INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

AI-ASSISTED IMAGING AND NAVIGATION IN MINIMALLY INVASIVE CARDIAC INTERVENTIONS

A SYSTEMATIC REVIEW

Asraful Hoque[1]*, Imran Ahmed[2], Nurun Nahar[3], Syeda Jabin Saria[4], Sinigdha Islam[5], MD Mehedi Hasan[6], Banasree Roy Urmi[7], Aditta Das[8]

[1]Associate Professor, Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Bangladesh.
[2]Assistant Registrar, National Institute of Cardiovascular Diseases (NICVD), Bangladesh.
[3]National Institute of Cardiovascular Diseases (NICVD), Bangladesh.
[4]Assistant Registrar, Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Bangladesh.
[5]MBBS, MPH, ZWH Medical Care PC NY, United States.
[6]Medical Officer, Sylhet Medical College, Bangladesh.
[7]Medical Officer, KC Hospital & Diagnostic Center, Bangladesh.
[8]Hebei Medical University, Shijiazhuang, China.

Corresponding Author: Asraful Hoque, Associate Professor, Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Bangladesh, dr_asraf_sium@yahoo.com

Acknowledgement: The authors acknowledge the contributions of the medical librarian for their assistance in developing the comprehensive search strategy and thank all researchers whose studies were included in this review. Appreciation is also extended to the peer reviewers for their valuable insights that improved the quality of this manuscript.

Conflict of Interest: None | Grant Support & Financial Support: None

ABSTRACT

Background: Minimally invasive cardiac interventions (MICIs), including transcatheter aortic valve replacement (TAVR), percutaneous coronary intervention (PCI), and catheter ablation, have significantly improved the management of cardiovascular diseases by offering reduced morbidity and faster recovery. However, the complex anatomical landscape and the dynamic nature of the heart create challenges in achieving accurate imaging and navigation. Emerging artificial intelligence (AI) technologies, including machine learning and augmented reality (AR), offer potential solutions, yet a comprehensive synthesis of their impact in MICIs remains limited.

Objective: This systematic review aims to evaluate the effectiveness of AI-assisted systems in enhancing preoperative planning, intraoperative navigation, and postoperative monitoring in MICIs, with a focus on procedural accuracy, safety, and efficiency.

Methods: A systematic review was conducted following PRISMA guidelines. Databases including PubMed, Scopus, EMBASE, and IEEE Xplore were searched from January 2013 to March 2025. Studies were included if they reported clinical applications of AI in imaging or navigation during MICIs. Data extraction and risk of bias assessment were independently performed by two reviewers using standardized tools (RoB 2.0, ROBINS-I). Studies involving animal models, simulations without clinical validation, and non-English articles were excluded.

Results: Out of 276 records, 43 studies met the inclusion criteria. AI technologies, particularly convolutional neural networks and AR-based guidance systems, demonstrated consistent improvements in anatomical visualization, procedural success, and navigation precision (mean accuracy within 2 mm). Compared to conventional approaches, AI-assisted procedures showed reduced fluoroscopy time (28% decrease), radiation dose (40% decrease), and overall procedure duration (18.4% reduction). AI was also associated with fewer complications and improved clinical outcomes in TAVR, PCI, and ablation procedures.

Conclusion: AI-assisted imaging and navigation significantly enhance the precision, safety, and operational efficiency of MICIs. Despite promising findings, variability in study designs and the need for high-quality, diverse datasets highlight the necessity for further large-scale, multicenter research. Future work should also focus on regulatory frameworks and seamless clinical integration.

Keywords: Artificial Intelligence, Minimally Invasive Cardiac Interventions, Imaging, Navigation, Augmented Reality, Systematic Review.

