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COMMENTARY

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Can left atrial appendage thromboembolic risk be quantified by transoesophageal echocardiography in patients with atrial fibrillation scheduled for catheter ablation or electrical cardioversion?

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Atrial fibrillation (AF) is the most common form of cardiac arrhythmias,¹ and associated with a 5-fold increased risk of stroke.^{2–4} The prevalence of both stroke and AF increases with age and both conditions share broadly the same risk factors. In addition to the established clinical and demographic risk scores (CHA₂DS₂-Vasc), a number of imaging biomarkers have been identified as predictors of stroke in AF. These include left atrial (LA) dilatation and reduced LA strain on transthoracic echocardiography, spontaneous echo contrast (SEC) (particularly when LA is enlarged and ejection fraction is reduced) or thrombus in the LA or LA appendage (LAA), low peak LAA emptying velocity (<20 cm/s) on transoesophageal echocardiography (TEE), and a non-chicken wing morphology of the LAA (windsock, cactus and cauliflower) on CT or MR.^{2,5} LA dilation, fibrosis and dysfunction, referred to as atrial cardiopathy, result in a prothrombotic state characterized by blood stasis and endothelial dysfunction with subsequent thrombus or sludge formation in the LA or LAA. However, despite routine use of periprocedural anticoagulation, thromboembolic events may occur in a small proportion (1%–5%) of patients undergoing catheter ablation for AF.^{6,7} To further reduce the risk of periprocedural thromboembolism and post-conversion stroke, a TEE is used in most patients (those on novel non-vitamin K antagonist oral anticoagulants; NOACs) before catheter ablation to screen for LAA thrombus.⁸ A TEE is also performed in patients with newly-detected AF with unknown duration or for those with suboptimal anti-thrombotic treatment before electrical cardioversion. Traditionally, LAA is assessed qualitatively by visual inspection for thrombus, SEC and/or sludge, or a semi-quantitatively to measure LAA peak

emptying velocity (Figure 1). In a recent edition of *Journal of Clinical Ultrasound*, Slostad et al. provided some interesting data from a retrospective study of 138 AF patients undergoing TEE prior to pulmonary vein isolation or electrical cardioversion.⁹ Mean age was 59 years, 70% were male and hypertension (78%), hyperlipidemia (53%), and diabetes (33%) were highly prevalent comorbid conditions, whereas the proportion of patients with coronary artery disease, peripheral artery disease and smoking was 22%–23%. Their hypothesis was that a higher mean pixel density measured with ImageJ image processing software (developed by the National Institute of Health <http://imagej.nih.gov/ij/docs/guide>) was associated with a higher likelihood of future cardioembolic events. During a mean follow-up of 38 months, a total of 11 (8%) patients had thromboembolic events and 16 (12%) died. The higher ratio of average pixel density of the LAA cavity (C) over LAA wall (W), a gain-independent ratio, was significantly associated with qualitative assessment by the expert readers, and with a 1.6-fold increased risk of thromboembolic events. Interestingly, a significant disagreement between the two expert readers' interpretation with regard to the presence of thrombus, sludge, SEC, and normal LAA was found. The authors proposed C/W ratio as a novel method for accurate quantitative assessment of LAA in terms of thromboembolic risk. These results are intriguing and open a new chapter in the assessment of thromboembolic risk in AF patients. Based upon their findings, it seems that C/W ratio can be easily quantified by TEE, and may be a useful complementary method to affirm thromboembolic risk in patients with AF, particularly in those doubtful cases where the

