

## ‘Smart’ solutions for paroxysmal atrial fibrillation?

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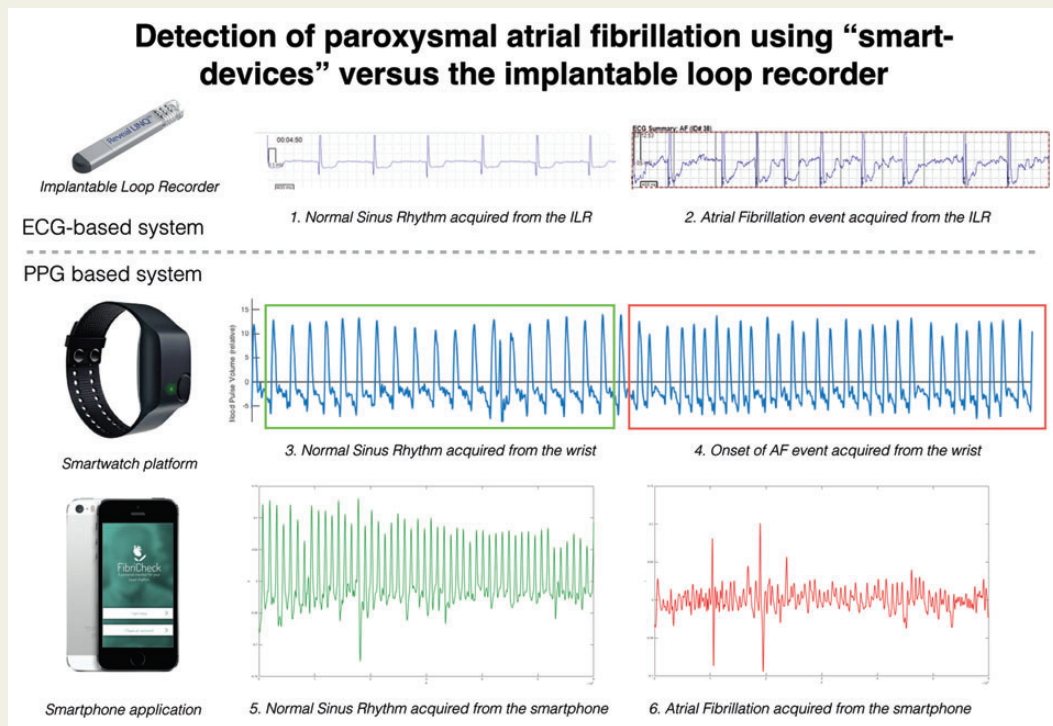
Based on the review of Carpenter and Frontera<sup>1</sup> we present a case of a 66-year-old female patient who was implanted with an implantable loop recorder (ILR) (LinQ, Medtronic) due a history of unexplained syncope and symptoms of palpitations. After the procedure the patient was provided with a smartwatch device (E4, Empatica), which measures the photoplethysmography (PPG) signal at the wrist, and an iPhone 5S smartphone with a custom-made application (FibriCheck<sup>®</sup>), which measures the PPG signal in the tip of the finger using the smartphone camera.

She was instructed to wear the smartwatch during the nights to perform at least 7 h of continuous measurements. After waking and removing the watch for charging, she was instructed to perform spot-check measurements (60 s) using a smartphone application (FibriCheck<sup>®</sup>). In total, two standard recordings were obtained per day and additional measurements upon presentation of symptoms.

All of these measurements were performed over a period of 4 months. Overall compliance rates for the smartwatch measurements and for the smartphone measurements were 98% and 107%, respectively, indicating a good adherence for long-term monitoring application. In total, the ILR detected nine episodes of paroxysmal AF with episodes ranging between 40 min to 3 h.

After synchronizing the data streams between the ILR, smartwatch, and smartphone, all AF events that occurred while wearing or using one of the smart devices were picked-up and identified as AF (as shown in Figure 1). Our in-house-developed algorithms identified episodes of AF when the erratic behaviour of consecutive RR intervals exceeds pre-defined boundaries. Using RR variability for the detection of AF is commonly accepted in literature.<sup>2,3</sup>

Figure 1 shows a normal sinus rhythm as well as episodes of atrial fibrillation. The upper panel represents the ILR results with a normal sinus rhythm as well as the onset of an AF event. This onset is synchronized with the PPG signal of the smartwatch (middle panel). The bottom panel shows two measurements from a smartphone recording using the FibriCheck<sup>®</sup> application.



**Figure 1** Overview of the results obtained using different measurement modalities on a single patient. The top panel shows an ECG-based system using the implantable loop recorder. The middle panel shows the photoplethysmogram signal acquired using a smartwatch. The bottom panel represents the spot-checks performed using the FibriCheck<sup>®</sup> application, where normal sinus rhythm were observed (verified by the ILR) as well as the presence of AF during registered events.

Despite the limitations and concerns about signal quality as indicated by Carpenter and Frontera, this case clearly shows the potential and opportunities of such technologies in the identification of atrial fibrillation in a non-invasive way and without the need for conventional medical hardware. Persuasive technologies such as smartphones and smartwatches provide a new potential in the detection and management of patients with AF, opening a unique way of long-term and cost-effective case-finding initiatives. These straightforward and low-threshold technologies will provide new insights into the long-term behaviour of AF patients and have the potential to completely change the way clinicians will diagnose and manage these patients in the future.

## References

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