Letter by Platonov et al Regarding Article, “Dominant Frequency of Atrial Fibrillation Correlates Poorly With Atrial Fibrillation Cycle Length”

To the Editor:

We have read with interest the article by Elvan et al., who studied the agreement between the dominant frequency (DF) of atrial fibrillation (AF) and local atrial fibrillation cycle length (AFCL). They suggested that high-frequency sites, being a potential target for ablation, should be localized using AFCL as estimated from endocardial electrograms and not by selecting the largest spectral peak as DF. The authors refer to the study by Ng et al., which demonstrated that signal amplitude and AFCL variability affect the spectral shape and thus may explain the discrepancies between DF and local AFCL.

Because this issue is highly relevant for ablation of AF guided by frequency mapping, we would like to draw attention to important aspects that affect estimation and interpretation of DF.

In the ideal situation, AFCL and repetition rate should correspond to each other. However, the robustness of each approach is crucial for obtaining reliable results in a comparative study. For AFCL estimation, peak detection must be performed with extreme care on fractionated signals, common in AF, since overestimation of the wave front number will otherwise result. On the other hand, the repetition rate is not always the DF of the spectrum.

Atrial waves are sometimes so sharp in their appearance that spectral harmonics have larger magnitudes than the peak corresponding to the true repetition rate, for example, the fundamental frequency (FF). Therefore, DF, defined by the largest spectral peak, is not always identical to FF; the latter index being the one to which AFCL should be compared. The consequence of this observation is that organized signals with large harmonics may appear to have a higher DF than less organized signals with smaller harmonics. This problem can be overcome by preprocessing of the raw signal that deemphasizes harmonics so that DF becomes equal to FF, or analysis of the spectral structure that detects whether DF is indeed the FF or a large-amplitude harmonic. However, highly fractionated atrial signals that may represent the true high-frequency sources of AF remain a problem for both AFCL estimation and determination of DF.

In our experience, it is more difficult, if not impossible, to set the thresholds for correct AFCL measurements than to handle varying signal characteristics in DF-based spectral measurements. Even though the estimation of FF requires considerable engineering efforts, a signal processing solution that would produce robust AFCL measurements in complex and fractionated signals is yet to be presented. Until then, extreme caution should be applied when AFCL, derived from such signals, is used to guide therapeutic intervention for AF.

Disclosures

None.

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References

Correlates Poorly With Atrial Fibrillation Cycle Length''

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