

Pacemaker Lead Malposition Detected in the Left Ventricle with Intraoperative TEE

Intraoperatif TÖE ile Sol Ventrikülde Tespit Edilen Kalp Pili Lead Malpozisyonu

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ABSTRACT

Pacemaker lead malposition is a rare event that can cause serious complications. Here, we report a case of intraoperatively detected pacemaker lead malposition in a 68-year-old patient scheduled for coronary artery bypass grafting (CABG) after acute coronary syndrome.

A 68-year-old male underwent transvenous pacemaker placement after developing a complete arteriovenous block during coronary angiography. Transesophageal echocardiography (TEE) during the CABG procedure revealed a linear hyperechoic area extending into the left ventricle. The short-axis and apical images showed that the lead passed through the left atrium via the interatrial septum and then entered the left ventricle via the mitral valve. Since the malposition was an acute event, septal repair was performed together with the CABG.

This case report demonstrates the importance of TEE in cardiac surgery. The rapid detection of a malpositioned pacemaker lead using TEE can avoid the potentially serious consequences of this rare complication.

Keywords: Anesthesia, cardiovascular surgery, pacemaker, complication, lead, transesophageal echocardiography

ÖZ

Kalp pili lead malpozisyonu nadir görülen ancak ciddi komplikasyonlara yol açabilen bir durumdur. Akut koroner sendrom sonrası koroner arter bypass greft (KABG) ameliyatı planlanan 68 yaşındaki bir hastada intraoperatif olarak tespit edilen kalp pili lead malpozisyonunu sunuyoruz.

Altmış sekiz yaşındaki erkek hasta, koroner anjiyografi sonrası tam atriyoventriküler blok gelişmesi üzerine transvenöz kalp pili implantasyonu geçirdi. Koroner arter bypass greftleme sırasında, transözofageal ekokardiyografi (TÖE) incelemesinde sol ventriküle uzanan lineer hiperekojen bir görüntü tespit edildi. Kısa aks ve apikal görüntülerde, leadin önce interatriyal septumu geçerek sol atriya, ardından mitral kapaktan geçerek sol ventriküle ilerlediği görüldü. Malpozisyonun akut gelişmiş olması nedeniyle, KABG ile birlikte septum onarımı da planlandı.

Bu olgu, kardiyak cerrahide TÖE'nin pacemaker lead malpozisyonunun tespitindeki kritik rolünü vurgulamaktadır. Bu tür yerleşim hatalarının hızlı bir şekilde tanınması ve düzeltilmesi, komplikasyonların önlenmesi ve hasta sonuçlarının iyileştirilmesi açısından hayati öneme sahiptir.

Anahtar sözcükler: Anestezi, kardiyovasküler cerrahi, kalp pili, komplikasyon, lead, transözofageal ekokardiyografi

INTRODUCTION

Very few cases of cardiac pacemaker lead malposition have been reported in the literature, such that the incidence of this rare complication and the clinical conditions under which it may occur are not well understood (1). However, a malpositioned cardiac lead may cause serious structural damage and trigger thromboembolic events, especially if the lead is located in the left atrium and ventricle. Among the methods used to confirm lead placement are fluoroscopy, echocardiography, direct radiography, and tomography (2). Of these, echocardiography is preferred because it is noninvasive and can be performed at the bedside.

Here we report a case of a malpositioned lead in a patient with acute coronary syndrome who underwent transvenous pacemaker placement after developing a complete atrioventricular (AV) block during angiography. During the coronary artery bypass graft (CABG) procedure, performed to treat his acute coronary syndrome, transesophageal echocardiography (TEE) revealed passage of the lead through the interatrial septum (IAS) into the left atrium and left ventricle. Detection of the malpositioned lead using TEE allowed the repair of the damaged IAS in conjunction with the previously planned CABG procedure.

Received/Geliş tarihi : 03.03.2025

Accepted/Kabul tarihi : 08.07.2025

Publication date : 30.10.2025

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Cite as: Ozdemir C, Yigiter EN, Tak S, Iriz E, Unal Y. Pacemaker lead malposition detected in the left ventricle with intraoperative TEE. JARSS 2025;33(4):322-325.



