

# Case of a malignant cardiac lymphoma in which a tumour biopsy was guided by the combined use of intra-cardiac ultrasound and a novel steerable sheath visualized by a three-dimensional mapping system

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## Case description

A 73-year-old woman presented with a cardiopulmonary arrest during treatment for heart failure and was transferred to our hospital. Transthoracic echocardiography showed a 24 × 27 mm mobile mass in the right atrium (Figure 1A). A fever, enlarged lymph nodes, and elevated soluble interleukin-2 receptors highly indicated a primary cardiac lymphoma. Contrast-enhanced computed tomography showed an extensive mass invasion from the right atrium involving the tricuspid valve ring, enlarged mediastinal lymph nodes, and enlarged gastric lesser curvature lymph nodes. However, no lesions that could be sampled percutaneously were detected. Initially, we considered an open chest method for a reliable tissue collection. However, due to the high degree of patient invasion, we opted for the following method, which was non-invasive and could reliably guide the biopsy forceps into the target tissue. An urgent pathological biopsy was performed for a rapid pathological diagnosis due to the high risk of a tumour embolization on day 7. An intra-cardiac echo (ICE) and three-dimensional electroanatomic

mapping system (EAM)-guided biopsy were performed. After the delineation of the targeted tumour on the EAM by ICE, biopsy forceps were guided to the tumour via an EAM-visualized steerable sheath (Figure 1B, C and Supplementary material online, Movie S1). A sufficient volume of the specimen was successfully obtained. A pathological evaluation diagnosed it as a diffuse large B-cell lymphoma (Figure 1D). Chemotherapy (R-CHOP) was started on day 18, and the patient was discharged on day 31 after a significant reduction in the tumour mass (Figure 1E).

Although a surgical resection with a diagnostic treatment is generally the standard biopsy for cardiac tumours, the indications for percutaneous myocardial biopsy have also been described in representative review articles. To the best of our knowledge, this is the first report of a non-invasive and accurate real-time guidance of biopsy forceps via a novel visualized sheath by an EAM during cardiac biopsies. The steerable sheath tip was guided close to the target tumour, and the depth of the forceps' insertion was confirmed by ICE imaging, allowing for a non-invasive, safe, and reliable biopsy to be performed.

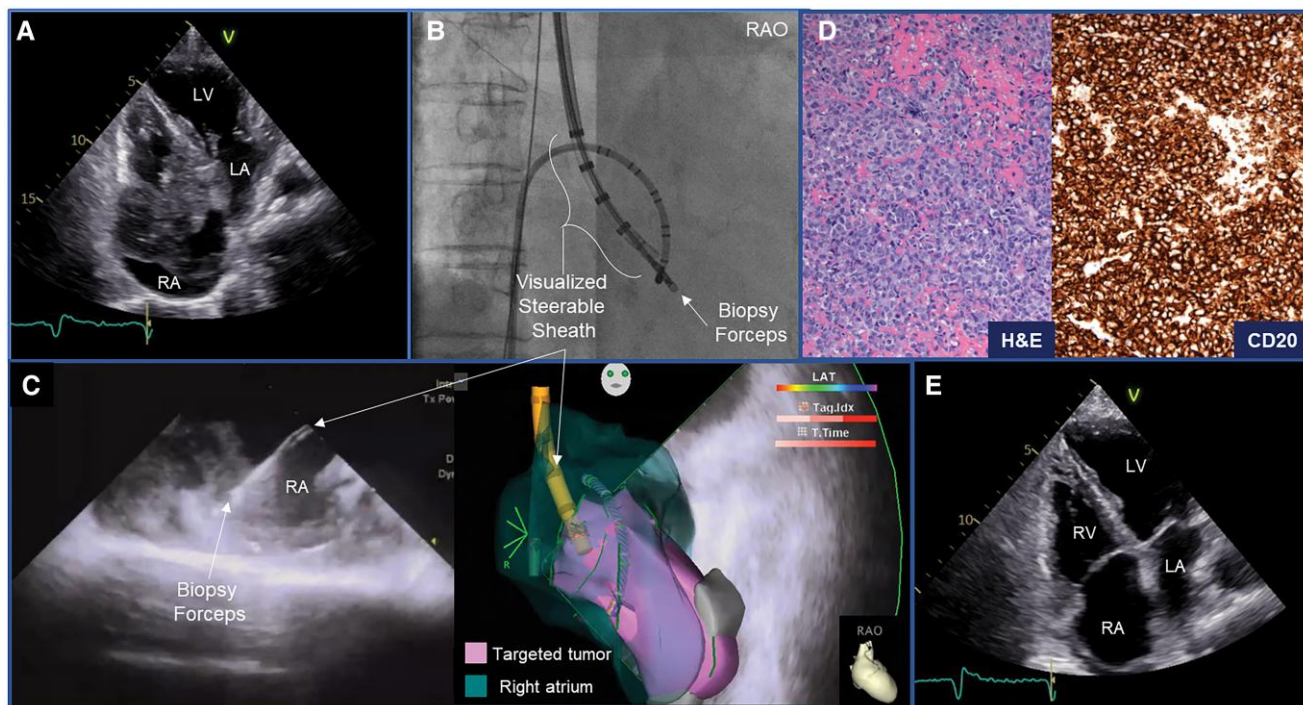
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**Figure 1** (A) Four-chamber view of the transthoracic echocardiography. A mobile mass lesion was found in the right atrium, with a suspected infiltration from the lateral wall of the right atrium to the tricuspid valve ring. (B) Fluoroscopic image. Biopsy forceps via a visualized steerable sheath inserted through the internal jugular vein. (C) Left: Biopsy forceps inserted into the target tumour delineated by intra-cardiac echo. Right: Real-time guided target tumour and visualized steerable sheath viewed by the electroanatomic mapping system. The target tumours were created from the intra-cardiac echo. (D) Pathological evaluation. The tumour is composed of a diffuse sheet of large lymphoid cells with abundant cytoplasm, large nuclei, and prominent nucleoli (Hematoxylin and eosin stain [H&E]). The tumour cells are positive for CD20. (E) The tumour dramatically disappeared after chemotherapy. LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.

## Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

**Consent:** The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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## Data availability

The data underlying this article are available in the article and in its on-line [supplementary material](#).