LETTER TO THE EDITOR

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The Potential Applications of Artificial Intelligence in the Assessment of Atrial Fibrillation: A Review

Yapay Zekanın Atriyal Fibrilasyonun Değerlendirilmesindeki Potansiyel Uygulamaları: Bir İnceleme

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To the Editor,

In the light of current data, the development of artificial intelligence (AI) and machine learning (ML) can play a role in healthcare professionals making more effective, safe, and data-driven decisions[1]. In this respect, the intervention of AI-based systems can be useful to provide a sensitive approach, especially for atrial fibrillation (AF), which is very common in community and where stroke prevention is the main focus of its management[2].

Firstly, AI algorithms can be integrated with electrocardiogram (ECG) data, thereby facilitating the diagnosis of AF. Furthermore, it has been documented that ECGs obtained during normal sinus rhythm in patients with AF can be utilized to ascertain future AF risk through p-wave morphologies and atrial remodeling using AI-supported ECG[3,4]. The application of AI systems to extensive patient data sets allows for the identification of risk factors for AF and evaluation of disease development potential. Additionally, the use of an AI-supported ECG algorithm may enable the prediction of the recurrence of paroxysmal AF after the catheter ablation[5]. The evaluation of patient data and determination of an appropriate treatment strategy based on the patient's individual characteristics can be facilitated by AI algorithms, thus aiding healthcare professionals in selecting the most efficacious AF treatment. Furthermore, they can enhance the predictive capacity of existing AF scoring systems (CHADS2, CHADS2-VA2, and HASBLED) for forecasting adverse outcomes[6].

AI algorithms have the potential to provide real-time feedback during AF endocardial catheter ablation operations. This may be an effective method evaluating voltage-dependent ablation techniques, substrate changes, and pulmonary vein isolation, regardless of the type of AF[7]. Furthermore, AFA-Recur, an ML-based probability score, demonstrated efficacy in predicting the one-year probability of recurrent atrial arrhythmia following AF ablation[8]. Another potential application of AI is an AI-based approach to determine the efficacy of electrical cardioversion for AF, based on patient characteristics and ECG data[9].

The perspective and multifaceted applications of AI in AF hold considerable promise for the advancement of the field, with the potential to revolutionize AF diagnosis, risk stratification and optimization of treatment. The AI algorithms can provide a comprehensive overview of a patient's health status by

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integrating data from a range of sources, including wearable devices (such as smart watches), imaging data, and electronic health records. This enables enhanced risk categorization and diagnostic accuracy. Moreover, healthcare professionals can tailor treatment plans to the specific needs of high-risk individuals. Deep learning (DL) strategies generally seek to utilize the entirety of information present within a dataset (e.g., every waveform change in an electrocardiographic recording) to generate novel features for downstream analysis. ML systems are designed to learn from data, identify patterns, and make decisions. ML can be further subdivided into three distinct categories: supervised, unsupervised, and reinforcement learning. The potential of more sophisticated AI algorithms, including DL and reinforcement learning, is being investigated by researchers to enhance the precision and therapeutic value of AF control. These algorithms have been shown to have the capacity to predict the likelihood of adverse events and, thus, to modify the proposed course of treatment[10]. Consequently, the integration of DL into wearable technology for intermittent screening for silent AF may be cost effective by preventing sequelae such as stroke. The AI may be utilized in the prediction of stroke with the incorporation of high-quality data obtained from patients with atrial high-rate episodes and atrial extrasystoles, in conjunction with the analysis of data from implantable loop recorders and smart watches. It may facilitate the identification of suitable candidates for patent foramen ovale and/or left atrial appendage closure procedures, thereby enabling an earlier diagnosis, more efficacious treatment and a reduction in complications[11]. Furthermore, there is a need for AI-based studies on the prediction and prognosis of stroke in patients with AF[12,13].

From another perspective, AI-based systems may prove beneficial in enhancing the efficacy of AF management and reducing healthcare expenditure. Furthermore, the utilization of AI algorithms has the potential to enhance outcomes and minimize the necessity for hospitalization through the remote monitoring of patients diagnosed with AF[14]. Ultimately, AI may facilitate a novel approach to identifying and managing genetic AF cases, and further research in this area is warranted[15].

