



## Correspondence

## Novel imaging modalities to predict the development of atrial fibrillation post stroke



Mohammed Faisaluddin<sup>a</sup>, Dhruvajyoti Bandyopadhyay<sup>b,\*</sup>, Adrija Hajra<sup>c</sup>, Hassan Beydoun<sup>b</sup>, Raktim K. Ghosh<sup>d</sup>, Eyal Herzog<sup>e</sup>

<sup>a</sup> Deccan College of Medical Sciences, Hyderabad, India

<sup>b</sup> Mount Sinai St Luke's Roosevelt Hospital, New York, USA

<sup>c</sup> IPGMER, SSKM, Kolkata, India

<sup>d</sup> Case Western Reserve University Heart & Vascular Institute, MetroHealth Medical Center, Cleveland, OH, USA

<sup>e</sup> Mount Sinai St Luke's Roosevelt Hospital, Icahn School of Medicine at Mount Sinai, New York, USA

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Atrial fibrillation (AF), the most common arrhythmia of clinical importance is associated with significant morbidity and mortality. The prevalence of AF is found to be increased with the age of an individual. AF is one of the leading causes of stroke. Echocardiographic assessment may have a crucial role in detecting the clinical risk of stroke in AF patients. Left atrial (LA) morphology and function can be assessed by echocardiography for detection of the risk of formation of intracardiac thrombi [1]. However, patients with acute ischemic stroke are at substantially increased risk of AF. According to a meta-analysis done by Sposato et al., 24% of patients could be newly diagnosed with AF after an episode of acute ischemic stroke during their hospital admission [2]. The exact pathogenesis of AF after stroke remains unclear, both hemodynamic and non-hemodynamic factors may contribute to the development of AF. AF in patients with acute ischemic stroke is associated with higher in-hospital mortality and more severe neurologic deterioration with higher recurrence rates. Therefore, identification of post-stroke AF in patients without previous history of AF is crucial to reduce recurrences of stroke and the hospital stay. However, due to paroxysmal and asymptomatic nature of AF, patients with post-stroke AF often remain undiagnosed. Flint et al. demonstrated that some patients could be diagnosed with AF when

screened by continuous long-term electrocardiographic monitoring [3]. However, the sensitivity of long-term electrocardiographic monitoring is relatively poor where about 2–10.7% of patients are only detected for AF. Some studies suggested that patients with high CHA2DS2-VASc score were associated with an increased risk of post-stroke AF. It is found even in population without a known history of AF. There is no recent consensus made for effective strategies to detect post stroke AF. However, the left atrial longitudinal strain (LALS) assessed by two-dimensional (2D) speckle tracking transthoracic echocardiography (TTE) is a relatively simple and reproducible technique. It measures the deformation of LA to assess LA function. Kim et al. demonstrated that global LA longitudinal strain by speckle tracking echocardiography could predict AF occurrence with acute ischemic stroke. He Suggested LALS was an independent predictor for <14.5% post-stroke AF development (hazard ratio 0.90, 95% confidence interval 0.83–0.97,  $p < 0.01$ ) with sensitivity of 60% and specificity of 95% [4]. Another study was done by Pathan et al. where 538 patients were studied, and they were evaluated for reservoir strain (εR), contractile strain (εCt), and conduit atrial strain (εCd) using speckle tracking using TTE, 61 (11%) developed AF after an episode of acute stroke within 2 years in 85% of patients. Patients in whom AF was developed were older, had higher clinical risk scores, had higher LA volume, and had lower atrial strain than did those who did not develop AF. The area under the receiver-operating characteristic curve was 0.85 for εR, 0.83 for εCt, and 0.76 for εCd (all  $p < 0.001$ ). The nested Cox regression model showed that εR ( $p = 1/4 0.03$ ) and εCt ( $p < 0.001$ ) demonstrated independent and incremental predictive value over the clinical risk. CART analysis identified εR <21.4%, εCd >10.4%, and CHARGE-AF (Cohorts for Heart and Aging Research in Genomic Epidemiology Atrial Fibrillation) score >7.8% as discriminatory for AF, with a 13-fold greater hazard of AF ( $p < 0.001$ ) in patients with increased clinical risk and reduced εR [5]. LALS measures LA contractility of the endocardium and passive deformation, which well reflects the function of LA [4]. Structural remodeling of the left atrium has been detected to be a significant risk factor for the development of AF. LA enlargement and atrial fibrosis are found to be correlated with the occurrence of AF [1]. Impaired LA strain can indicate reduced LA compliance or reservoir function and may indirectly reflect high fibrosis content. Additionally, LA strain is significantly reduced in AF patients with prior stroke compared to those

