Transesophageal echocardiography before atrial fibrillation ablation: To do or not to do?

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Article type: Editorial

Received: May 6, 2024

Accepted: May 6, 2024

Early publication date: May 7, 2024
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Transcatheter ablation (TCA) of atrial fibrillation (AF) has reached significant goals in the recent years, allowing stable sinus rhythm in the majority of treated patients independently by the available energy sources (thermal or not) that are implemented for rhythm control [1]. Such results would have probably not been achieved without advanced echocardiographic imaging that evolved from transthoracic to transesophageal echocardiography (TEE), together with computed tomography, magnetic resonance, until left atrium (LA) and pulmonary veins tridimensional digital reconstruction through electroanatomic mapping. LA mechanical function, sinus rhythm and embolic stroke are the main considerations when a certain patient is scheduled for TCA of the arrhythmic substrate. Recent guidelines support the concept that in patients with AF, detection of intracardiac thrombus, mostly located in LA appendage (LAA), should prompt cancellation of planned cardioversion or TCA and institution of therapeutic anticoagulation in anticoagulant-naive patients [2]. In the current issue of the Polish Heart Journal, Kaufmann and coworkers [3] consider critically to rule out the use of TEE in patients undergoing TCA of AF or atrial flutter; based on multiple echocardiographic parameters, including left ventricular ejection fraction >65%, LA diameter <40 mm, LA area <20 cm², LA volume <113 ml, and LA volume index <51 ml/m², they demonstrated 100% sensitivity and 100% negative
predictive value for LA thrombosis absence in 417 patients. Additional echocardiographic indices that combined the above elucidated parameters excluded LA thrombus in over one-third of the study participants with 100% sensitivity and a 100% negative predictive value, without using TEE. Overall, the authors demonstrated that simple echocardiographic parameters could help identify individuals for whom TEE could be safely omitted before scheduled for elective TCA due to AF and atrial flutter [3]. Previous reports have variably investigated bio-humoral features, such as cardiac troponin I, C-reactive protein, B-type natriuretic peptide, D-dimer, uric acid, creatinine seric levels [4–7], as well as multiple seric parameters including activated partial thromboplastin time, creatinine, hematocrit, hemoglobin level, international normalized ratio, platelet count, white blood cell count [8]. Additional reports focused on clinical assessments, like age >75 years, diabetes mellitus, systemic hypertension, valvular heart diseases, prior stroke or transient ischemic attack, and cardiomyopathy [9] which reinforced the role of the CHA2DS2-VASc score. The most updated data derive from uninterrupted use of direct oral anticoagulants (DOACs) [10] and from the LATTEE registry which evaluated together several predicting factors like age, AF type, sinus rhythm during TEE, heart failure, diabetes, systemic connective tissue disease, chronic obstructive pulmonary disease, previous CHA2DS2-VASc score, prevalence of DOACs [11].

In summary, TEE in cardiac electrophysiology is required for three main clinical reasons: i) transeptal puncture for LA catheterization; ii) LAA thrombus exclusion before electrical cardioversion; iii) LAA thrombus exclusion before TCA (Figure 1). While the “less invasive” approach represented by electrical cardioversion may be safely omitted when the patient is strictly following oral anticoagulation regimens, either assuming the DOACs continuously or the vitamin K antagonist for obtaining the right therapeutic range along several checks (the so-called time therapeutic range higher than 70%), ruling out TEE when TCA of AF is planned yet represents a matter of debate. Improved materials and technology evolution in high volume and experienced hospital centres allow to perform transeptal puncture by simply adopting X-ray anatomical points in real time; on the other side, the actual exclusion of periprocedural LAA thrombus is a critical caveat that has prompted several trials in suggesting ablation under no interruption or minimally interruption of the DOACs [1, 2, 10]. Unfortunately, periprocedural TEE with or without uninterrupted DOACs does not warrant stroke-free procedures in all cases; perhaps, the atrial cardiomyopathy that develops when AF is not treated adequately, is responsible for loss of atrial contraction and transport function [12] that can be translated in increased risk of stroke in few cases, while others might experience cognitive decline and dementia [13, 14]. However, what comes from the sub-analysis of the LATTEE registry is that a thorough evaluation of the AF clinical cases before TCA contributes to stroke risk abatement, mostly when oral anticoagulation is ongoing and CHA2DS2-VASc score is low [3, 8, 11,
We therefore agree with the current perspective which could be reinforced by cardiac computed tomography, particularly with delayed contrast-enhanced image acquisition protocol, that has emerged as an alternate imaging modality to exclude intracardiac thrombus, as well as for cardiac magnetic resonance imaging. Remarkably, it should be considered that catheter-based intracardiac ultrasound can be implemented as well for transeptal puncture and for LAA thrombus exclusion, with the additional value of pulmonary veins visualization for ameliorating wall contact and ensuing transmural lesions that allow AF-free survival in majority of the studies [1, 2]. Time has therefore arrived for standardization of ablation procedures; nowadays, great practice variation exists on how TCA of AF is performed, either considering the invasive approach as firs-line therapy or repeated procedures. Large registries and more data are required to better define standards of care for this therapeutic choice. Many interventions, such as extra ablation lines in the LA, are still performed despite limited data demonstrating efficacy, whereas the best approaches to persistent AF and repeat ablation are poorly defined. Perhaps, TEE exclusion requires selected candidates for ablation: cardiologists and electrophysiologists should better identify clinical markers to establish when TCA is unlikely to benefit patients and define specific criteria for candidacy for first time and repeat procedures. In a near future, artificial intelligence could potentially be used to better tailor therapy to the individual patient, taking into consideration numerous factors that may better select candidates for therapeutic approaches, such as anticoagulation versus LAA occlusion, rhythm versus rate control, TCA versus medical therapy, modification of risk factors, genetics, and others [11]. Hopefully, artificial intelligence will be implemented not just for assessing TEE requirement, but ideally for AF management as well.

Article information
Conflict of interest: None declared.
Funding: None.
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**Figure 1.** Indications and contraindications to transesophageal echocardiography for atrial fibrillation treatment. The left circle depicts categories for treatment orientation. Vertical rectangles indicate feasible scenarios (green label), debated areas (yellow label) and exclusion criteria (red label).

Abbreviations: AF, atrial fibrillation; AI, artificial intelligence; ATE, atrial thrombus exclusion score (ref#7); CATES, score (ref#6) that includes C-reactive protein, atrial volume, troponin I and C, episode duration, stroke or embolism; CLOTS-AF: score (ref#5) that includes creatinine >1.5 mg/dl, left ventricular ejection fraction <50%, overload LA volume index >34ml/m², tricuspid annular plane systolic excursion <17 mm, stroke; CT, computed tomography; ECV, electrical cardioversion; eGFR, estimated glomerular filtration rate; LA, left atrium; LAA, left atrial appendage; LAAC, left atrial appendage closure; LVEF, left ventricular ejection fraction; RV, right ventricle; TCA, transcatheter ablation; TEE, transesophageal echocardiogram; TTE, transthoracic echocardiogram.