INTRODUCTION

Minimally invasive cardiac interventions (MICIs) have transformed the landscape of cardiovascular care, providing alternatives to traditional open-heart surgeries with reduced perioperative risks, shorter hospital stays, and accelerated patient recovery. Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, accounting for approximately 17.9 million deaths annually, highlighting the critical need for effective and less invasive treatment options (1). MICIs such as transcatheter aortic valve replacement (TAVR), percutaneous coronary interventions (PCI), and catheter-based electrophysiological ablations have increasingly become standard practice, particularly among patients considered high-risk for open surgery (2). These procedures, however, rely on precise imaging and navigation to traverse complex anatomical pathways and achieve optimal therapeutic outcomes. Despite the remarkable progress in MICIs, several challenges persist. Traditional imaging techniques like fluoroscopy and echocardiography provide limited two-dimensional representations of intricate three-dimensional cardiac structures, complicating real-time navigation and increasing the risk of procedural errors such as device malposition or vascular injury (3,4). Moreover, anatomical variations among patients and the dynamic nature of a beating heart further complicate the navigation process, demanding higher operator skill and experience (5). Consequently, there is a growing interest in integrating advanced technologies, particularly artificial intelligence (AI), to enhance intraoperative visualization, accuracy, and decision-making during MICIs. AI has emerged as a promising solution to address many of these procedural challenges. Through machine learning algorithms and data-driven analysis, AI applications have shown potential in augmenting preoperative planning, real-time image interpretation, and postoperative monitoring (6). AI-powered platforms can generate detailed three-dimensional reconstructions from preoperative CT or MRI scans, aiding clinicians in identifying ideal access routes, evaluating anatomical risks, and selecting appropriate device sizes for interventions such as TAVR (7). Moreover, intraoperative applications, including AI-enhanced image fusion and augmented reality systems, are being used to overlay patient-specific anatomy onto the surgical field, improving spatial awareness and procedural safety (8). These innovations not only reduce procedure time and radiation exposure but also enhance clinical outcomes.

Despite growing evidence supporting the utility of AI in MICIs, the current literature remains fragmented, with varying methodologies, patient populations, and outcome measures. There is limited consensus on which AI applications provide consistent benefits across different procedural contexts, and questions remain regarding their generalizability and clinical integration. As MICIs continue to evolve with technological advancements, it is imperative to systematically evaluate the role of AI in improving procedural efficacy, patient safety, and clinical outcomes. This systematic review aims to address the following research question: In adult patients undergoing minimally invasive cardiac interventions (Population), how does the integration of artificial intelligence-based imaging and navigation systems (Intervention) compare to conventional imaging and navigation techniques (Comparison) in improving procedural accuracy, safety, and patient outcomes (Outcome)? The objective is to synthesize recent evidence from studies published between 2018 and 2024, including randomized controlled trials and observational studies, that assess the impact of AI-assisted systems in MICIs. The review will encompass global literature without geographical restriction and will adhere to PRISMA guidelines to ensure methodological transparency and reproducibility. By consolidating current knowledge and identifying evidence gaps, this review seeks to inform clinicians, researchers, and policy-makers on the effectiveness and future potential of AI technologies in MICIs. It aims to guide clinical decision-making, facilitate the integration of AI into surgical workflows, and highlight areas requiring further research and technological development.

METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological transparency, reproducibility, and rigor throughout the review process. A comprehensive search strategy was developed in collaboration with an experienced medical librarian to identify relevant studies that investigated the application of artificial intelligence (AI) technologies in minimally invasive cardiac interventions (MICIs). The databases searched included PubMed/MEDLINE, Scopus, IEEE Xplore, EMBASE, Web of Science, and the Cochrane Library. The search incorporated Medical Subject Headings (MeSH) and free-text keywords such as “Artificial Intelligence,” “Machine Learning,” “Deep Learning,” “Augmented Reality,” combined with cardiac procedure-specific terms like “Transcatheter Aortic Valve Replacement,” “Percutaneous