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CASE PRESENTATION

A 68-year-old male was admitted to an external emergency department due to acute worsening of dyspnea and left arm pain for the last 20 days. Neither comorbidities nor medication use were reported in his medical history. Following a preliminary diagnosis of non-ST-segment elevation myocardial infarction based on elevated high-sensitivity troponin and creatine phosphokinase-MB levels without any electrocardiogram (ECG) changes, he was started on antiplatelet and anticoagulant therapy. During coronary angiography, the patient developed a complete AV block, necessitating the implantation of a transvenous pacemaker lead in the right atrium via the right femoral vein (mode: VVI, rate: 80 ppm, output: 10 mA). As the patient also had a fully occluded right coronary artery (RCA), a stent was placed distal to the artery and flow was established. A CABG was planned to treat his other coronary lesions, including in the distal RCA. The patient was therefore transported to the Gazi University Faculty of Medicine. Transthoracic echocardiography performed in the cardiovascular surgery clinic showed that the left ventricular chamber size and wall thickness were normal but the inferior wall and middle base of the posterior wall were hypokinetic. His pulmonary artery pressure (PAP) was 30 mmHg and his ejection fraction (EF), measured using the modified Simpson method, was 46%. The position of the pacemaker lead in the right heart chambers was as expected. No thrombus was detected in the heart chambers whereas first-degree regurgitation in both the mitral and tricuspid valves was noted.

On the day of CABG surgery, the patient was hemodynamically stable, with a 2 L min^{-1} oxygen requirement, and was taken to the operating room. As he remained pacemaker-dependent due to the persisting AV block, his pacemaker was set to V00 mode as a precaution. The ECG and oxygen saturation (SpO_2) monitoring were performed. After the uneventful induction of anesthesia using thiopental, fentanyl, and rocuronium, the patient was intubated. The radial and femoral arteries were cannulated for invasive arterial blood pressure monitoring. Central venous catheterization was performed via the right jugular vein to allow fluid and blood transfusion. A temperature probe was placed in the esophagus for temperature monitoring. During TEE, the patient's EF was consistent with the preoperative evaluation. However, the mid-esophageal 4-chamber view revealed a hyperechoic linear line starting from the superior vena cava, passing through the IAS to the left atrium, and extending to the left ventricle over the mitral valve (Figure 1), interpreted as pacemaker lead malposition. To determine how the pacemaker lead had crossed from the IAS into the left atrium, the septal region was re-evaluated in detail.

In the mid-esophageal 120° bicaval view (Figure 2), air bubbles were seen passing from the right atrium to the left atrium via the IAS during the administration of agitated saline through the central catheter. The passage area of the air bubbles was not consistent with patent foramen ovale (PFO) (Figure 3). The mitral valve was examined for possible structural damage using a 0° transgastric view. Color Doppler imaging showed that the anterior and posterior valves moved freely and that leakage occurred only at the lead position (Figure 4). Based on the TEE findings, the CABG was revised to include IAS repair. The IAS perforation was confirmed during surgery. The patient's PAP was within the normal range during intra-operative TEE. However, the patient's end-tidal carbon dioxide was significantly lower than the arterial measurement ($> 10 \text{ mmHg}$) and his tricuspid annular plane systolic excursion was $< 17 \text{ mm}$, indicating right heart failure. To manage the isolated right heart dysfunction in the presence of a normal

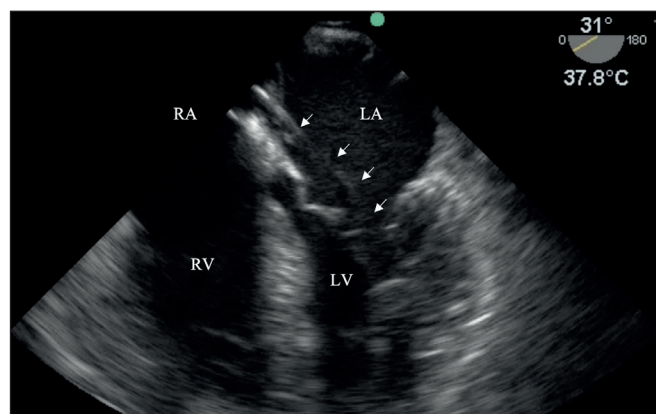


Figure 1. The mid-esophageal 4-chamber image shows the pacemaker lead (arrows) passing from the RA to the LA via the interatrial septum and reaching the LV through the mitral valve. RV: Right ventricle, LV: Left ventricle, RA: Right atrium, LA: Left atrium.

