary edema, circulatory collapse, or progressive dyspnea and typical findings include a diminished mechanical valve sound, decreased valve area, and increased transprosthetic gradients on Doppler echocardiography.<sup>[2]</sup> Surgery is recommended in patients with PHVT and a large LA thrombus.<sup>[3,4]</sup> Although TEE is the method of choice in evaluating patients with PHVT,<sup>[5]</sup> evaluation of mechanical aortic valves<sup>[6]</sup> and ventricular side of MMVs<sup>[2]</sup> by TEE is challenging due to their strong echo-reflective properties. Although the thrombus usually involves the atrial aspect of MMVs, those



**Figure 3.** Multidetector computed tomography images: (A) *En bloc* giant left atrial (LA) thrombus (8.3x2.4 cm) with its extending portion into the left atrial appendage (LAA), (C) which matched closely to the operative view. (B) Two thrombi on the atrial aspect of the prosthesis (arrowheads), one of them extending to the ventricular side (arrows). (D) Surgical view of the thrombus (arrowheads) located on the atrial aspect of the prosthesis, and the protruding portion (arrow) to the ventricular side through the valve orifice, causing restriction of leaflet motion. LA: Left atrium; LAA: Left atrial appendage; LV: Left ventricle.



involving the ventricular side may also cause obstruction or embolism. In this regard, in a previous report, we emphasized the use of MDCT for the evaluation of PHVT.<sup>[7]</sup> In our case, MDCT showed the MMV thrombus on the atrial side with its extension to the ventricular side, which most importantly was not noted by TEE.

Transesophageal echocardiography has proved to be the most sensitive and specific technique for the detection of LA thrombi.<sup>[8]</sup> Recent advances in MDCT allow accurate and consistent imaging of cardiac structures, including LA/LAA anatomy especially in patients undergoing electrophysiological procedures for ablation of atrial fibrillation.<sup>[9]</sup> Although the initial studies suggested that TEE was better for small LAA thrombi compared to computed tomography,<sup>[10-12]</sup> these studies used standard lung protocols and were restricted to older generation MDCT or electron beam computed tomography scanners with inferior temporal and spatial resolution. In a more recent study, detection of LA/LAA thrombus with 64-slice MDCT was also reported to be less reliable compared with TEE, possibly due to the lack of ECG-gating and specific volume parameters.<sup>[13]</sup> In contrast, in our case, ECG-gated 64-slice MDCT provided more precise information about the size, attachment site, and the integrity of the LA thrombus compared with TEE. The dimensions of the LA thrombus measured by MDCT was the same as that measured *in vitro*, which was two-fold of the size estimated by TEE. Of note, MDCT also showed that the thrombus involving the LA and LAA was of the same composition as confirmed surgically, rather than being a freestanding LAA thrombus as underestimated by TEE.

The use of MDCT for the evaluation of MMVs may have some limitations besides standard contraindications of MDCT imaging. Firstly, patients with PHVT and poor functional capacity (New York Heart Association class III-IV) may not be eligible for MDCT scan because of inability to lie in the supine position and comply with breath commands. Secondly, atrial fibrillation, the most common arrhythmia in patients with PHVT, remains a limitation for cardiac MDCT due to extreme beat-to-beat variability which may lead to severe motion artifacts.<sup>[14]</sup> However, the influence of heart rate variability on image quality in patients with atrial fibrillation undergoing cardiac MDCT has not been widely assessed.<sup>[15]</sup> In a recent study, 64-slice MDCT was found to reliably yield diagnostic-quality images of the coronary arteries in patients with atrial fibrillation.<sup>[16]</sup> In our patient with

chronic atrial fibrillation, high-quality images could be obtained by achieving heart rate control with intravenous metoprolol administration before the scan, and multiple phase reconstructions and ECG editing after the scan.

This case illustrates the successful and accurate diagnosis of PHVT and associated giant LA thrombus extending into the LAA by MDCT with surgical confirmation. The ability of ECG-gated 64-slice MDCT to detect PHVT, and thrombus involving the LA and LAA in comparison with TEE has yet to be defined.

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