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Harnessing RNA therapeutics: novel approaches and emerging strategies for cardiovascular disease management

Cardiovascular diseases (CVDs) are still the primary cause of death globally, responsible for nearly one-third of global mortality. Although existing pharmacological treatments are effective, they are often limited by side effects, incomplete protection, and their inability to target disease at the genetic level. RNA therapeutics have been a revolutionary method of directly modulating gene expression with the aid of tools like messenger RNA (mRNA), small interfering RNA (siRNA), microRNA (miRNA), antisense oligonucleotides, and RNA aptamers. Recent advances show their potential in treating hypertension, hypercholesterolemia, lipoprotein(a)-related risk, heart failure, and vascular inflammation, with notable clinical breakthroughs being mipomersen, inclisiran, and olpasiran. While promising results exist, delivery, safety, and long-term efficacy are yet to be overcome. Advances like lipid nanoparticles, exosome-based carriers, and ligand-targeted systems are enhancing specificity and stability. In the future, complementarity with personalized medicine, bioinformatics, and artificial intelligence provides the potential to revolutionize CVD management. In this study, the role of RNA therapeutics mechanism as revolutionizing tools for future cardiovascular therapy is emphasized.

Authors: Ms GOPE, somiparna (student); Ms KRISHNA DAS, vani (student); Ms KRISHNA DAS, veena (student)

Co-authors: Dr ., Sheshadri; Dr V.S, chitra; Dr VH, jayashree

Presenters: Ms GOPE, somiparna (student); Ms KRISHNA DAS, vani (student); Ms KRISHNA DAS, veena (student)

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