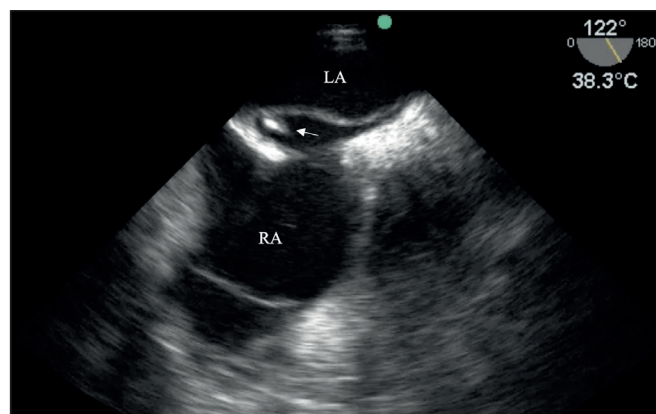


Figure 2. The mid-esophageal 120° bicaval view shows the lead passing through the interatrial septum. RA: Right atrium, LA: Left atrium.

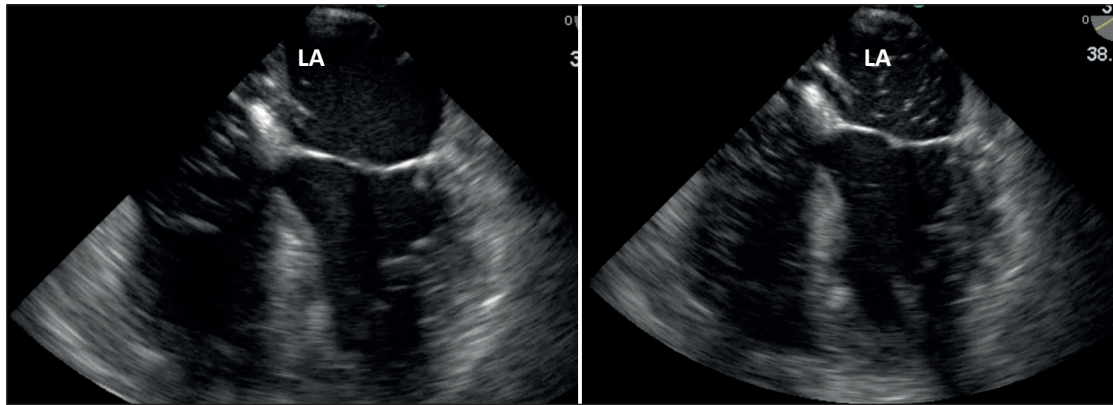


Figure 3. The mid-esophageal 4-chamber view shows that agitated saline delivered through the central catheter passes from the right to the left atrium through the perforated interatrial septum. **LA:** Left atrium.

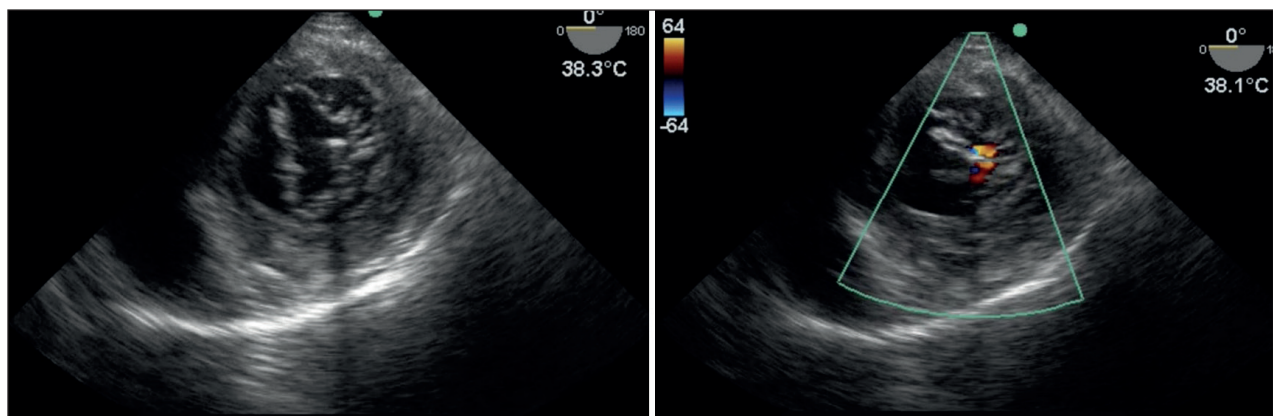


Figure 4. The mitral valve is seen in the transgastric view. The lead close to the posterior cusps may cause leakage in this area. There was no leakage outside this area and the anterior and posterior cusps could move freely.