Coronary Intervention," "Catheter Ablation," and "Image-Guided Navigation" using Boolean operators. The search was restricted to studies involving human subjects, published in English between January 2013 and March 2025. In addition to database searches, references from included studies and relevant reviews were manually screened to identify additional eligible publications. Eligibility criteria for study inclusion were based on the PICOS framework. Studies were considered eligible if they included adult patients undergoing MICIs, such as TAVR, PCI, electrophysiological catheter ablation, or mitral valve interventions, and utilized AI-based imaging or navigational systems. Eligible interventions included machine learning algorithms, convolutional neural networks (CNN), image fusion, computer vision techniques, and augmented reality guidance systems. Comparators included conventional imaging or navigation techniques without AI augmentation. The primary outcomes assessed were procedural accuracy, navigation precision, radiation exposure, operative time, complication rates, and operator satisfaction. Accepted study designs included randomized controlled trials (RCTs), prospective and retrospective cohort studies, case-control studies, case series with a minimum of five patients, and clinically validated AI studies published in peer-reviewed conference proceedings. Studies were excluded if they were animal or cadaveric models, simulation-only without clinical validation, diagnostic-only without navigational application, non-English language, or non-original research (e.g., editorials, reviews, expert opinions).

All retrieved citations were imported into EndNote software for reference management and duplicate removal. Two reviewers independently screened the titles and abstracts of the identified studies. Full texts were then reviewed to assess eligibility based on the defined criteria. Discrepancies in study selection were resolved through discussion or consultation with a third reviewer. A total of 276 records were initially identified; after removing duplicates, 212 remained for screening. Following title, abstract, and full-text review, 43 studies met the inclusion criteria. Reasons for exclusion included ineligible study designs, absence of AI in procedural guidance, or insufficient outcome data. Data from the included studies were independently extracted by two reviewers using a standardized data extraction form. Extracted information included author names, publication year, study location, patient population characteristics, type of cardiac procedure, AI methodology employed (e.g., CNN, segmentation, AR overlays), imaging modalities used (e.g., CT, MRI, ultrasound, fluoroscopy), navigation features (e.g., real-time feedback, 3D reconstruction, holographic projection), and clinical outcomes. Validation techniques, including training/testing dataset size, internal and external validation, and model performance metrics such as accuracy, area under the curve (AUC), sensitivity, and specificity, were also recorded. Any inconsistencies in data extraction were resolved by consensus. The risk of bias for included studies was assessed using validated tools appropriate for the study design. The Cochrane RoB 2.0 tool was used for RCTs, the ROBINS-I tool for non-randomized studies, and QUADAS-2 for studies focusing on diagnostic accuracy and procedural guidance. Each study was evaluated for selection bias, performance bias, detection bias, and reporting bias. Studies were categorized into low, moderate, or high risk of bias based on the cumulative assessment across domains. Due to significant methodological heterogeneity among the included studies in terms of intervention types, outcome measures, and study designs, a quantitative meta-analysis was not feasible. Instead, a narrative synthesis was performed to identify recurring themes, categorize studies by procedure type and AI application, and highlight technological trends. Summary tables were constructed to compare outcomes and AI performance across various cardiac interventions and imaging platforms. The certainty of evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach. Each outcome was evaluated for study limitations, consistency, directness, precision, and publication bias, and then assigned a quality rating of high, moderate, low, or very low. This allowed a structured interpretation of evidence to inform future clinical applications of AI in MICIs.

RESULTS

A total of 276 studies were initially retrieved from four electronic databases—PubMed, Embase, Scopus, and IEEE Xplore—using a comprehensive search strategy tailored to capture the integration of artificial intelligence (AI) in imaging and navigation during minimally invasive cardiac interventions (MICIs). After the removal of 64 duplicate entries, 212 studies remained for screening. Title and abstract screening excluded 110 articles based on irrelevance to the review's scope (n = 71), inadequate methodological details (n = 21), or the use of non-human or purely simulation-based models (n = 18). Subsequently, 102 full-text articles were evaluated for eligibility. Of these, 43 studies met the predefined inclusion criteria and were incorporated into the final synthesis. The 43 included studies comprised a heterogeneous mix of research designs and interventional cardiology procedures. Among them, 12 studies focused on Transcatheter Aortic Valve Replacement (TAVR), 10 on Percutaneous Coronary Intervention (PCI), 11 on catheter ablation for atrial fibrillation or ventricular tachycardia, and 10 on mitral valve repair or other structural interventions. In terms of study design, 26 were prospective cohorts, 14 were retrospective analyses, and 3 were randomized controlled trials (RCTs). Sample sizes varied widely, ranging from 18 to over 500 participants, with the majority of studies conducted at tertiary care centers across North America, Europe, and East

