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THE FOUR CORNERS: CLINICAL VIGNETTE CORNER

# Enhancing Diagnostic Precision

## Intracardiac Echocardiography-Guided Endomyocardial Biopsy for Complex Right Atrial Mass

Catarina Gregório, MD, Marta Vilela, MD, Catarina Oliveira, MD, Fausto J. Pinto, MD, PhD, Miguel Nobre Menezes, MD

**ABSTRACT**

An 80-year-old woman with a history of B-cell non-Hodgkin lymphoma presented to the emergency department with exertional dyspnea and lower limb edema. A transthoracic echocardiogram revealed a large extracardiac mass invading the right atrium. A diagnostic transcatheter endomyocardial biopsy guided by intracardiac echocardiography was performed. This case highlights the role of intracardiac echocardiography in enabling unusual endomyocardial biopsy targeting, allowing for correct positioning of the bioptome, adding to the procedure's safety and precision, mainly when performed on atrial masses. (JACC Case Rep. 2024;29:102864) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

An 80-year-old woman with a dual-chamber pacemaker and a history of splenic marginal zone lymphoma diagnosed in 2018 and treated with splenectomy presented to the emergency department with progressive exertional dyspnea and lower limb edema. Transthoracic echocardiogram (TTE) revealed an incidental extracardiac mass (65 × 22 mm) in the right atrioventricular groove, with apparent invasion of the right atrium (RA) and circumferential pericardial effusion (**Figure 1A**, Videos 1 and 2). Cardiac computed tomography showed a large mass adjacent to the anterior and inferior walls of the RA, suggestive of a mural thrombus (**Figure 1B**).

**TAKE-HOME MESSAGES**

- EMB is crucial in diagnosing and guiding therapy for intracardiac masses based on histopathologic analysis. However, when targeting masses in the RA, this procedure carries a higher risk of complications, notably perforation and tamponade.
- Procedures guided by ICE are effective, safe, and accurate in localizing tissue, thereby minimizing procedural complications.

From the Department of Cardiology, Centro Hospitalar Universitário Lisboa Norte,Centro Cardiovascular da Universidade de Lisboa (CCUL@RISE), Faculdade de Medicina da Universidade de Lisboa, Centro Académico de Medicina de Lisboa, Lisbon, Portugal.

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**ABBREVIATIONS AND ACRONYMS**

**EMB** = endomyocardial biopsy

**ICE** = intracardiac echocardiography

**RA** = right atrial/atrium

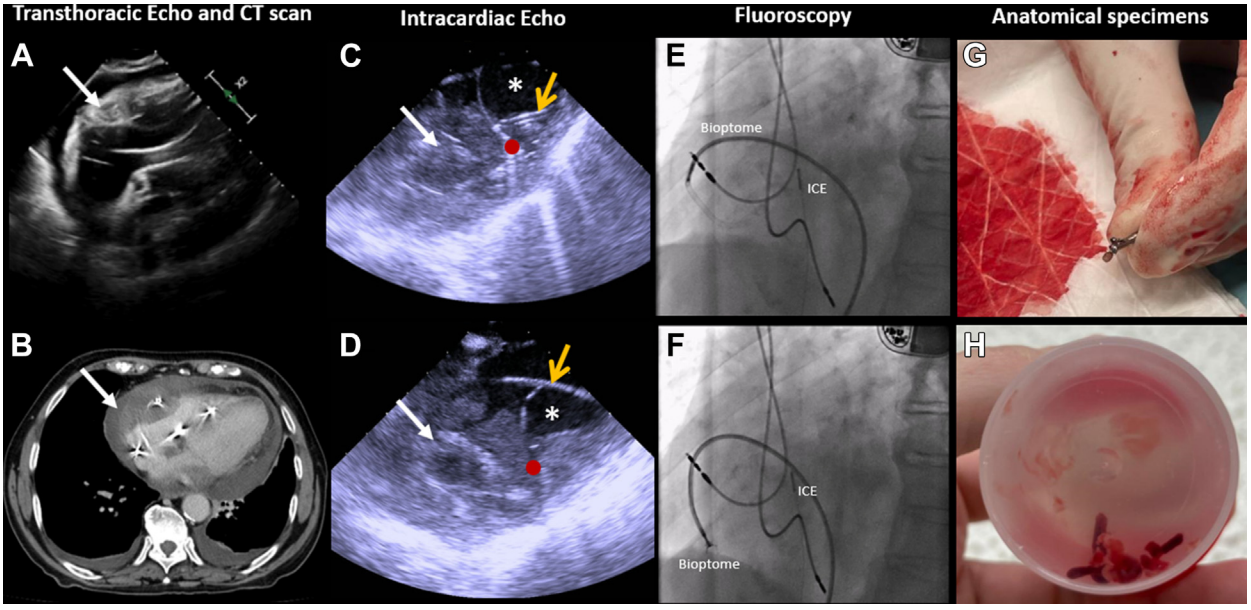
**TTE** = transthoracic echocardiogram

The patient underwent cardiac magnetic resonance imaging, which confirmed an extracardiac mass extending over the right chambers and major cardiac vessels, infiltrating the RA and involving the course of the right coronary artery. The mass exhibited T2 hyperintensity, evidence of perfusion, and scattered areas of late gadolinium enhancement, characteristics suggestive of malignancy. The differential diagnosis for the mass included thrombus, metastatic, or primary malignancy. Due to her previous oncologic history, there was a high suspicion of recurrent lymphoma.