PAP, the patient was administered a combination of dobutamine $8 \mu\text{g kg}^{-1} \text{min}^{-1}$ and $0.1 \mu\text{g kg}^{-1} \text{min}^{-1}$ of norepinephrine infusions intravenously. Nonetheless, his hemodynamics deteriorated further and an intra-aortic balloon pump (IABP) was therefore inserted. As this measure did not improve the patient's hypotension and his oxygenation level continued to deteriorate, he was placed on extracorporeal membrane oxygenation (ECMO). Arterial cannulation was achieved with a right subclavian artery graft and venous cannulation via the femoral vein. The patient was transferred to the intensive care unit with veno-arterial ECMO, an IABP, and inotropic support. Following stabilization of his hemodynamics, the venous and arterial cannulas were removed and the pump process was terminated.

DISCUSSION

Lead malpositioning is a rare complication of cardiac pacemaker implantation, with rates varying between 1.7% and 12.4% (3,4). Anatomical variations, especially PFO, are the most common cause while the most common route is via the

IAS. In some cases, such as in our patient, the lead perforates the left atrium and becomes lodged in the left ventricle (5).

Inadvertent placement of a ventricular lead into the left ventricle is a rare complication during cardiovascular implantable electronic device implantation. In a retrospective study of 2579 patients undergoing pacemaker implantation, 6 patients (0.34%) had inadvertent lead malposition in the left heart. Lead malposition in the left ventricle can lead to serious cardiovascular complications including mitral valve damage, mitral regurgitation, left ventricular thrombus, and stroke (6,7). However, there are few reports of lead migration into the left ventricle (8-10).

Left ventricular lead malposition can be seen on an ECG, two-dimensional echocardiogram, or chest computer tomography (CT) scan (11,12). An ECG showing accelerated QRS complexes with right bundle branch block morphology suggests left ventricular pacing but cannot definitively establish the diagnosis or guide treatment. Two-dimensional echocardiograms and chest CT scans can demonstrate lead placement. However, they are not useful intraoperatively. Ra-

diographically, it may be very difficult to distinguish left ventricular lead malposition from that in the middle cardiac vein or coronary sinus; chest CT scans or two-dimensional echocardiograms may be necessary.

Diagnosis of lead malposition under TEE guidance and monitoring of the patient require significant experience and knowledge. Transesophageal echocardiography guidance facilitates diagnosis, the exact location of the defect is determined, surgical intervention is facilitated, and the presence of a possible residual defect after repair can be investigated. we have successfully detected and managed a lead malposition during preoperative TEE evaluation. The importance of echocardiography has also been emphasized in similar case reports by Teshome and Contractor (13,14).

The treatment of left ventricular lead malposition depends on the clinical picture, the time of implantation, and the occurrence of complications. If the diagnosis is made soon after pacemaker implantation, percutaneous lead removal may reduce the risk of future thromboembolic events without the need for lifelong anticoagulation. Since the malpositioning in our patient was an acute event, detected during TEE, the lead position could be corrected and the atrium repaired in conjunction with the planned CABG. Ours is the first reported case in which a malpositioned lead was detected during intraoperative TEE.

Conflict of Interest: The authors have no conflict of interest to declare.

Funding: None

Informed Consent: The authors confirm that the patient's written consent for the submission and publication of this case report, including images and associated text, was obtained in accordance with the guidelines of the Publication Ethics Committee of the Gazi University Faculty of Medicine.

AUTHOR CONTRIBUTIONS

Conception or design of the work: CO

Data collection: ENY

Data analysis and interpretation: ST

Drafting the article: EI

Critical revision of the article: YU

The author (CO, ENY, ST, EI, YU) reviewed the results and approved the final version of the manuscript.

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