Despite the considerable potential of AI in the management of AF, its application is not without constraints. The development of AI systems requires the availability of substantial quantities of high-quality data. The potential of AI to accurately forecast outcomes or make treatment decisions may be limited by an absence of data on specific patient subgroups or unconventional clinical presentations. The generalization and development of AI models across different populations or healthcare systems may be affected by the use of data from a specific population or healthcare system. This can present a significant challenge when employing AI models across a diverse range of patient groups, which may impede the interpretation of the generated predictions. In this regard, following the implementation of the requisite ethical and patient privacy protocols, the utilization of big data from national health systems can be contemplated for the advancement of AI with dependable data. The deployment of AI in healthcare may give rise to ethical concerns, including the possibility of bias in the data employed to develop the algorithms and concerns about patient privacy. It is imperative that collaboration among cardiologists, data scientists, and ethicists be established on this issue. It is of the utmost importance to guarantee that AI tools are not only technically proficient but also ethically sound.

In conclusion, the use of AI in the healthcare system is increasing, and AF patients are at the forefront of this trend. It is important to prepare for the AI era, which has the potential to transform healthcare.

Footnotes

Authorship Contributions

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REFERENCES

1. Koçak B, Cuocolo R, dos Santos DP, Stanzione A, Ugga L. Must-have qualities of clinical research on artificial intelligence and machine learning. Balkan Med J. 2023;40:3-12.
2. Hayıroğlu Mİ, Altay S. The role of artificial intelligence in coronary artery disease and atrial fibrillation. Balkan Med J. 2023;40:151-2.
3. Attia ZI, Noseworthy PA, Lopez-Jimenez F, Asirvatham SJ, Deshmukh AJ, Gersh BJ, et al. An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation during sinus rhythm: a retrospective analysis of outcome prediction. Lancet. 2019;394:861-7.
4. Choi JH, Song SH, Kim H, Kim J, Park H, Jeon J, et al. Machine learning algorithm to predict atrial fibrillation using serial 12-Lead ECGs based on left atrial remodeling. J Am Heart Assoc. 2024;13:e034154.
5. Jiang J, Deng H, Liao H, Fang X, Zhan X, Wei W, et al. An artificial intelligence-enabled ecg algorithm for predicting the risk of recurrence in patients with paroxysmal atrial fibrillation after catheter ablation. J Clin Med. 2023;12:1933.
6. Joddrell M, El-Bouri W, Harrison SL, Huisman MV, Lip GYH, Zheng Y, et al. Machine learning for outcome prediction in patients with non-valvular atrial fibrillation from the GLORIA-AF registry. Sci Rep. 2024;14:27088.
7. Rolf S, Kircher S, Arya A, Eitel C, Sommer P, Richter S, et al. Tailored atrial substrate modification based on low-voltage areas in catheter ablation of atrial fibrillation. Circ Arrhythm Electrophysiol. 2014;7:825-33.
8. Saglietto A, Gaita F, Blomstrom-Lundqvist C, Arbelo E, Dagres N, Brugada J, et al. AFA-Recur: an ESC EORP AFA-LT registry machine-learning web calculator predicting atrial fibrillation recurrence after ablation. Europace. 2023;25:92-100.

9. Vinter N, Frederiksen AS, Albertsen AE, Lip GYH, Fenger-Grøn M, Trinquart L, et al. Role for machine learning in sex-specific prediction of successful electrical cardioversion in atrial fibrillation? Open Heart. 2020;7:e001297.

10. Krittanawong C, Johnson KW, Rosenson RS, Wang Z, Aydar M, Baber U, et al. Deep learning for cardiovascular medicine: a practical primer. Eur Heart J. 2019;40:2058-73.

11. Saini H, Rose DZ. The Ghost in the Machine: Artificial intelligence in neurocardiology will advance stroke care. Neurohospitalist. 2024:19418744241288887.

12. Goh B, Bhaskar SMM. Evaluating machine learning models for stroke prognosis and prediction in atrial fibrillation patients: a comprehensive meta-analysis. Diagnostics (Basel). 2024;14:2391.

13. Ortega-Martorell S, Olier I, Ohlsson M, Lip GYH; TARGET Consortium. TARGET: a major european project aiming to advance the personalised management of atrial fibrillation-related stroke via the development of health virtual twins technology and artificial ıntelligence. Thromb Haemost. 2025;125:7-11.

14. Guo RX, Tian X, Bazoukis G, Tse G, Hong S, Chen KY, et al. Application of artificial intelligence in the diagnosis and treatment of cardiac arrhythmia. Pacing Clin Electrophysiol. 2024;47:789-801.

15. Kany S, Ellinor PT, Khurshid S. Another piece in the puzzle of atrial fibrillation risk: clinical, genetic, and electrocardiogram-based artificial intelligence. Eur Heart J. 2024;45:4935-7.