A multidisciplinary discussion was held, and a shared decision-making approach was pursued. Histopathological diagnosis was deemed essential for defining a therapeutic strategy. Considering the risk profile of open chest surgery, without direct prognostic benefit in an unresectable mass, it was decided to proceed with percutaneous endomyocardial biopsy (EMB), given that the mass appeared to invade deeply into the atrial wall.

The procedure was undertaken by an operator with both extensive expertise in EMB (including of the left ventricle), and intracardiac echocardiography (ICE) (because he is also an operator for ICE-guided septal and left atrial appendage procedures) and was initially guided by fluoroscopy and TTE (Video 3). Given that the latter proved insufficient for an appropriate definition of the mass and catheter directing, a decision was made to proceed with an ICE-guided biopsy. The right femoral vein was used, with the placement of a 7-F sheath for the guide catheter and an 8-F sheath for the ICE probe. Transfemoral venous access was preferred over the transjugular route, because we were concerned that the pacemaker leads might render manipulating additional equipment through the superior vena cava more challenging. Notwithstanding, we believe the transjugular route would also have been viable, because a guide catheter might have been easier to maneuver, given the relatively lateral and inferior position of the mass. We therefore would have used this route if we had been unsuccessful via the femoral vein.

**FIGURE 1** Echocardiographic, Cardiac CT, and ICE Images of the Mass, Fluoroscopy and Anatomic Specimens Obtained From Endomyocardial Biopsy




(A) Transthoracic echocardiogram subcostal view showing an extracardiac mass invading the right atrium, in relation to the atrial pacing catheter. (B) Cardiac CT revealed a right intra-atrial mass, adjacent to the anterior and inferior walls, laminar in appearance, suggestive of a mural thrombus. (C) ICE-guided biopsy of the right atrium mass: a large mass is observed in the right atrium, crossed by the atrial pacemaker lead, with the intervention catheter directed toward the mass. (D) ICE-guided biopsy of the right atrium mass (other view): ICE guides the intervention catheter to ensure optimal sampling from the core without penetrating the thin atrial wall. (E, F) Fluoroscopy with the ICE catheter, introducer, bioptome. (G, H) From the same patient, tissue samples were retrieved from the cardiac mass. White arrows denote the cardiac mass, yellow arrows refer to the intervention catheter, red dots correspond to the atrial pacemaker lead; and asterisks correspond to the atrial cavity. CT = computed tomography; ICE = intracardiac echocardiography.

The ICE images showed a large mass with multiple papillary projections infiltrating the free wall of the RA (**Figures 1C and 1D**, Videos 4 and 5).

Initially, sampling was attempted with a 5-F Maslanka bioptome directed by a 7-F JR 3,5 guide catheter, but the bioptome could not be placed deep inside the mass. A 7-F JL 3,5 catheter was then chosen, and a less rigid 5,4-F Cordis bioptome was used instead. This combination enabled proper placement of the forceps system relative to the mass, along with selective steering of the bioptome (**Figures 1E and 1F**, Video 6). A total of 6 samples were retrieved directly from the bioptome forceps (**Figure 1G**, Video 7). As the catheter was aspirated between attempts, further larger mass fragments were also obtained (**Figure 1H**). The procedure was concluded without complications, and the histopathologic analysis showed a fibrin-associated diffuse large B-cell lymphoma, confirming our main diagnostic suspicion. This information fundamentally changed the clinical course of the patient, because our hematology department was then able to start appropriate treatment with confidence and avoid more invasive procedures, such as open-heart surgery.

The ICE-guided approach enables accurate localization of cardiac structures and precise positioning of the bioptome. This was especially relevant in this case, given the unusual location of the mass in the RA, which is readily accessible with ICE, since it is the very heart chamber through which one enters the heart with the probe. Although it may be placed in any chamber and thus aid in biopsy in all locations, we believe it may be especially useful for atrial biopsies. This is because maneuvering the ICE probe inside the atria is easier, as it does not require a lot of probe tilting and tension. Placing the probe on the left atrium is more challenging but perfectly feasible for operators familiar with the technique. On the other hand, ICE may be less useful for ventricular masses—in such cases, not only is the probe harder to stabilize in an exact position, but also, simple TTE is often helpful enough.

ICE also enables reduced radiation exposure and shortened procedure time. This tool reduces the risk of complications, particularly RA perforation and cardiac tamponade. Finally, it is performed without additional sedation or general anesthesia, minimizing discomfort for the patient and overcoming the limitations of transesophageal echocardiography-guided EMB.[1] Notwithstanding, it is worth noting that ICE imaging has some degree of a learning curve, and we believe this approach should be used by operators with more than minimal ICE experience, if sampling the RA. If sampling the left atrium, we believe experienced ICE operators are required.

In conclusion, multimodality cardiac imaging is essential for diagnosing cardiac masses. However, histologic diagnosis is crucial for initiating targeted therapy. Guide catheter-directed EMB is safe and effective for sampling the left ventricle,[2,3] but very limited data are available regarding the additional use of ICE. This case report describes the use of ICE for transcatheter biopsy of a cardiac mass as an attractive modality, especially for unusual locations, namely, atrial.

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**ADDRESS FOR CORRESPONDENCE:** Dr Miguel Nobre Menezes, Department of Cardiology, Hospital Universitário de Santa Maria, Centro Cardiovascular da Universidade de Lisboa (CCUL@RISE), Faculdade de Medicina da Universidade de Lisboa, Centro Académico de Medicina de Lisboa, Av Prof Egas Moniz MB, 1649-028 Lisboa, Portugal. E-mail: mnmenezes.gm@gmail.com.

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**KEY WORDS** cardiac mass, echocardiography, endomyocardial biopsy, fluoroscopy, intravascular ultrasound

**APPENDIX** For supplemental videos, please see the online version of this paper.