JACC: CARDIOVASCULAR IMAGING VOL. 13, NO. 10, 2020

PUBLISHED BY ELSEVIER

iVIEW

EDITOR'S PAGE

Left Atrial Strain

Part of the Solution to Taming the Vicious Twins

Thomas H. Marwick, MBBS, PhD, MPH, *Deputy Editor*,
Y. Chandrashekhar, MD, *Editor-in-Chief*

Atrial fibrillation (AF) and heart failure with preserved ejection fraction (HFpEF) share common risk factors, and symptoms, they potentiate each other, and together contribute to poor prognosis (1). Both conditions are increasing in prevalence with population aging. They are linked by left ventricular (LV) and left atrial (LA) dysfunction, but this has been a problem in addressing their pathophysiology and perhaps even in defining a treatment, because these phenomena have conventionally been difficult to measure.

LA volume and function have been considered important for diastolic evaluation (2), and both predict future AF, both overt (3) and silent (4). Assessment of LA function using classical techniques such as pulmonary venous and transmitral flow measurements is less feasible and less widely adopted. In contrast, measurements of LA reservoir strain (LARS) and LA contractile strain are feasible and intuitive (5), and the ability to measure atrial strain using echocardiography or cardiac magnetic resonance (CMR) with equal predictive value (6) has led to a substantial body of work in the last decade (7). LA strain adds value (8) over and above other parameters, including the HbA1c value of the atrial LA volume (9). Differential changes in reservoir function and conduit function may provide finer insights (10)

Normal ranges of LARS (39%; 95% confidence interval [CI]: 38% to 41%) and LA contractile strain (17%; 95% CI: 16% to 19%) have been defined (11). Normal LARS far exceeds the levels (18% to 24%) associated with various adverse outcomes, suggesting that there is considerable reserve. The 2 major clinical applications of LA strain are the assessment of diastolic function or LV filling pressure and the assessment of risk of atrial fibrillation. In this issue of *iJACC*, 2 important papers explore the ability of LA strain imaging to integrate the assessment of LV function and AF risk (6,12).

In a study of 257 patients following myocardial infarction, Kim et al. (6) documented a twofold difference in LARS in patients with diastolic dysfunction and those without. LARS was significantly impaired even in patients with mild dysfunction, regardless of whether echocardiographic or CMR methods were used. Importantly, impaired LARS was associated with AF in follow-up. As pointed out by the accompanying editorial, the work by Kim et al. (6) advances the field by independent validation of echocardiographic methods by CMR, the use of vendor-agnostic software, and the link between diastolic dysfunction, AF, and heart failure.

These findings were complemented by Park et al. (12), whose study of 4,312 consecutive patients with acute HF, 16% of whom developed new onset AF over follow-up. Patients with reduced LARS (≤18%) had a 60% increment of hazard of new-onset AF, independent of age, hypertension, LA size, HFpEF, and the absence of beta blockade. Although the accompanying editorial expressed reservations about the uptake of the resulting HAS-BAP (hypertension, age, PALS, no Beta-blocker prescription at discharge, atrial volume index, HFpEF (range, 0-6)) score, the ability to identify a high-risk group opens intriguing possibilities.

Strain measurements open another interesting avenues of research in the AF-embolic events linkage: could they denote an "atrial myopathy" that could mediate blood stasis and risk thromboembolism

ISSN 1936-878X/$36.00 https://doi.org/10.1016/j.jcmg.2020.09.001

events independent of AF (13,14)? LA strain abnormalities are early signs of chamber dysfunction and remodeling and correlate with local structural changes like regional fibrosis (15). Whether through AF or without it, LA strain seems to predict adverse events robustly and becomes a useable marker in clinical practice.

The pathophysiology of cardiac aging underlies the most common and increasing cardiac diseases, AF and HFpEF. Measurement of LV global longitudinal strain, already a sensitive marker of subclinical LV dysfunction (16), is now being strengthened by a strain measurement for atrial dysfunction. The 2 measurements provide an opportunity for better characterization of the complexities of diastolic dysfunction where the current pillars of LA volume, transmitral flow, e′, and E/e′ leave many situations of ambiguity and uncertainty. More importantly, better phenotyping may lead to options for therapeutic strategies that might otherwise have not been considered. Now that we have the diagnostic and prognostic data to support these new tests, we hope to see studies where they are used to drive decisions and optimize outcomes.

