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Clinical Image

CLINICAL IMAGE

Direct ICE imaging from inside the left atrial appendage during ablation of persistent atrial fibrillation

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Abstract

We present the case of a 59-year-old patient with persistent atrial fibrillation, referred for atrial fibrillation ablation. The procedure was performed with the help of NAVX 3D mapping system (Saint Jude Medical) and iLAB Ultra ICE Plus ultrasound imaging catheter (Boston Scientific). The catheter permits cross-sectional images perpendicular to catheter's long axis. From inside left atrial appendage (LAA) looks trabeculated, due to pectinate muscles running parallel to each other. The presence of a thrombus was excluded from the appendage. The contractility of LAA was also assessed using multiple frames recorded on videotape. Our case demonstrates that LAA's morphology and function can be directly assessed by intracardiac ultrasound with the probe inserted inside the appendage.

INTRODUCTION

A 59-year-old obese and hypertensive male with persistent atrial fibrillation was referred to our cardiology department for persistent atrial fibrillation ablation. Before the procedure, the patient underwent transesophageal echocardiography that excluded a left atrial thrombus and the LAA filling velocity was 45 cm/s. CT imaging using a contrast medium was also conducted prior to ablation to assess the anatomy of the left atrium, and identified four distinct pulmonary veins.

The ablation procedure was performed using the NAVX electroanatomical mapping system (Saint Jude medical) and the iLAB UltraICE Plus ultrasound imaging catheter (Boston Scientific). A 8Fr Agilis sheath was inserted through the femoral vein for the ultrasound catheter and a 8Fr SL-0 sheath for the Brockenbrough needle. After performing transseptal puncture with the Brockenbrough needle [1], both sheaths were inserted inside the left atrium and the ultrasound catheter was placed inside different anatomical structures, including the pulmonary veins and left atrial appendage. The catheter permits cross-sectional images perpendicular to catheter's long axis. The images were displayed on the Boston ultrasound console and recorded on videotape [2]. Rotational images of the left atrial appendage at 1800 rpm, with a 9 MHz catheter were obtained. From inside, LAA looks trabeculated, due to pectinate muscles running parallel to each other [3,4]. The presence of a thrombus was once again excluded. However, ICE imaging from inside the left atrial appendage cannot totally exclude a distal thrombus because the apex of the appendage is not reached with the

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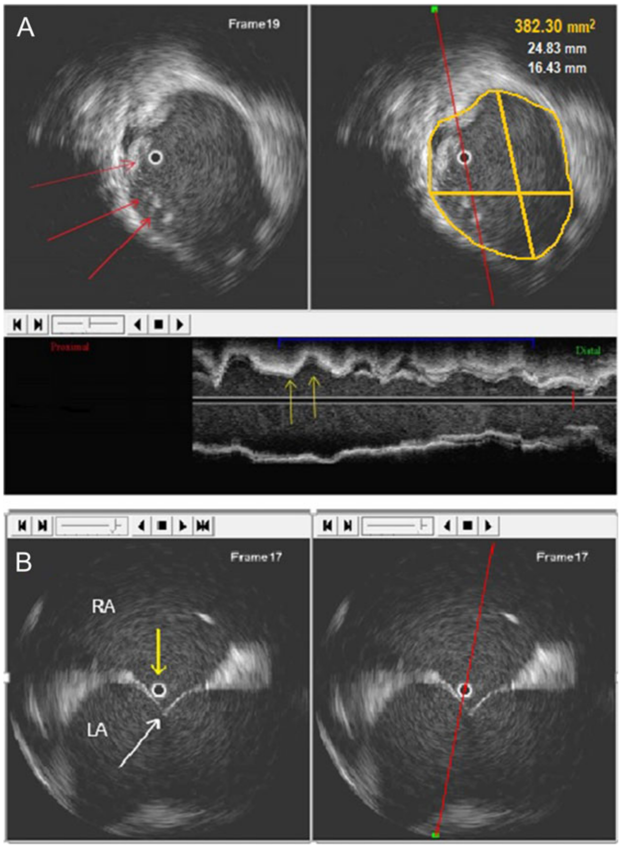