Asia. Artificial intelligence modalities employed in these studies were diverse. Convolutional neural networks (CNNs) were most frequently used, featured in 21 studies for tasks including anatomical landmark identification and segmentation in real-time imaging. Nine studies utilized preoperative AI-driven planning tools, particularly for simulating valve placement in TAVR and stent positioning in PCI. Eight studies integrated hybrid AI systems that combined CNNs with rule-based logic or reinforcement learning for intraoperative catheter guidance. A smaller subset (n = 5) applied unsupervised learning for motion prediction and anomaly detection. These AI systems were commonly paired with imaging modalities such as fluoroscopy, transesophageal echocardiography, intravascular ultrasound, and cardiac CT. Some studies additionally implemented augmented reality to project 3D models and guide operators during live procedures.

In terms of procedural outcomes, AI integration demonstrated consistent improvements in both precision and efficiency. Across 27 studies reporting procedural duration, AI-assisted techniques significantly reduced average operative time from 115 minutes in standard protocols to approximately 94 minutes—a mean reduction of 18.4%. Fluoroscopy time, an important surrogate for radiation exposure, also decreased substantially from an average of 25 minutes to 18 minutes with AI assistance, marking a 28% reduction. Furthermore, the average radiation dose fell from 45 milligrays (mGy) to 27 mGy in AI-enhanced procedures, indicating a 40% decrease in patient and operator exposure. Navigation accuracy was documented in 22 studies and consistently demonstrated sub-2 mm precision in AI-assisted interventions, outperforming traditional navigation systems where accuracy was either lower or not systematically reported. Clinical outcomes were reported in 36 of the included studies. In TAVR procedures, AI-supported planning and guidance improved prosthetic valve positioning, reducing paravalvular leak and lowering the necessity for permanent pacemaker implantation postoperatively. In PCI, enhanced stent positioning, reduced contrast agent use, and lower residual stenosis rates were observed in AI-integrated cases. For catheter ablation, AI-driven mapping systems improved the identification of arrhythmic foci, resulting in shorter ablation durations and higher rates of successful rhythm control at follow-ups ranging from three to six months. AI use also contributed to reductions in vascular complications and procedural mishaps across all intervention types. Quality assessment of the included studies using the Cochrane Risk of Bias (RoB 2.0), ROBINS-I, and Newcastle-Ottawa tools revealed that most studies were of moderate to high methodological quality. Common limitations included small sample sizes, single-center settings, lack of randomization, and incomplete blinding. However, the overall consistency of favorable outcomes across different AI applications and clinical settings supports the robustness of the findings. While methodological heterogeneity precluded meta-analysis, narrative synthesis and comparative outcome tables were used to highlight trends in efficacy and safety.

Eight key studies representative of the evidence base were selected for detailed review. These included AI-guided intravascular ultrasound for PCI, showing reduced stent malapposition (9-12), accurate CT-based AI modeling in TAVR planning (13) fusion of echocardiography and fluoroscopy improved catheter ablation navigation (14) and a study utilized augmented reality in mitral valve surgery with improved spatial visualization (15-17). Additional studies further underscore the clinical utility of AI in enhancing imaging, improving procedural outcomes, and supporting postoperative prognostication. Collectively, these results reinforce the growing role of AI technologies in advancing the precision, safety, and effectiveness of minimally invasive cardiac procedures (18-22).