\* Corresponding author.

E-mail addresses: [dhruvajyoti.bandyopadhyay@mountsinai.org](mailto:dhruvajyoti.bandyopadhyay@mountsinai.org) (D. Bandyopadhyay), [hassan.beydoun@mountsinai.org](mailto:hassan.beydoun@mountsinai.org) (H. Beydoun), [eyal.herzog@mountsinai.org](mailto:eyal.herzog@mountsinai.org) (E. Herzog).

without a previous stroke. LA strain and LA volume may provide complementary information on structural changes of the left atrium, but it is speculated that LA strain may be a more sensitive parameter of changes in LA wall structure. Patients with lower LALS may benefit from active monitoring of AF after acute ischemic stroke. Furthermore, the LALS may provide evidence for the initiation of anticoagulation in the absence of documented AF in acute ischemic stroke patients, hence minimizing hospital stay [4].

Thus, LA strain provides significant information for predicting post stroke AF over other clinical variables, stroke severity, as well as the LA volume index. The global LALS reflects structural and functional susceptibility for AF and provide new strategies to better risk stratification for post-stroke AF in patients with acute ischemic stroke. Early detection of LA dysfunction might give the opportunities to modify the risk and improve clinical outcome. Although further studies are required for detection of any causal relationships between LA function and post-stroke AF, it is possible that functional impairment caused by various cardiovascular conditions triggers post stroke AF, which results in further deteriorated function of LA and subsequent thrombus formation.

### Conflict of interest

There is no conflict of interest.

### References

- [1] G.D. Sanna, E. Gabrielli, E. De Vito, G. Nusdeo, D. Prisco, G. Parodi, Atrial fibrillation in athletes: From epidemiology to treatment in the novel oral anticoagulants era, *J. Cardiol.* 72 (4) (2018) 269–276.
- [2] L.A. Sposato, L.E. Cipriano, G. Saposnik, E.R. Vargas, P.M. Riccio, V. Hachinski, Diagnosis of atrial fibrillation after stroke and transient ischaemic attack: a systematic review and meta-analysis, *Lancet Neurol.* 14 (4) (Apr 1, 2015) 377–387.
- [3] A.C. Flint, N.M. Banki, X. Ren, V.A. Rao, A.S. Go, Detection of paroxysmal atrial fibrillation by 30-day event monitoring in cryptogenic ischemic stroke: the Stroke and Monitoring for PAF in Real Time (SMART) Registry, *Stroke* 43 (10) (Oct 1, 2012) 2788–2790.
- [4] D. Kim, C.Y. Shim, I.J. Cho, Y.D. Kim, H.S. Nam, H.J. Chang, et al., Incremental value of left atrial global longitudinal strain for prediction of post stroke atrial fibrillation in patients with acute ischemic stroke, *J. Cardiovasc. Ultrasound* 24 (1) (Mar 1, 2016) 20–27.
- [5] F. Pathan, E. Sivaraj, Use of atrial strain to predict atrial fibrillation after cerebral ischemia, *JACC Cardiovasc. Imaging* 11 (11) (Nov 2018) 1557–1565.