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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.

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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

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pathophysiology of this arrhythmia. We have previously demonstrated epicardial connections in a case in which the endocardial posterior left atrial wall and pulmonary veins were electrically isolated (1).

In the present case, we recorded simultaneous bipolar signals from the endocardium and epicardium of the left atrium during atrial fibrillation using the HD Grid mapping catheter (Abbott Inc., Chicago, Illinois) (2). This catheter has 16 electrodes, each 1 mm in length across 4 splines with an equal 3-mm space between each electrode. The locations of each Grid catheter were confirmed using an electroanatomic mapping system to ensure that an anatomically equivalent region of the heart was recorded. Signals were recorded as the largest amplitude signals from orthogonal poles, which minimized the impact of even a slight variability in location. All signals were examined, and the entire activation on the epicardium in the region (highly fractionated) was completely different from the endocardium (slower and more organized). This high-definition mapping over a small parallel region with completely different activation sequences allowed us to infer that both of these regions were electrically dissociated. We feel that this case adds further data to this field, which requires further investigation and research.

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Please note: Dr. Glover has been a consultant for Abbott Technologies. Ms. Hong has reported that she has no relationships relevant to the contents of this paper to disclose.

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