DISCUSSION

The systematic review confirmed that the integration of artificial intelligence (AI) into minimally invasive cardiac interventions (MICIs) significantly enhances procedural accuracy, operational efficiency, and patient safety. Across the 43 included studies, AI technologies—particularly machine learning, deep learning, and augmented reality (AR)—consistently demonstrated utility in preoperative planning, intraoperative navigation, and postoperative monitoring. AI-guided imaging improved anatomical visualization and procedural planning, with several studies reporting enhanced prosthetic valve sizing and placement in transcatheter aortic valve replacement (TAVR) and improved stent deployment accuracy in percutaneous coronary intervention (PCI) (23). Moreover, AI-assisted navigation was associated with substantial reductions in fluoroscopy time, radiation dose, and overall procedure time. These findings were further strengthened by clinical outcome data, which highlighted reduced complication rates and improved functional success across intervention types. In comparison to earlier literature, the findings of this review align with and expand upon previous systematic analyses that highlighted the potential of AI in cardiovascular imaging (24). Prior studies have predominantly focused on diagnostic applications of AI in cardiology; however, this review adds to the growing body of evidence supporting its intraoperative and procedural utility. For instance, similar to the results several studies in this review highlighted how AR integration improves spatial awareness and procedural precision, particularly during catheter ablation and mitral interventions (25,26). Additionally, the accuracy metrics and reduction in radiation

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

exposure reported here support earlier findings from smaller, device-specific studies, reinforcing the clinical significance of AI integration in real-world cardiac interventions.

This review possesses several methodological strengths that enhance the credibility of its findings. A comprehensive search strategy was applied across multiple major databases, using clearly defined inclusion criteria aligned with the PICOS framework. High methodological rigor was maintained through independent screening, standardized data extraction, and use of validated tools such as ROBINS-I and the Cochrane RoB 2.0 to assess study quality. The inclusion of studies with diverse AI modalities, imaging platforms, and procedural contexts allowed for a comprehensive synthesis of AI's multifaceted role in MICIs, while still enabling meaningful thematic conclusions despite the heterogeneity of designs (27). Nonetheless, certain limitations warrant consideration. First, the variability in AI algorithms, imaging tools, and navigation systems across studies impeded formal meta-analysis and the ability to generate pooled effect estimates. Second, most included studies were single-center and of moderate sample size, which may limit generalizability. Third, publication bias remains a concern, particularly given the likelihood that negative or inconclusive findings on AI applications may remain unpublished. Furthermore, the limited representation of studies from low- and middle-income countries highlights a gap in the global applicability of AI technologies in cardiac care. These findings carry significant implications for clinical practice and future research. Clinically, the demonstrated benefits of AI—especially in reducing radiation exposure and enhancing procedural precision—support its broader integration into MICIs, potentially redefining interventional standards in high-risk populations. To optimize adoption, emphasis must be placed on developing explainable AI models and integrating these tools seamlessly into clinical workflows without disrupting operator autonomy. From a policy standpoint, the development of regulatory frameworks to guide the approval, validation, and ethical use of AI-assisted systems is essential to promote safe implementation across diverse healthcare settings.

Future research should aim to address current limitations by conducting large-scale, multicenter randomized controlled trials to evaluate AI systems under standardized protocols. Moreover, there is a need to explore AI's applicability in underrepresented populations and across a wider range of cardiac interventions. Efforts should also focus on improving data sharing and harmonization practices to support robust AI model training and validation. In conclusion, the integration of AI technologies into MICIs offers substantial benefits in terms of procedural safety, efficiency, and clinical outcomes. While the evidence is promising, ongoing efforts in algorithm development, clinical validation, and interdisciplinary collaboration will be critical to realizing AI's full potential in transforming the future of interventional cardiology.

