Editorial

The Future of CPR: Leveraging Artificial Intelligence for Enhanced Cardiopulmonary Resuscitation Outcomes

Payam Emami, MSc[1], Mohammad Sistani, MSc[2], Ameneh Marzban, PhD[3*]

[1]Department of Emergency Medical Sciences, Faculty of Paramedical Sciences, Kurdistan University of Medical Sciences, Sanandaj, Iran.
[2]Department of Nursing, School of Nursing and Midwifery, Bam University of Medical Sciences, Bam, Iran.
[3]Department of Health in Disasters and Emergencies, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran.

Sudden cardiac arrest remains a significant contributor to global mortality, accounting for 15% to 20% of all deaths and affecting approximately 50 to 100 individuals per 100,000 population.[1] Early cardiac arrest prediction is crucial, as it enables prompt action to prevent or intervene at its onset. Cardiopulmonary resuscitation (CPR) and electrical defibrillation are essential interventions for effective resuscitation in patients with cardiac arrest associated with ventricular fibrillation rhythms.[1, 2] Recent advancements in artificial intelligence (AI) technology present opportunities to improve CPR procedures. AI can enhance various aspects of CPR, resulting in more efficient and accurate resuscitation processes.

AI-powered simulators and training systems enable individuals to practice and refine CPR skills through realistic simulations. These systems provide instant feedback, allowing for technique refinement and confidence building in effective CPR performance. AI has contributed to the development of virtual reality simulations and training modules for CPR, enabling healthcare providers to hone their skills in a safe and realistic environment. Such simulations improve medical personnel's competency and increase their confidence when responding to real-life emergencies.[3-5] AI algorithms can analyze real-time patient data, including vital signs and ECGs, to rapidly identify cardiac arrest symptoms. Early detection facilitates prompt CPR initiation, significantly enhancing survival chances.[4, 6]

AI-driven dispatch systems can analyze incoming emergency calls, prioritize them based on severity, and provide real-time guidance to dispatchers. By rapidly assessing the emergency and caller's location, AI can help reduce response times by promptly dispatching the nearest available units. Proper chest compressions are essential during CPR. AI-assisted devices provide real-time feedback and guidance to healthcare professionals or bystanders performing CPR, ensuring optimal compression depth, rate, and recoil, as well as detecting rescuer fatigue, thereby maintaining high-quality CPR administration.[3] AI algorithms can analyze vast amounts of data and medical literature to assist healthcare providers in making informed decisions during

This paper should be cited as: Emami P, Sistani M, Marzban A. The Future of CPR: Leveraging Artificial Intelligence for Enhanced Car-diopulmonary Resuscitation Outcomes. J Teh Univ Heart Ctr 2024;19(2):77-78.

Corresponding Author: **Ameneh Marzban,** *Department of Health in Disasters and Emergencies, School of Health Management and Information Sciences, Faculty of Medical Information and Management, Rashid Yasmi Street, Vali-e-Asr, Tehran, Iran. 19967138. Tel: +98 21 88882886. Fax: +98 2188794301. E-mail: amenemarzban@yahoo.com.*

resuscitation efforts, including personalized treatment recommendations and predictive analytics for optimizing outcomes.[6] The integration of AI with automated external defibrillators (AEDs), portable devices that deliver electric shocks to restore normal heart rhythm in cases of sudden cardiac arrest, has the potential to enhance AED effectiveness and improve outcomes for individuals experiencing cardiac emergencies.[1] As AI technology continues to advance, ongoing research, development, and integration within CPR protocols have the potential to significantly improve survival rates and long-term patient outcomes. It is crucial to recognize that AI should be considered a complementary tool to human expertise, rather than a replacement, in the delivery of high-quality CPR and overall patient care.[7, 8]

In conclusion, the integration of AI technologies in CPR has the potential to transform emergency medical care. AI facilitates early recognition, optimizes chest compressions, provides automated feedback and training, and offers decision support, revolutionizing CPR interventions. Collaboration among healthcare professionals, researchers, and technology developers is essential to fully harness AI's potential in saving lives. Further advancements in AI for CPR should be encouraged and supported to ensure this innovative technology becomes widely accessible, contributing to a world where more lives can be saved during critical emergencies.

References

1. Aqel S, Syaj S, Al-Bzour A, Abuzanouneh F, Al-Bzour N, Ahmad J. Artificial Intelligence and Machine Learning Applications in Sudden Cardiac Arrest Prediction and Management: A Comprehensive Review. Curr Cardiol Rep 2023;25:1391-1396.
2. Iqbal A, Nisar I, Arshad I, Butt UI, Umar M, Ayyaz M, Farooka MW. Cardiopulmonary resuscitation: Knowledge and Attitude of doctors from Lahore. Ann Med Surg (Lond) 2021;69:102600.
3. Brown G, Conway S, Ahmad M, Adegbie D, Patel N, Myneni V, Alradhawi M, Kumar N, Obaid DR, Pimenta D, Bray JJH. Role of artificial intelligence in defibrillators: a narrative review. Open Heart 2022;9:e001976.
4. Viderman D, Abdildin YG, Batkuldinova K, Badenes R, Bilotta F. Artificial Intelligence in Resuscitation: A Scoping Review. J Clin Med 2023;12:2254.
5. Emami P, Javanmardi K. Enhancing Emergency Response through Artificial Intelligence in Emergency Medical Services Dispatching; a Letter to Editor. Arch Acad Emerg Med 2023;11:e60.
6. Chee ML, Chee ML, Huang H, Mazzochi K, Taylor K, Wang H, Feng M, Ho AFW, Siddiqui FJ, Ong MEH, Liu N. Artificial intelligence and machine learning in prehospital emergency care: A scoping review. iScience 2023;26:107407.
7. Choudhury A, Asan O. Role of Artificial Intelligence in Patient Safety Outcomes: Systematic Literature Review. JMIR Med Inform 2020;8:e18599.
8. Emami P, Marzban A. The Synergy of Artificial Intelligence (AI) and Geographic Information Systems (GIS) for Enhanced Disaster Management: Opportunities and Challenges. Disaster Med Public Health Prep 2023;17:e507.