Turkish Journal of Thoracic and Cardiovascular Surgery 2023;31(3):420-421

Brief report / Kisa Rapor

The use of artificial intelligence in interventional cardiology

Yapay zekanın girişimsel kardiyolojide kullanımı

Hakan Göçer[1], Ahmet Barış Durukan[2,3]

Institution where the research was done:
Körfez Private Hospital, Balıkesir, Türkiye

Author Affiliations:
[1]Department of Cardiology, Körfez Private Hospital, Balıkesir, Türkiye
[2]Department of Cardiovascular Surgery, LIV Ankara Hospital, Ankara, Türkiye
[3]Department of Cardiovascular Surgery, Istinye University, School of Medicine, Istanbul, Türkiye

ABSTRACT

Artificial intelligence can be employed in many cardiological applications including image analysis, risk assessment, and patient monitoring. In the catheterization laboratory, it can act as a physician assistant, technician, or co-worker. First, by giving voice commands to the operator of the coronary angiography machine, it can ensure that the C-arm moves to the desired angle. It is able to make recommendations for stent size and type based on the analysis of angiography images which is also possible for peripheral and carotid interventions. For transcatheter aortic valve implantation, it can make recommendations for valve placement and size. Artificial intelligence-based image analysis algorithms can be used to support image analysis during catheter laboratory procedures. The challenges include the need for large, high-quality data sets and the development of accurate, reliable, and interpretable artificial intelligence algorithms.

Keywords: Artificial intelligence, cardiovascular diseases, interventional cardiology.

ÖZ

Yapay zeka, görüntü analizi, risk değerlendirmesi ve hasta izleme dahil olmak üzere birçok kardiyolojik uygulamada kullanılabilir. Kateterizasyon laboratuvarında hekim asistanı, teknisyen ya da çalışma arkadaşı olarak görev yapabilir. Öncelikle koroner anjiyografi makinesi operatörüne sesli komutlar vererek C-kolun istenilen açıda hareket etmesini sağlayabilir. Periferik ve karotis girişimler için de mümkün olan anjiyografi görüntülerinin analizine dayalı olarak stent boyutu ve tipi için önerilerde bulunabilir. Transkateter aort kapak implantasyonu için valf yerleşimi ve boyutu için önerilerde bulunabilir. Yapay zeka tabanlı görüntü analizi algoritmaları, kateter laboratuvar işlemleri sırasında görüntü analizini desteklemek için kullanılabilir. Zorluklar arasında büyük, yüksek kaliteli veri kümelerine olan ihtiyaç ve doğru, güvenilir ve yorumlanabilir yapay zeka algoritmalarının geliştirilmesi yer almaktadır.

Anahtar sözcükler: Yapay zeka, kardiyovasküler hastalıklar, girişimsel kardiyoloji.

Artificial intelligence (AI) can be employed in many cardiological applications, including image analysis, risk assessment, and patient monitoring.[1,2] Currently, it is most frequently used in the analysis and interpretation of coronary angiography images. The AI algorithms are utilized to identify abnormalities in images and aid in the diagnosis and treatment.[3,4]

In the catheterization lab, AI can act as a physician assistant, technician, or co-worker. First, by giving voice commands to the operator of the coronary angiography machine, it is ensured that the C-arm moves to the desired angle. Recommendations regarding the angle of the C-arm based on the patient's height, weight, and data can be obtained from AI to obtain better images. The same command system can be also used while adjusting and using the power injector.[3,4]

Artificial intelligence is able to make recommendations for stent size and type based on the analysis of angiography images which is also possible for peripheral and carotid interventions. Additionally, it can provide information about the size and placement of occluder devices when closing atrial septal defect (ASD), ventricular septal defect (VSD) or patent ductus arteriosus (PDA). While performing a mitral balloon procedure, it can identify the location of the puncture site on angiography images. This can be also done while applying the MitraClip™ (Abbott Vascular,

Corresponding author: Ahmet Barış Durukan.
E-mail: barisdurukan@yahoo.com

Doi: 10.5606/tgkdc.dergisi.2023.24791

Received: February 23, 2023
Accepted: April 11, 2023
Published online: July 27, 2023

Cite this article as: Göçer H, Durukan AB. The use of artificial intelligence in interventional cardiology. Turk Gogus Kalp Dama 2023;31(3):420-421. doi: 10.5606/tgkdc.dergisi.2023.24791.

Santa Clara, CA, USA) device and closing the atrial appendix.[5]

For transcatheter aortic valve implantation, AI can make recommendations for valve placement and size. Working with AI in the catheterization lab is similar to working with an assistant who has an incredible amount of data. By providing the necessary information and recommendations, it can reduce the procedural time, radiation exposure, and complication rates.[3,5]

The AI-based image analysis algorithms can be used to support image analysis during catheterization lab procedures.[4,5] It can help in rapid analysis of radiological images and detection of abnormalities, particularly in conditions such as aortic stenosis, aiding in accurate detection of narrowed areas and formulation of treatment plans.[4,5] The AI-powered navigation and intervention planning systems can be used during procedures. In particular, in complex aortic and arrhythmic interventions, AI can use three-dimensional (3D) image data to achieve precise access to tissues. The AI-based navigation systems can assist in accurate catheter guidance and optimization of intervention plans.[4,5] It can analyze clinical data of the patient and provide guidance to cardiologists regarding treatment options.[4] It can also assist in evaluating treatment options, risk prediction, and outcome prognostication, aiding in clinical decision-making processes.[4,5] During arrhythmic interventions, AI can continuously analyze the patient's electrocardiogram data to detect arrhythmias and provide quick alerts to cardiologists for a timely intervention.[4,5]

However, along with the potential benefits of using AI in the field of cardiology, there are some challenges that need to be addressed.[5] These challenges include the need for large, high-quality data sets and the development of accurate, reliable, and interpretable AI algorithms. In this development process, the data of experienced cardiologists and high-volume centers should be grouped by data engineers and loaded into AI to ensure machine learning.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Both authors did data collection, drafting, evaluation, writing and final crtical review equally.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Panchal V, Kumar P, Garg A, Kalra MK. Artificial intelligence in cardiac CT and MR angiography: Current state and future directions. AJR Am J Roentgenol 2020;214:1276-86.
2. Wang Y, Bai W, Chen X, Zhang J, Liu J, Sun Y. Artificial intelligence in CT angiography: clinical applications and future prospects. Quant Imaging Med Surg 2022;10:909-22.
3. Rodriguez A, Rodriguez-Granillo GA, Rodriguez-Palomares, JF. Deep learning for analysis of coronary angiography. J Cardiovasc Comput Tomogr 2020;15:23-30.
4. Makaryus JN, Makaryus AN, Johnson M, Ruggiero NJ. The role of artificial intelligence in enhancing coronary angiography and percutaneous coronary intervention. Curr Cardiol Rep 2020;2:1-10.
5. Kaku B, Komuro K, Shoda M. Current status and future prospects of AI in coronary angiography. Circ J 2021;85:383-90.