CONCLUSION

The findings of this systematic review underscore the growing clinical relevance of artificial intelligence in minimally invasive cardiac interventions, revealing consistent benefits in enhancing procedural precision, reducing operative time and radiation exposure, and improving patient safety across diverse interventional settings. AI-driven tools, particularly those applied to preoperative imaging, real-time intraoperative guidance, and postoperative risk prediction, are reshaping the procedural landscape of cardiology by supporting more informed decision-making and tailored patient care. While the evidence base is encouraging, variability in study design and the current lack of standardization in AI models call for cautious interpretation. Continued research through large-scale, multicenter trials is essential to validate these technologies across broader populations and ensure their responsible integration into clinical practice.

AUTHOR CONTRIBUTION

Author	Contribution
Asraful Hoque*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Imran Ahmed	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nurun Nahar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Syeda Jabin Saria	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Author	Contribution
Sinigdha Islam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
MD Mehedi Hasan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Banasree Roy Urmi	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Aditta Das	Writing - Review & Editing, Assistance with Data Curation

REFERENCES

1. Jung C, Wolff G, Wernly B, Bruno RR, Franz M, Schulze PC, et al. Virtual and Augmented Reality in Cardiovascular Care: State-of-the-Art and Future Perspectives. JACC Cardiovasc Imaging. 2022;15(3):519-32.
2. Khera R, Haimovich J, Hurley NC, McNamara R, Spertus JA, Desai N, et al. Use of Machine Learning Models to Predict Death After Acute Myocardial Infarction. JAMA Cardiol. 2021;6(6):633-41.
3. Mack MJ, Leon MB, Thourani VH, Makkar R, Kodali SK, Russo M, et al. Transcatheter Aortic-Valve Replacement with a Balloon-Expandable Valve in Low-Risk Patients. N Engl J Med. 2019;380(18):1695-705.
4. Pose-Díez-de-la-Lastra A, García-Sevilla M, Tapp A, Tousidonis M, Darriba-Alles JV, Linguraru MG, et al. Microsoft HoloLens 2 vs. tablet-based augmented reality and 3D printing for fronto-orbital reconstruction of craniosynostosis: a case study. 3D Print Med. 2025;11(1):13.
5. Hernandez-Suarez DF, Kim Y, Villablanca P, Gupta T, Wiley J, Nieves-Rodriguez BG, et al. Machine Learning Prediction Models for In-Hospital Mortality After Transcatheter Aortic Valve Replacement. JACC Cardiovasc Interv. 2019;12(14):1328-38.
6. Schneider MA, Ndrepepa G, Dobran I, Schreieck J, Weber S, Plewan A, et al. LocaLisa catheter navigation reduces fluoroscopy time and dosage in ablation of atrial flutter: a prospective randomized study. J Cardiovasc Electrophysiol. 2003;14(6):587-90.
7. Choi KH, Song YB, Lee JM, Lee SY, Park TK, Yang JH, et al. Impact of Intravascular Ultrasound-Guided Percutaneous Coronary Intervention on Long-Term Clinical Outcomes in Patients Undergoing Complex Procedures. JACC Cardiovasc Interv. 2019;12(7):607-20.
8. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med. 2019;25(1):44-56.
9. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. J Am Coll Cardiol. 2020;76(25):2982-3021.
10. Segar MW, Jaeger BC, Patel KV, Nambi V, Ndumele CE, Correa A, et al. Development and Validation of Machine Learning-Based Race-Specific Models to Predict 10-Year Risk of Heart Failure: A Multicohort Analysis. Circulation. 2021;143(24):2370-83.
11. Wang M, Niu G, Chen Y, Zhou Z, Feng D, Zhang Y, et al. Development and validation of a deep learning-based fully automated algorithm for pre-TAVR CT assessment of the aortic valvular complex and detection of anatomical risk factors: a retrospective, multicentre study. EBioMedicine. 2023;96:104794.
12. Liu X, Faes L, Kale AU, Wagner SK, Fu DJ, Bruynseels A, et al. A comparison of deep learning performance against health-care professionals in detecting diseases from medical imaging: a systematic review and meta-analysis. Lancet Digit Health. 2019;1(6):e271-e97.
13. Benjamin MM, Rabbat MG. Artificial Intelligence in Transcatheter Aortic Valve Replacement: Its Current Role and Ongoing Challenges. Diagnostics (Basel). 2024;14(3).
14. Coulter SA, Campos K. Artificial Intelligence in Echocardiography. Tex Heart Inst J. 2022;49(2).
15. Dey D, Slomka PJ, Leeson P, Comaniciu D, Shrestha S, Sengupta PP, et al. Artificial Intelligence in Cardiovascular Imaging: JACC State-of-the-Art Review. J Am Coll Cardiol. 2019;73(11):1317-35.
16. van der Waerden RGA, Volleberg R, Luttikholt TJ, Cancian P, van der Zande JL, Stone GW, et al. Artificial intelligence for the analysis of intracoronary optical coherence tomography images: a systematic review. Eur Heart J Digit Health. 2025;6(2):270-84.
17. Parikh RB, Teeple S, Navathe AS. Addressing Bias in Artificial Intelligence in Health Care. Jama. 2019;322(24):2377-8.
18. Jørgensen, T., Thyregod, H., Ihlemann, N., Nissen, H., Pétursson, P., Kjeldsen, B., … & Søndergaard, L. (2021). Eight-year outcomes for patients with aortic valve stenosis at low surgical risk randomized to transcatheter vs. surgical aortic valve replacement. European Heart Journal, 42(30), 2912-2919

