Case Reports and Reviews

Short Communication



Current Applications and Clinical Impact of Artificial Intelligence in Pediatric Cardiology

Manal Mohammed Helmy Nabo

Consultant Pediatric Cardiology, Maternity and Children, Hospital, El Madina El Munawara, Hail, Saudi Arabia.
Doctor of Philosophy, Tokushima University, Japan.

Correspondence

Manal Mohammed Helmy Nabo

Consultant Pediatric Cardiology, Maternity and Children Hospital, El Madina El Munawara, Hail, Saudi Arabia.

Abstract

Artificial intelligence (AI) is an important component of modern cardiovascular medicine. All complex multimodal data, including echocardiography, electrocardiography (ECG), cardiac magnetic resonance imaging (MRI) and computed tomography (CT) are widely studied.

Recent advances in machine learning and deep learning have demonstrated potential for automated image interpretation, congenital heart disease (CHD) detection.

AI can assist with image acquisition, view classification, segmentation and quantitative measurements.

Recent pediatric-specific models demonstrate the ability to assess right ventricular function based on datasets across multiple centers.

AI-assisted ECG analysis may identify abnormalities that are difficult to recognize using conventional interpretation. In fetal cardiology, AI-assisted echocardiography may improve the detection of congenital heart disease and increase diagnostic ability.

AI systems must complement method rather than replace pediatric cardiologists. Future research should focus on multicenter prospective validation, pediatric-specific foundation models, multimodal AI.

.

- **Received Date**: 22 Sep 2026
- **Accepted Date:** 17 Oct 2026
- **Publication Date**: 28 Oct 2026

Keywords

artificial intelligence, pediatric cardiology, congenital heart disease and machine learning.

Copyright

© 2026 Authors. This is an open- access article distributed under the terms of the Creative Commons Attribution 4.0 International license.

Introduction

Artificial intelligence (AI) refers to computational methods capable of performing tasks that traditionally require human intelligence. These are including pattern of recognition, prediction, classification and decision support.

Machine learning (ML) and deep learning (DL) have rapidly expanded the potential applications of AI in cardiovascular medicine [1,2].

AI helps in cardiac assessment frequently involves large amounts of complex visual and physiological information.

Recent reviews indicate that AI applications in pediatric cardiology are expanding across imaging and ECG interpretation [1-3].

Pediatric-specific datasets and validation are essential. The children's cardiovascular anatomy, heart rate, ventricular geometry and normal reference ranges.

Artificial Intelligence in Pediatric Echocardiography

Echocardiography is one of the most important applications of AI in pediatric cardiology. Conventional pediatric echocardiography can be technically challenging because of rapid heart rates, small anatomical structures, patient movement, variable acoustic windows and complex congenital anatomy [1].

AI can potentially assist at several stages of the echocardiographic workflow as image acquisition, view recognition, image-quality assessment , anatomical segmentation and automated measurements [1,4].

AI-based systems have demonstrated the ability to automate portions of echocardiographic analysis and reduce variability between observers [1]. Pediatric-specific AI systems are increasingly being developed rather than relying exclusively on adult-trained models [4].

Automated ventricular assessment

Assessment of ventricular function is particularly suitable for AI because ventricular borders can be difficult to trace manually.

The right ventricle presents a special challenge because of its complex three-dimensional geometry. A multi-center pediatric deep-learning study demonstrated automated assessment of right ventricular function [5].

Such systems may eventually assist with assessment of Right ventricular fractional area change, left ventricular ejection fraction, ventricular dimensions, chamber volumes and both global and regional function

Citation: Nabo MMH. Current Applications and Clinical Impact of Artificial Intelligence in Pediatric Cardiology. Case Rep Rev. 2026;6(4):100.

The ventricular dysfunction associated with congenital heart disease are easy seen and full assessment is done [4,5]

Automated measurements safe the time required for repetitive quantitative assessment.

AI and congenital Heart Disease

Congenital heart disease (CHD) is one of the most important areas for AI research in pediatric cardiology.