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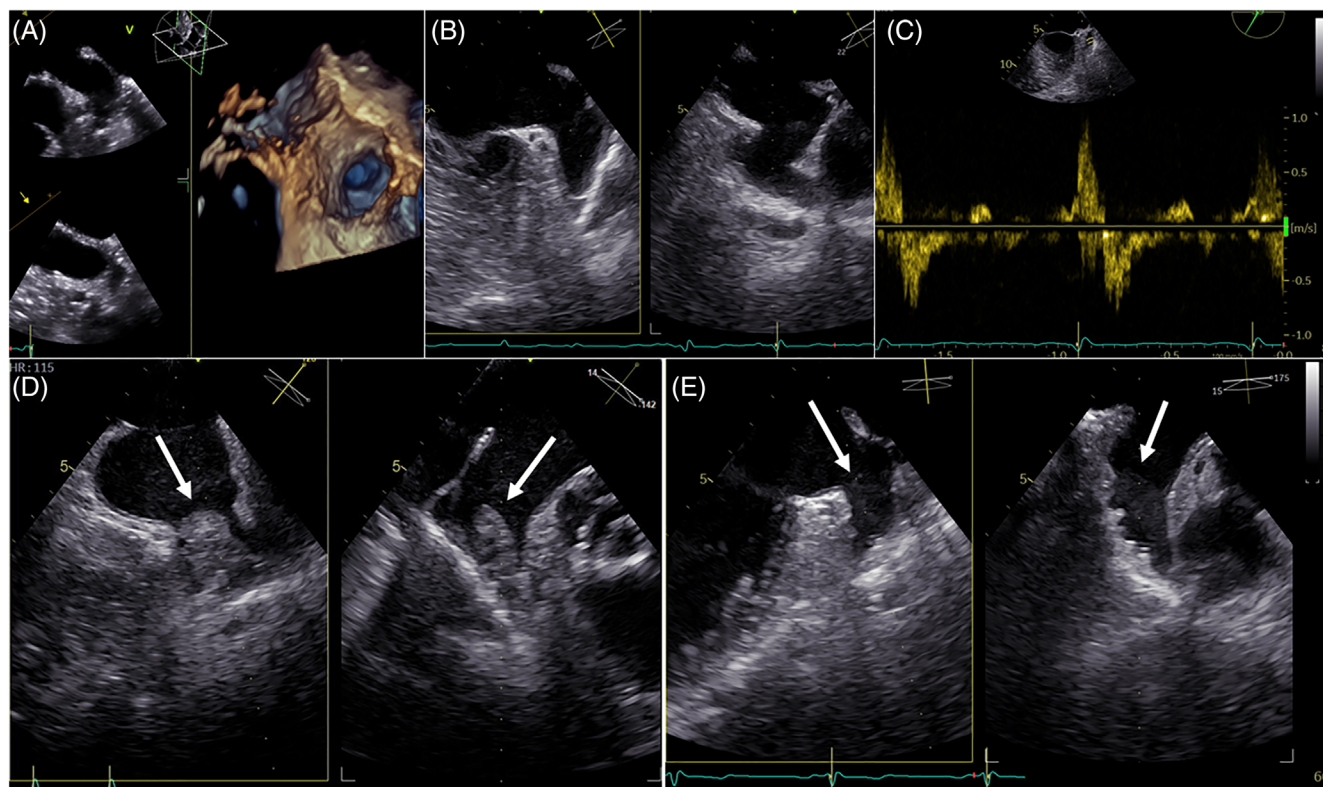


FIGURE 1 Transesophageal echocardiography images (A, 3D; B–E, 2D) of patients with atrial fibrillation prior to catheter ablation. There is no thrombus in the left atrial appendage (LAA) in (A) and (B). (C) Belongs to the same patient in (B) and shows normal peak LAA emptying velocity of 1 m/s. (D) is an X-plane view of the LAA showing an organized thrombus in the LAA (arrows). (E) is also an X-plane view of the LAA and illustrates sludge in the LAA (arrows), defined as a viscid intracavitary echodensity without a discrete organized mass continuously seen throughout the cardiac cycle⁹

qualitative assessment is inconclusive. There is almost no previous work for comparison. The novel method now needs to be tested in larger, well-designed, prospective studies. For example, the ongoing case control Searching for Explanations for Cryptogenic Stroke in the Young: Revealing the Etiology, Triggers, and Outcome (SECRETO) study may have the potential to identify novel cardiac imaging biomarkers associated with the risk of early-onset ischemic stroke by utilizing C/W ratio and other methods, and hence fill some knowledge gaps between clinical practice and research, and hopefully enable more personalized therapeutic options for stroke patients.¹⁰

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

Sahrai Saeed wrote the first draft of the article. Eivind Solheim and Jukka Putaala revised it. All authors approved the final submission.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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