

State of the Art and Future Perspectives of Virtual Reality, Augmented Reality, and Mixed Reality in Cardiovascular Care

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Abstract : The field of cardiovascular care is being transformed by the incorporation of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), collectively known as Extended Reality (XR), into medical education, procedural planning, and patient care. This review examines the state-of-the-art applications of XR in cardiology, emphasizing its role in enhancing the precision of interventional procedures and understanding complex anatomical structures. XR technologies complement conventional imaging methods by enabling immersive three-dimensional interaction that facilitates both preoperative planning and intraoperative guidance. Despite these promising developments, challenges such as harmonizing data, integrating various imaging systems, and addressing the prevalence of cybersickness remain. Ethical considerations, including maintaining physician focus and ensuring patient safety, are crucial when implementing XR in clinical settings. This review summarizes the existing literature and highlights the need for more rigorous future studies to validate therapeutic benefits and ensure safe application. By examining both the potential and the challenges, this paper aims to delineate the current and future roles of XR in cardiovascular care, emphasizing the necessity for continued innovation and ethical oversight to improve patient outcomes.

Keywords : virtual reality, augmented reality, mixed reality, cardiovascular care, education, preprocedural planning, intraoperative guidance, postoperative patient rehabilitation

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