Pitfalls in the definition of complex fractionated atrial electrograms for atrial fibrillation studies

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Letter to the Editor

Pitfalls in the definition of complex fractionated atrial electrograms for atrial fibrillation studies

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Conflict of interests

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To the Editor,

We read with great interest the study by Baher and colleagues. Their work helps to consolidate the use of recurrence quantification analysis (RQA) in the investigation of cardiac dynamics during atrial fibrillation (AF). It also motivates further discussion on creative methods and biomarkers for studying such complex cardiac disorder.

As clearly pointed out by the editorial-invited perspective from Roney and Bishop, the multiple definitions of complex fractionated atrial electrograms (CFAEs) represent an important hurdle for the identification of atrial substrate. We have recently shown that CFAE target identification to guide radiofrequency ablation is dependent on the system used and settings applied. Each system measures different aspects of the atrial electrograms (AEGs) to characterize the atrial substrate during AF. These factors induce inconsistencies and make the reproducibility of the AEG classification difficult. Using revised settings that minimize the differences in CFAE classification performed by individual system can decrease methodological heterogeneities and facilitate comparisons of CFAE mapping among different studies.

The authors should also be commended for integrating in-silico and in-vivo models in their study, which certainly provides further details on the underlying AF electrophysiology. In the clinical arm of the investigation, a smaller portion of the patients (41%) was identified with persistent AF. Additionally, pulmonary vein isolation (PVI) terminated AF in all cases, which, despite intense debate, is challenging in persistent AF patients. Finally, the underlying electrophysiology of CFAEs is remarkably different between paroxysmal and persistent AF, which might hinder a proper definition of active and passive CFAEs, even following AF termination. These differences should be addressed using the method proposed by the authors. We have recently used RQA to investigate the effect of PVI on the underlying dynamics of persistent AF in 18 patients. Although ablation with PVI did not terminate AF, our results show that the RQA variables were significantly affected by PVI, and that the variables were effective in discriminating CFAE vs. normal AEGs. On other work, we investigated changes in CFAE distribution induced by PVI in the same cohort. Our results suggest that some atrial regions are
impervious to PVI, while others are affected by it. Nearly half of the atrial regions classified as CFAE at baseline continued as CFAE after PVI. These could represent atrial regions important in AF perpetuation, as they appear to be anchored in the atria and persisted after PVI.

Baher and colleagues should be praised for their work. RQA is a versatile and compelling method that will certainly help improving our comprehension on the underlying dynamics of AF. Their method should be further explored in other cohorts – both \textit{in-silico} and \textit{in-vivo} – to study different underlying dynamics and electrophysiological mechanisms that participate in AF perpetuation.

\textbf{References}