AI can potentially recognize anatomical patterns associated with: ventricular septal defect, atrial septal defect, Tetralogy of Fallot, transposition of the great arteries, coarctation of the aorta, atrioventricular septal defect, pulmonary stenosis, single-ventricle physiology and complex congenital heart disease [3,6]

AI-based image analysis can identify patterns that may be difficult to recognize rapidly, particularly when multiple abnormalities coexist.

Artificial intelligence may also assist with classification of cardiac structures and identification of abnormal anatomy. However, the performance of AI systems can vary according to the patient population, imaging equipment, acquisition protocol and disease prevalence [6,7].

Artificial Intelligence in Fetal Cardiology

Prenatal diagnosis of congenital heart disease can influence delivery planning, neonatal stabilization and referral to specialized cardiac centers.

AI-assisted fetal echocardiography may support recognition of abnormal four-chamber views, detection of outflow tract abnormalities, classification of cardiac structures, automated image-quality assessment, CHD risk estimation [6,8]

A systematic review and meta-analysis of AI-assisted fetal echocardiographic image analysis reported high diagnostic performance for CHD detection across the included studies [8].

AI in Pediatric Electrocardiography

ECG is inexpensive, non-invasive, and widely available, making it an attractive source for AI analysis.

Deep-learning models can analyze ECG waveforms for patterns associated with: arrhythmias , conduction abnormalities, ventricular hypertrophy and repolarization abnormalities. [9]

AI may be particularly useful when an abnormality is represented and difficult to identify using conventional rule-based interpretation [9]. However, pediatric ECG interpretation is strongly age-dependent. Heart rate, PR interval, QRS duration, and normal voltage patterns change throughout childhood.

Consequently, pediatric AI models should incorporate age, body size, and developmental stage rather than simply applying adult algorithms [9].

AI in Cardiac MRI and CT

Cardiac MRI and CT provide detailed anatomical and functional information in children with complex congenital heart disease.

AI can assist with image reconstruction, segmentation, chamber volume calculation, flow analysis and anatomical modeling. [3]

AI-assisted imaging may be particularly useful in complex CHD, where conventional manual segmentation and quantitative analysis can be time-consuming [3].

In the future, AI may facilitate patient-specific three-dimensional cardiac models that could support surgical and interventional planning.

AI in Pediatric Cardiac Surgery and Interventional Cardiology

Many applications are used as surgical risk prediction, prediction of postoperative complications, prediction of prolonged intensive-care admission, procedural planning, three-dimensional anatomical reconstruction, catheterization planning and prediction of hemodynamic changes [3,10].

AI in Pediatric Cardiac Intensive Care

Pediatric cardiac intensive care needed well adapted base information regarding heart rate, blood pressure, oxygen saturation, respiratory rate and both ECG and Echocardiographic measurements [2,3]

AI could potentially identify patterns associated with clinical deterioration before they become obvious clinically.

Possible applications include prediction of low cardiac output syndrome, arrhythmia, respiratory deterioration, acute kidney injur and prolonged intensive-care admission [2,3]

The future may involve combining genotype with cardiac imaging to determine whether a genetic variant is associated with a particular anatomical or functional phenotype.

This may be particularly relevant to inherited cardiomyopathy, channelopathies, syndromic CHD and rare pediatric cardiac disorders.

Discussion

Artificial intelligence represents an important emerging technology in pediatric cardiology. Its potential extends from automated imaging analysis to ECG interpretation, fetal cardiac screening, congenital heart disease diagnosis, ventricular-function assessment, procedural planning, intensive-care monitoring, and risk prediction [1,2,3,4,6,9,10].

Echocardiography currently represents one of the most developed areas of pediatric cardiac AI. Automated view classification, segmentation, measurements, and ventricular-function assessment may improve efficiency and reproducibility [1,4,5]. Pediatric-specific models are particularly important because normal cardiac anatomy and physiology change substantially with age.