ADDRESS FOR CORRESPONDENCE: Dr. Y. Chandrashekhar, University of Minnesota/VAMC, Division of Cardiology, Mail Code: 111C, 1 Veterans Drive, Minneapolis, Minnesota 55417 E-mail: shekh003@umn.edu OR Prof. Thomas Marwick, Baker Heart and Diabetes Institute, 75 Commercial Road, Melbourne, V3004, Australia. E-mail: tom.marwick@baker.edu.au.

REFERENCES

1. Kotecha D, Lam CS, Van Veldhuisen DJ, Van Gelder IC, Voors AA, Rienstra M. Heart failure with preserved ejection fraction and atrial fibrillation: vicious twins. J Am Coll Cardiol 2016;68:2217–28.

2. Hoit BD. Left atrial size and function: role in prognosis. J Am Coll Cardiol 2014;63:493–505.

3. Olsen FJ, Møgelvang R, Jensen GB, Jensen JS, Biering-Sørensen T. Relationship between left atrial functional measures and incident atrial fibrillation in the general population: the Copenhagen City Heart Study. J Am Coll Cardiol Img 2019;12:981–9.

4. Choi HM, Yoon YE, Oh IY, Cho Y, Cho GY. Global left atrial strain as a predictor of silent atrial fibrillation following dual chamber cardiac implantable electronic device implantation. J Am Coll Cardiol Img 2018;11:1537–9.

5. Buggey J, Hoit BD. Left atrial strain: measurement and clinical application. Curr Opin Cardiol 2018;33:479–85.

6. Kim J, Yum B, Palumbo MC, et al. Left atrial strain impairment precedes geometric remodeling as a marker of post-myocardial infarction diastolic dysfunction. J Am Coll Cardiol Img 2020 Aug 16 [E-pub ahead of print].

7. Thomas L, Marwick TH, Popescu BA, Donal E, Badano LP. Left atrial structure and function and left ventricular diastolic dysfunction: JACC State-of-the-Art Review. J Am Coll Cardiol 2019;73:1961–77.

8. Morris DA, Belyavskiy E, Aravind-Kumar R, et al. Potential usefulness and clinical relevance of adding left atrial strain to left atrial volume index in the detection of left ventricular diastolic dysfunction. J Am Coll Cardiol Img 2018;11:1405–15.

9. Negishi K. Incremental diagnostic value of left atrial strain over left atrial volume: an analogy of glucose level and glycosylated hemoglobin? J Am Coll Cardiol Img 2018;11:1416–8.

10. Pathan F, Sivaraj E, Negishi K, et al. Use of atrial strain to predict atrial fibrillation after cerebral ischemia. J Am Coll Cardiol Img 2018;11:1557–65.

11. Pathan F, D'Elia N, Nolan MT, Marwick TH, Negishi K. Normal ranges of left atrial strain by speckle-tracking echocardiography: a systematic review and meta-analysis. J Am Soc Echocardiogr 2017;30:59–70.

12. Park JH, Park JJ, Hwang IC, Park JB, Cho GY, Marwick TH. Left atrial strain as a predictor of new-onset atrial fibrillation in patients with heart failure. J Am Coll Cardiol Img 2020 Jul 9 [E-pub ahead of print].

13. Goldberger JJ, Arora R, Green D, et al. Evaluating the atrial myopathy underlying atrial fibrillation: identifying the arrhythmogenic and thrombogenic substrate. Circulation 2015;132:278–91.

14. Habibi M, Zareian M, Ambale Venkatesh B, et al. Left atrial mechanical function and incident ischemic cerebrovascular events independent of AF: insights from the MESA study. J Am Coll Cardiol Img 2019;12:2417–27.

15. Habibi M, Lima JA, Khurram IM, et al. Association of left atrial function and left atrial enhancement in patients with atrial fibrillation: cardiac magnetic resonance study. Circ Cardiovasc Imaging 2015;8:e002769.

16. Potter E, Marwick TH. Assessment of left ventricular function by echocardiography: the case for routinely adding global longitudinal strain to ejection fraction. J Am Coll Cardiol Img 2018;11:260–74.