

# Intracardiac echocardiography for invasive procedures performed in the left atrium -- an underestimated safety guard technictechnique?

Jakub Baran<sup>1,A-D,F</sup>, Sebastian Stec<sup>2,B-C</sup>, Piotr Kułakowski<sup>3,C-F</sup>

A - Research concept and design, B - Collection and/or assembly of data, C - Data analysis and interpretation, D - Writing the article, E - Critical revision of the article, F - Final approval of article

1. Postgraduate Medical School Warsaw, Szpital Grochowski

2. Klinika Kardiologii CMKP

3. CMKP

## Address for correspondence:

Jakub Baran, Postgraduate Medical School Warsaw, Szpital Grochowski  
email: j.baran@sampi.pl

Sebastian Stec, Klinika Kardiologii CMKP  
email: smstec@wp.pl

Piotr Kułakowski, CMKP  
email: kulak@kckcmkp.pl

Received: 2018-01-02

Revised: 2018-12-09

Accepted: 2018-12-10

Final review: 2018-12-10

DOI: 10.24255/hbj/100629

## Key words:

atrial fibrillation, Thrombusthrombus, intracardiac echocardiography.

## Abstract

Ablation in the left atrium has become the standard of care for patients with atrial fibrillation, however, it may be associated with severe complications. On-line imaging using intracardiac echocardiography (ICE) is one of the modern options to visualize cardiac chambers during the procedure, which allows early detection of complications and

prompt treatment. We present a case of a 69-year-old female woman who developed massive thrombi in the right and left atrium, followed by thrombosis of coronary arteries and haemodynamical complications. Rapid detection of these phenomena using ICE enabled prompt effective treatment and a good outcome.

## Background

Interventional procedures in the left atrium (LA) have become the standard of care for patients with atrial fibrillation (AF). There is growing evidence that AF ablation<sup>[1]</sup> and left atrial appendage (LAA) occlusion<sup>[2]</sup> reduce the risk of stroke. However, periprocedural complications are still an important issue due to known and unknown prothrombotic risk factors. One potential solution to improve patient safety is better intraprocedural visualization of cardiac chambers, which may reveal complications in the early stage of procedures and provide an opportunity to start proper action. Herein we report

the usefulness of intracardiac echocardiography (ICE) in early detection of thrombotic complications during AF ablation.

## Case Presentation

A 69-year-old woman with a CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 1 and prior effective anticoagulation, confirmed by four weekly performed consecutive laboratory INR (international normalized ratio) examinations (all results > 2.0), was scheduled for AF ablation. Before the procedure, the patient was in AF lasting less than 24 hours. Apart from standard electrophysiological catheters, an ICE probe was introduced into the right atrium

(RA) and pulmonary artery (PA). In addition, another ICE probe was placed in the esophagus (Figure 1) to assist in the

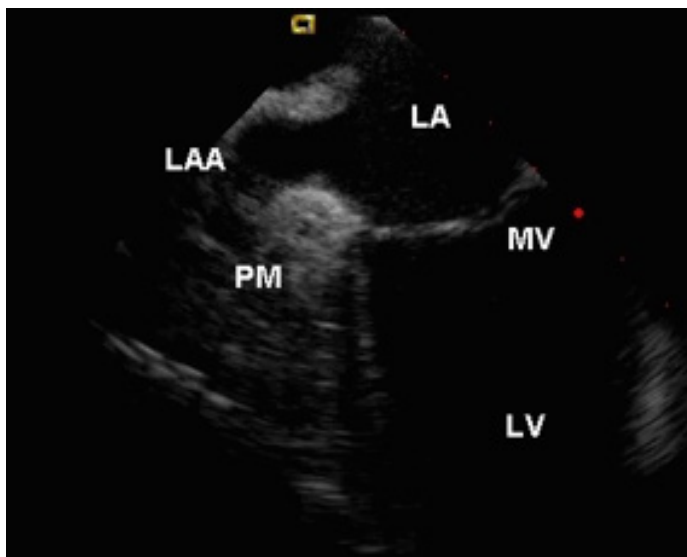


Figure 1. ICE probe located in esophagus. Left atrial appendage without thrombus is presented. LAA=left atrial appendage, LA=left atrium, MV=mitral valve, LV=left ventricle, PM=pectinate muscle.

imaging of the LA and LAA. Both techniques excluded the presence of thrombus in the LA and LAA. The inter-atrial septum (IAS) was punctured under ICE guidance and a transeptal sheath (8F) was introduced across the IAS to the LA and left upper pulmonary vein. Immediately after IAS puncture unfractionated heparin was administered (9 000 units) to achieve ACT >350 seconds.

