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DOI
10.1093/ehjdh/ztac020

Publication date
2022

Document Version
Final published version

Published in
European Heart Journal - Digital Health

European Heart Journal - Digital Health (2022) **3**, 236–237
https://doi.org/10.1093/ehjdh/ztac020

EDITORIAL

Detection of atrial fibrillation-related electropathology by artificial intelligence: is the future already here?

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Online publish-ahead-of-print 4 May 2022

Introduction

The major challenge in management of the worldwide most common, age-related cardiac arrhythmia atrial fibrillation (AF) is early recognition of patients at risk. Early recognition of high-risk patients enables timely start of anticoagulation therapy and hence prevention of the most feared AF-related complication stroke. Already many years ago, it was demonstrated that parameters derived from the sinus rhythm P-wave on the surface electrocardiogram (ECG), including, e.g. amplitude, duration, or morphology is associated with development of AF.[1]

The rise of artificial intelligence (AI) in healthcare paves the pathway for introduction of the surface ECG as a diagnostic, predictive tool to accurately recognize patients early at risk for AF.[2] By investigating the *trends* of AI-ECG probability around the time of the first AF episode, Christopoulos *et al*. took a considerable leap forward in this area for which they should be congratulated.

In this issue, the authors introduced in their paper entitled 'Artificial Intelligence—Electrocardiography to Detect Atrial Fibrillation: Trend of Probability Before and After the First Episode' an AI-based predictive tool for estimating the probability of developing AF from surface ECGs recorded during sinus rhythm. They collected for this purpose surface ECGs from 59 212 patients before and after the first documented AF episode (median number of ECGs before and after, respectively, 7 and 5) and demonstrated that the AI-ECG probability of AF (i) gradually increases prior to the first AF episode and (ii) continues to increase immediately after the first AF episode.

Discussion

From their observations, the authors concluded that on-going changes in AF-related electropathology are already present before AF onset which results in subtle changes in the surface ECG. These changes are invisible for the human eye yet detectable by a neural network. However, as also acknowledged by the authors, there are some limitations which need to be addressed in following studies. The study population selected could be further refined. First of all, patients with atrial flutter should be excluded. It is understandable that manual evaluation of the huge amounts of ECGs is not possible and an algorithm discriminating between these two types of arrhythmias [and thus also between ECGs with (i) atrial flutter and variable atrioventricular conduction or (ii) AF with complete atrioventricular conduction block and a regular escape rhythm] might be challenging. Although there is a clear (clinical) interrelationship between atrial flutter and AF, it remains questionable whether electropathology giving rise to AF is comparable with that of atrial flutter. Also, as continuous rhythm monitorings were not performed before the moment of the first ECG recordings, it could be that patients may have had asymptomatic AF episodes. Hence, it is uncertain whether the first documented AF episode is the true first AF episode and thus 'how early AF is actually recognized' by the proposed AI-ECG tool. A representative study population, containing patients with and without AF ensures that the interesting finding of the observed trend of AI-ECG can really be attributed to AF development.

If the proposed neural network algorithm can detect subtle changes in the ECG prior to AF development, it is really intriguing what the associated underlying electropathology is. Interestingly, high-resolution mapping studies failed to demonstrate a relation between excitation patterns of the atria and 'simple' ECG characteristics such as P-wave duration.[3]

This is understandable, as there may be small, circumscriptive areas of considerable conduction delay present. The sinus rhythm wavefront just curves without any significantly delay thereby resulting in a normal total excitation time. These areas of conduction delay appeared not to be detectable on the surface ECG by the human eye, yet it is intriguing

The opinions expressed in this article are not necessarily those of the Editors of the *European Heart Journal – Digital Health* or of the European Society of Cardiology.

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to postulate that these localized areas of conduction delay can be detected by a neural network on the surface ECG.

Nevertheless, the concept that signs of future AF are already present on the sinus rhythm ECG and become clearer over time is at least to say intriguing and we cannot wait to see further evaluation of the interesting AI-ECG AF probability tool!

Conflict of interest: None declared.

Data availability

Nothing to declare.

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