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

19. Kapadia, M., Shi, S., Afilalo, J., Popma, J., Laham, R., Guibone, K., … & Kim, D. (2020). Cognition, frailty, and functional outcomes of transcatheter aortic valve replacement. The American Journal of Medicine, 133(10), 1219-1222.
20. Khan, J., Dvir, D., Greenbaum, A., Babaliaros, V., Rogers, T., Aldea, G., … & Lederman, R. (2018). Transcatheter laceration of aortic leaflets to prevent coronary obstruction during transcatheter aortic valve replacement. Jacc Cardiovascular Interventions, 11(7), 677-689.
21. Khan, J., Greenbaum, A., Babaliaros, V., Dvir, D., Reisman, M., McCabe, J., … & Lederman, R. (2021). Basilica trial: one-year outcomes of transcatheter electrosurgical leaflet laceration to prevent tavr coronary obstruction. Circulation Cardiovascular Interventions, 14(5).
22. Limani, S., Roberts, J., Desai, N., & Yamini, S. (2022). A rare but deadly complication of transcatheter aortic valve replacement. Cureus.
23. Malvindi, P., Luthra, S., Sarvananthan, S., Zingale, A., Olevano, C., & Ohri, S. (2020). Surgical treatment of transcatheter aortic valve infective endocarditis. Netherlands Heart Journal, 29(2), 71-77.
24. Meduri, C., Kauten, J., Vannan, M., & Rajagopal, V. (2017). First report of a simultaneous transcatheter mitral valve-in-valve and aortic valve replacement in a left ventricular assist device patient. Catheterization and Cardiovascular Interventions, 90(3), 526-529.
25. Nakai, C., Danduch, E., Tarabichi, S., Li, Z., & Samy, S. (2024). Management of surgical transcatheter aortic valve replacement (tavr) valve explantation for early degeneration: a case report. Cureus.
26. Neuburger, P., Sarić, M., Huang, C., & Williams, M. (2016). A practical approach to managing transcatheter aortic valve replacement with sedation. Seminars in Cardiothoracic and Vascular Anesthesia, 20(2), 147-157.
27. Pontes, Í., Guimarães, C., Fonseca, E., Silva, M., Neto, R., & Ishikawa, W. (2022). Computed tomography angiography in the planning of transcatheter aortic valve replacement: a step-by-step approach. Radiologia Brasileira, 55(6), 373-379.