Figure 1: Intracardiac echocardiography using the Ultra ICE Boston Scientific ultrasound system. 1**A**. Intracardiac echocardiographic imaging from inside the left atrial appendage. The ICE catheter in the middle of the image. The transducer images in a plane radial to the tip. The 360° acoustic arc of the ultrasound catheter produces a cross-sectional image of the LAA. The measured area of LAA is 3.82 cm^2. Contractions of the appendage are clearly displayed in the lower part of the Figure 1A with the help of yellow arrows. 1**B**. Intracardiac echocardiographic imagind during transseptal puncture. The transseptal needle is inside the right atrium, tenting the fossa ovalis and pushing it into the left atrium. White arrow: BRK transseptal needle against the interatrial septum. Yellow arrow: ICE catheter in the middle of the image. LA, left atrium; RA, right atrium.

ICE probe. The contractility of LAA was also assessed using multiple frames recorded on videotape (Figure 1). Obtained images correspond to those acquired by transesophageal echocardiography using various imaging planes [5].

DISCUSSION

ICE provides superior image quality of the left atrium compared to transesophageal or transthoracic echography. Whether or not ICE can provide systematic, diagnostic images of the LAA with the consistency of TEE remains unproven [6]. The value of ICE for detecting LAA thrombus remains also to be demonstrated [7,8].

Transseptal puncture with ICE is most valuable in case of: (i) anatomical variations of the pulmonary veins. During PV ablation, ICE can show individual PV anatomy, such as number of PVs, the presence of a common trunk or additional PVs, that may affect the ablation strategy [9]; (ii) dilatation of the left atrium—will direct the foramen ovale more posterior and ICE can be helpful to avoid puncture of the posterior left atrial wall [9,10]; (iii) dilatation of the aortic root—also will direct foramen ovale more posterior [9,10]; (iv) pericardial patches for atrial septal defect—implies a systematically use of ICE for transseptal puncture [9]; (v) occlusion devices in the region of foramen ovale: ICE guidance permits the approach through the superior or inferior limbus [9–11]; (vi) dextrocardia—in this case, the puncture should be performed with the needle pointing to 7'o clock instead of 5 o'clock [9]; (vii) in case of difficult fluoroscopy-guided transseptal puncture, ICE is also helpful [9,10]; (viii) in case of difficult electrical isolation of PVs due to incorrect contact with the venous antrum. An optimal delivery of energy to the tissue with a good endocardial contact can be obtained using ICE [9,10].

One of the most important complications related to transseptal puncture is cardiac wall perforation with subsequent pericardial effusion or tamponade. ICE permits continuous monitoring of the pericardial space during the procedure, with prompt diagnosis of pericardial effusion and facilitates pericardial puncture when needed [9].

Other risk with transseptal puncture is thrombus formation. ICE allows detection of thrombi inside LAA, left atrium or on the transseptal sheath, and permits monitoring of the thrombus during increased dose of Heparine [10]. ICE has the same risk of vascular access and right heart catheterization as with other EP catheters introduced through the femoral vein. Although data are lacking, by manipulation ICE catheter through the interatrial septum there is always the risk of perforating the left atrium or left atrial appendage [11,12].

ICE was specifically performed in our case because: (i) transseptal puncture was carried out under ICE guidance; (ii) we confirmed the absence of LAA thrombus which was in concordance with TEE; (iii) ICE helped us visualize the PV ostium and the endocardial contact of the ablation catheter with the ostium. The ridge between LAA and LSPV was very difficult to ablate and necessitated multiple RF applications both from the venous aspect of the ridge and from the LAA and (iv) we looked for microbubbles formation during RF application. In case of excessive microbubbles we stopped ablation to prevent coagulum formation.

CONCLUSION

This case illustrates that left atrial appendage's morphology and function can be directly visualized by intracardiac ultrasound with the probe inserted inside the appendage through a transseptal puncture. LAA direct ultrasound seems to be feasible and is a useful tool to exclude the presence of a thrombus or spontaneous echo contrast, to confirm the normal contraction and to guide radiofrequency application at the base of the appendage with good tissue contact in patients with persistent atrial fibrillation.

CONFLICT OF INTEREST STATEMENT

None declared.

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ETHICS APPROVAL

Not required.

CONSENT

The patient provided consent for case description and personal echo images to be published.

GUARANTOR

Dr Cismaru Gabriel.

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