Because balloon cryoablation was planned, an 8F transeptal sheath was replaced by a 14 F sheath – at that moment ACT was 385 s. After this maneuver the patient's status immediately deteriorated; she developed typical anginal chest pain and dyspnea. Blood pressure values dropped to 60/40 mm Hg and ECG revealed ST-segment elevation in leads II, III, aVF, V4-V6 with concomitant bradycardia that required ventricular pacing (Figure 2). The ICE view from the RA showed formatted thrombi attached to the sheath in both the

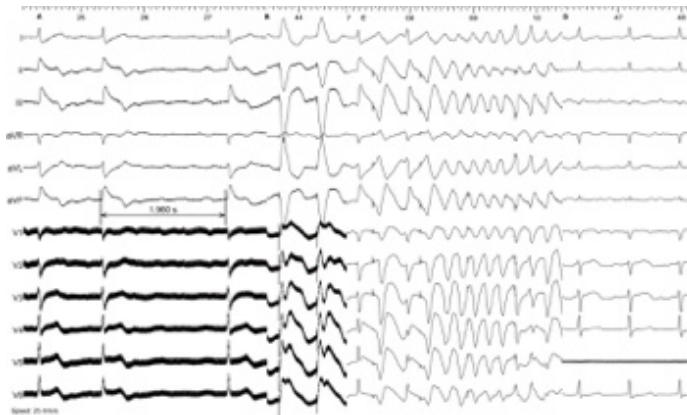


Figure 2. Original ECG recorded during procedure.  
A. ST-segment elevation in leads II, III, aVF, V4-V6 during atrial fibrillation. Bradycardia with AV nodal conduction pause up to 2 seconds is visible.  
B. Right ventricular pacing.  
C. Onset of ventricular tachycardia during ventricular pacing and degeneration to fast polymorphic VT which later transformed into ventricular fibrillation.  
D. After defibrillation normalization of ST-segment is noted with ongoing AF.

RA and LA. Cardiac tamponade was excluded. At the same time, the ICE probe was positioned in the right ventricular inflow tract and showed mobile thrombi in the right ventricle outflow tract under the pulmonary valve (Figure 3). Similar thrombi were found on the left side, most likely causing right

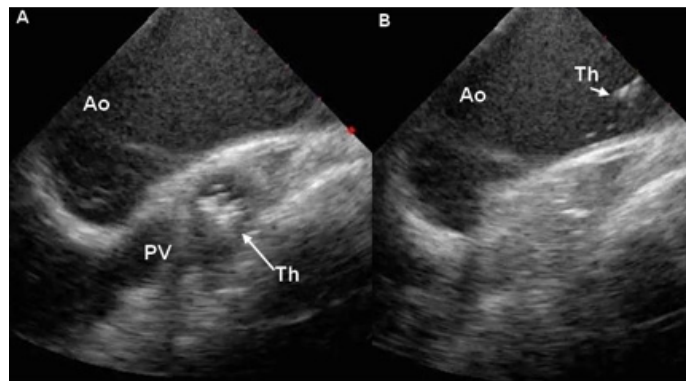


Figure 3. Fragmented thrombus (Th) located in the right ventricle outflow tract under pulmonary valve (PV) (panel A) and aortic root (panel B). Aortic root (Ao) with aortic valve is displayed. Ao=Aortic root; PV=Pulmonary valve; Th=Thrombus

coronary artery obstruction and ST elevation depicted on inferior leads on ECG. During right ventricular (RV) pacing, ventricular tachycardia developed, which degenerated into ventricular fibrillation, successfully terminated by external defibrillation. Subsequent ST segment elevation decreased. Immediate coronary angiography revealed normal coronary arteries and intracoronary thrombi were excluded. Unfractionated heparin was continuously administered until the thrombi disappeared. After 30 minutes the patient recovered completely with no neurological and systemic consequences. Ablation was postponed. Subsequent evaluation for prothrombotic hematological disorders was conducted in the tertiary hematology department that excluded all known prothrombotic conditions.

## Conclusions

This case clearly demonstrates that continuous visualization during an invasive LA procedure may be crucial for patient safety. The ICE is one of the options which may be superior to standard TEE, allowing the conscious patient to report symptoms. This may also be achieved by introducing to the esophagus a very thin ICE probe or micro-TEE probe<sup>31</sup>. In our case rapidly developing thrombi, migrating to the circulation, right coronary cusp and coronary artery are the most likely cause of the complication. However, we cannot exclude the less likely situation that the chest pain and ST segment elevation in inferior leads were due to crossing the IAS with a large sheath, whereas thrombi in the LAA were secondary to the blood stasis due to the fast VT. In order to increase patient safety, other methods for LA and LAA visualization, including ICE imaging, not only from the RA but also from other probe locations, such as the PA or RV, might be applied.

Conflict of Interest Disclosures: Travel grants from J&J: J. Baran, S.M. Stec, P. Kulakowski.

## References

1. Bunch TJ, May HT, Bair TL, Weiss JP, Crandall BG, Osborn JS, Mallender C, Anderson JL, Muhlestein BJ, Lappe DL, Day JD. "Atrial fibrillation ablation patients have long-term stroke rates similar to patients without atrial fibrillation regardless of CHADS2 score". *Heart Rhythm* 2013;10:1272–1277
2. Reddy VY, Doshi SK, Sievert H, Buchbinder M, Neuzil P, Huber K, Halperin JL, Holmes D; PROTECT AF Investigators. "Percutaneous left atrial appendage closure for stroke prophylaxis in patients with atrial fibrillation: 2.3-Year Follow-up of the PROTECT AF (Watchman Left Atrial Appendage System for Embolic Protection in Patients with Atrial Fibrillation) Trial." *Circ* 2013;12:720-9
3. Stec S, Zaborska B, Sikora-Frac M, Kryński T, Kułakowski P. „First experience with microprobe transoesophageal echocardiography in non-sedated adults undergoing atrial fibrillation ablation: feasibility study and comparison with intracardiac echocardiography." *Europace*. 2011;13:51-6