AI-assisted fetal echocardiography is another promising field. Earlier identification of CHD could facilitate appropriate referral and delivery planning. However, high diagnostic performance in retrospective studies does not necessarily demonstrate clinical effectiveness in routine practice. Prospective multicenter validation remains necessary [7,8].

ECG analysis provides another important opportunity because ECGs are inexpensive and widely available. Deep-learning algorithms may recognize combinations of waveform characteristics that are difficult to identify using conventional interpretation [9]. Pediatric-specific models must account for developmental changes in normal ECG parameters.

The next major development is likely to be multimodal AI. Instead of asking an algorithm to interpret a single echocardiographic image, future systems may integrate imaging, ECG, genetics, laboratory data, clinical history, and longitudinal outcomes. This could support more individualized diagnosis and risk assessment [2,3].

However, implementation should proceed cautiously. Pediatric AI faces substantial challenges related to dataset

size, demographic representation, external validation, interpretability, privacy, and workflow integration [7,11].

Therefore, AI should currently be regarded as a clinical support technology rather than an autonomous pediatric cardiologist. The most appropriate model is human–AI collaboration, in which algorithms perform repetitive or computationally complex tasks while pediatric cardiologists provide clinical reasoning, contextual interpretation, communication with families, and final clinical decision-making.

Conclusion

Artificial intelligence has the potential to transform pediatric cardiology. Current applications include echocardiography, ECG analysis, fetal cardiac screening, cardiac MRI and CT. More application are used for congenital heart disease diagnosis, ventricular-function assessment, procedural planning, intensive-care monitoring, and risk prediction [1,2,3,4,6,9,10].

The strongest future opportunity is the development of pediatric-specific multimodal AI systems that integrate imaging. Also. physiological data, genetics, and longitudinal clinical information can be well tested. The successful implementation requires transparent algorithms, diverse datasets, strong data protection, and continued pediatric cardiologist oversight [7,11].

AI should therefore be viewed not as a replacement for pediatric cardiology expertise, but as a tool that can augment diagnosis, standardize measurements, improve efficiency, and support increasingly personalized cardiovascular care.

References

1. Nguyen HH, Villemain O, Friedberg MK, Lovstakken L, Rusin CG, Mertens L. Artificial intelligence in the pediatric echocardiography laboratory: automation, physiology, and outcomes. Pediatric Cardiology. 2023.
2. Artificial Intelligence in Pediatric Cardiology: Present Applications and Future Directions. Pediatric Reports. 2026;18(3):70.
3. The role of artificial intelligence in pediatric cardiovascular imaging: clinical applications and future directions in computed tomography and magnetic resonance imaging. 2025. PMID: 41351630.
4. Deep Learning-Based Automated Echocardiographic Measurements in Pediatric and Congenital Heart Disease. 2025. PMID: 41728295.
5. AI learning for pediatric right ventricular assessment: development and validation across multiple centers. npj Digital Medicine. 2025.
6. Artificial Intelligence in Fetal and Pediatric Echocardiography. Review. 2025.
7. Artificial intelligence in pediatric cardiology: challenges, validation, and future directions. Recent pediatric cardiology AI literature, 2025–2026.
8. Artificial Intelligence-Assisted Echocardiographic Image-Analysis for the Diagnosis of Fetal Congenital Heart Disease: A Systematic Review and Meta-Analysis. 2025. PMID: 40351693.
9. Leone DM, O'Sullivan D, Bravo-Jaimes K. Artificial Intelligence in Pediatric Electrocardiography: A Comprehensive Review. Children (Basel). 2025;12(1):25.
10. Holt DB, El-Bokl A, Stromberg D, Taylor MD. Role of Artificial Intelligence in Congenital Heart Disease and Interventions. Journal of the Society for Cardiovascular Angiography & Interventions. 2025;4(3):102567.
11. Ethical considerations in AI for child health and recommendations for child-centered medical AI. npj Digital Medicine. 2025.