

Apple Watch-assisted supraventricular tachycardia detection and qualification for electrophysiological study

Wspomagana AppleWatchem detekcja tachykardii nadkomorowej i kwalifikacja do badania elektrofizjologicznego

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Abstract

Cardiac arrhythmias are a common cause of heart palpitations. As symptoms usually occur only temporarily, diagnosis is often challenging. The current market offers a variety of wearable heart rhythm monitors. In the presented case, a novel technology, the AppleWatch®, detected an episode of AVNRT. It contributed to faster qualification for electrophysiological study and subsequent successful ablation. As a result, a further decrease in patients' quality of life was halted. The development of potentially severe complications, including tachycardia-mediated cardiomyopathy, was prevented. This case exemplifies the clinical utility of ECG-based mobile applications in monitoring patients' heart rhythms in everyday clinical practice. The feasibility of AppleWatch® in other types of arrhythmias remains underinvestigated. Broadening current guidelines for the use of digital health solutions in cardiac rhythm abnormalities should be further discussed.

Key words: atrioventricular nodal re-entrant tachycardia, arrhythmia, telemedicine, electrophysiology

Folia Cardiologica 2022; 17, 5: 315–317

Introduction

Given the increasing ageing of the population and subsequently higher prevalence of age-related diseases, as well as the limited access to healthcare professionals, novel telemedical solutions have recently become a subject of extensive research. The SARS-CoV-2 pandemic has contributed to the further acceleration of studies in the digital health sector [1, 2]. Considering the overall growing burden of arrhythmia, recognizing novel diagnostic tools as valid, is crucial for patient management. Application of newly developed devices into everyday clinical practice is becoming more and more common, partially due to greater health-related awareness and technological interest of patients.

Case report

A 44-year-old woman with a history of palpitations underwent an ambulatory cardiac consultation. However, as the resting 12-lead electrocardiogram (ECG) did not register any presence of arrhythmia, nor sign of pre-excitation, further screening was advised. ECG Holter showed no abnormalities. On the next visit, the patient presented a single-lead ECG tracing with an episode of supraventricular tachycardia (SVT) and suspected atrioventricular nodal reentry tachycardia (AVNRT), recorded on her AppleWatch® (Figure 1). The patient was referred to hospital admission to the 1st Chair and Department of Cardiology, Medical University of Warsaw, to undergo an

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electrophysiological study (EPS). The patient had a history of palpitations and suffered from Hashimoto's disease, which was adequately treated. She reported experiencing chest pain and palpitations during onsets of arrhythmia, decreased exercise tolerance and dizziness. On admission, the patient was in overall good condition, with no symptoms of angina or heart failure. Physical examination revealed a regular heart rate rhythm of 80 bpm, BP 138/83 mm Hg and no other significant deviations. Standard laboratory tests were within the normal range. During EPS dual conduction through the atrioventricular node was confirmed and subsequent AVNRT was induced with stimulation manoeuvres. According to current guidelines, radiofrequency catheter ablation of the slow pathway was subsequently performed [3]. Standard ECG showed sinus rhythm at baseline. The procedure and periprocedural period were carried out without adverse events. The patient was discharged the following day in overall good condition. No further palpitations were noted by the patient within a 2-month follow-up.

Discussion

Telemedical solutions have recently been included in current ESC guidelines for the management of atrial fibrillation, as well as SVT [3, 4]. As it is common for most episodes of tachycardia to be sporadic and elusive, many may not

be frequent enough to be recorded in ambulatory settings. Therefore, transtelephonic monitoring, mobile recording devices or wrist-worn wearable monitors may be of great value for the diagnostic process. Nevertheless, adequate validation is necessary [5]. A wide range of products is available. The patient used a smartwatch single-lead ECG recording (AppleWatch®). The assistance of a novel wearable device facilitated early detection of SVT and referral for invasive EPS. To sum up, described workflow led to a successful ablation and enabled the prevention of the potential development of tachycardia-mediated cardiomyopathy and a further decrease in quality of life as tachycardia episodes intensified over time. This case demonstrates the clinical utility of ECG-based mobile applications in monitoring patients' heart rhythm, as well as in providing additional medical data, which can facilitate the diagnosis and treatment of cardiac arrhythmias. Even though similar cases of a smartwatch - assisted arrhythmia management have been previously described, evidence on this matter remains limited [6, 7]. Therefore, reporting such cases could potentially contribute to increasing the credibility of the presented method.

Conclusions

Novel telemedical tools are becoming an important element of everyday clinical practice.



Figure 1. AppleWatch® recording of supraventricular tachycardia at a rate of about 200 bpm

The Apple Watch® can successfully detect AVNRT. Application of Apple Watch® recorded ECG can contribute to faster qualification for electrophysiological procedures. Broadening current guidelines for the use of wrist-worn devices in cardiac arrhythmias should be considered.

