

Letters

Epicardial Electric Activation During Atrial Fibrillation



With great interest we read the clinical vignette by Hong et al. (1). It is increasingly being recognized that atrial tachyarrhythmias such as atrial fibrillation (AF) have a 3-dimensional substrate and hence require a 3-dimensional ablative approach. This clinical vignette is a nice example demonstrating the importance of endocardial-epicardial asynchrony in clinical practice. However, there are some limitations of the mapping technique that need to be discussed.

Endocardial-epicardial differences in electrophysiological properties of the ventricles are linked to ventricular arrhythmogenesis, but unraveling this association in human atria has only started recently (2). Acknowledging that AF has a complex 3-dimensional arrhythmogenic substrate is a great step forward in the improvement of (ablative) AF therapy. To reliably investigate differences in electric activity between both sides of the atrial wall, it is essential to optimize the mapping technique (3). Exact opposite positioning of the endo- and epicardial electrodes in the presence of very narrow fibrillation waves is essential to draw robust conclusions, especially when using bipolar mapping systems. In contrast to unipolar measurements, bipolar measurements are influenced by direction of activation waves and bipole orientation (4). First, it is important to precisely position the endocardial-epicardial electrode pairs in the exact opposite position. As shown in Figure 1 in the Hong et al. (1) vignette, it is unclear how precisely the flexible endo- and epicardial electrode arrays are positioned on top of each other using the anatomic construction only. This is important because persistent AF is characterized by very narrow fibrillation waves with a width of only 1 to 2 mm, as previously demonstrated in high-resolution mapping studies (2). Hence, a thoracoscopic approach might be suboptimal in validating the position of the electrodes because of technical challenges. In addition, the epicardial bipolar electrograms reflect continuous electric activity. This raises the question of which deflections are used for the corresponding

voltage maps, as it is difficult to discriminate local from far-field electrograms in these types of recordings.

The investigators should be congratulated for their work, as this clinical case is another step forward in recognizing electric endocardial-epicardial asynchrony underlying AF persistence. Complex 3-dimensional interactions in electric activity between the endo- and epicardium provide mechanistic insights into the pathophysiology of AF.

Rohit K. Kharbanda, MD

Fons J. Wesselijs, BSc

*Natasja M.S. de Groot, MD

*Unit Translational Electrophysiology

Department of Cardiology

Erasmus Medical Center

Doctor Molewaterplein 40

3015 GD Rotterdam

the Netherlands

E-mail: n.m.s.degroot@erasmusmc.nl

<https://doi.org/10.1016/j.jaccas.2019.11.073>

© 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Please note: The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

REFERENCES

1. Hong KL, Baley J, Baranchuk A, Bisleri G, Glover BM. Epicardial electrical activation during atrial fibrillation: Looking at the other side of the coin. *J Am Coll Cardiol Case Rep* 2019;1:401-2.
2. de Groot N, van der Does L, Yaksh A, et al. Direct proof of endo-epicardial asynchrony of the atrial wall during atrial fibrillation in humans. *Circ Arrhythm Electrophysiol* 2016;9:e003648.
3. Knops P, Kik C, Bogers AJ, de Groot NM. Simultaneous endocardial and epicardial high-resolution mapping of the human right atrial wall. *J Thorac Cardiovasc Surg* 2016;152:929-31.
4. Takigawa M, Relan J, Martin R, et al. Effect of bipolar electrode orientation on local electrogram properties. *Heart Rhythm* 2018;15:1853-61.

REPLY: Epicardial Electrical Activation During Atrial Fibrillation



In response to the letter by Dr. Kharbanda and colleagues, we are in strong agreement that atrial fibrillation relies on 3-dimensional conduction with dissociation between the endocardium and epicardium, which may play an important role in the