Author contributions

Maria Boszko: Writing – Original draft preparation; Bartosz Krzowski, Łukasz Januszkiewicz, Piotr Łodziński: Conceptualization, Writing – Reviewing and Editing, Supervision.

Conflict of interest

The authors declare no conflicts of interest.

Ethics approval statement

This study did not require any approval other than notification of the bioethics committee and conformed to the ethical guidelines of the 1975 Declaration of Helsinki.

Funding statement

This research received no funding.

Patient consent statement

The patient provided both written and oral consent.

Streszczenie

Zaburzenia rytmu są częstą przyczyną odczuwanych kołatań serca. Najczęściej objawy występują jedynie okresowo, dlatego też postawienie prawidłowego rozpoznania niejednokrotnie może stanowić wyzwanie. Na rynku dostępnych jest obecnie szereg zakładanych na nadgarstek urządzeń monitorujących czynność rytmu serca. W przedstawionym przypadku, nowoczesna technologia – AppleWatch®, wykryła epizod AVNRT. Przyczyniło się to do szybszej kwalifikacji pacjentki do badania elektrofizjologicznego i wcześniejszego wykonania skutecznej ablacji. Dzięki temu nie dopuszczono do dalszego pogarszania się jakości życia pacjentki oraz rozwoju potencjalnych poważnych powikłań, w tym kardiomiopatii tachyarytmicznej. W przedstawionym przypadku zilustrowano przydatność kliniczną aplikacji mobilnych wykonujących badanie EKG w monitorowaniu rytmu serca pacjentów w codziennej praktyce. Możliwość wykorzystania AppleWatcha® w innych typach zaburzeń rytmu serca wymaga dalszych badań. Poszerzenie obecnych wytycznych, dotyczących wykorzystania nowoczesnych technologii w zaburzeniach rytmu serca, pozostaje tematem dalszych dyskusji.

Słowa kluczowe: nawrotny częstoskurcz węzłowy, arytmia, telemedycyna, elektrofizjologia

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References

1. Kaushik A, Patel S, Dubey K. Digital cardiovascular care in COVID-19 pandemic: A potential alternative? *J Card Surg.* 2020; 35(12): 3545–3550, doi: [10.1111/jocs.15094](https://doi.org/10.1111/jocs.15094), indexed in Pubmed: [33040399](https://pubmed.ncbi.nlm.nih.gov/33040399/).
2. Hincapié MA, Gallego JC, Gempeler A, et al. Implementation and usefulness of telemedicine during the COVID-19 pandemic: a scoping review. *J Prim Care Community Health.* 2020; 11: 2150132720980612, doi: [10.1177/2150132720980612](https://doi.org/10.1177/2150132720980612), indexed in Pubmed: [33300414](https://pubmed.ncbi.nlm.nih.gov/33300414/).
3. Brugada J, Katritsis DG, Arbelo E, et al. 2019 ESC Guidelines for the management of patients with supraventricular tachycardia. The Task Force for the management of patients with supraventricular tachycardia of the European Society of Cardiology (ESC). *Eur Heart J.* 2020; 41(5): 655–720, doi: [10.1093/eurheartj/ehz467](https://doi.org/10.1093/eurheartj/ehz467), indexed in Pubmed: [31504425](https://pubmed.ncbi.nlm.nih.gov/31504425/).
4. Hindricks G, Potpara T, Dagres N, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. *Eur Heart J.* 2021; 42(5): 373–498, doi: [10.1093/eurheartj/ehaa612](https://doi.org/10.1093/eurheartj/ehaa612), indexed in Pubmed: [32860505](https://pubmed.ncbi.nlm.nih.gov/32860505/).
5. Wang R, Blackburn G, Desai M, et al. Accuracy of wrist-worn heart rate monitors. *JAMA Cardiol.* 2017; 2(1): 104–106, doi: [10.1001/jamacardio.2016.3340](https://doi.org/10.1001/jamacardio.2016.3340), indexed in Pubmed: [27732703](https://pubmed.ncbi.nlm.nih.gov/27732703/).
6. Kasai Y, Kasai J, Sekiguchi Y, et al. Apple Watch® facilitates single-session catheter ablation of coexisting atrioventricular nodal reentrant tachycardia and atrioventricular reentrant tachycardia. *Clin Case Rep.* 2021; 9(8): e04702, doi: [10.1002/ccr3.4702](https://doi.org/10.1002/ccr3.4702), indexed in Pubmed: [34457301](https://pubmed.ncbi.nlm.nih.gov/34457301/).
7. Siddeek H, Fisher K, McMakin S, et al. AVNRT captured by Apple Watch series 4: Can the Apple watch be used as an event monitor? *Ann Noninvasive Electrocardiol.* 2020; 25(5): e12742, doi: [10.1111/anec.12742](https://doi.org/10.1111/anec.12742), indexed in Pubmed: [31994780](https://pubmed.ncbi.nlm.nih.gov/31994780/).