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Commentary

Advances in miRNA Technology: Predicting, Diagnosing, and Treating Human Diseases

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DESCRIPTION

In humans, about 85% of the genome will be sequenced; nevertheless, only around 2% of the genome is dedicated to coding Ribonucleic Acid (RNA) transcription. As a result, Noncoding Rnas (ncRNAs) code for the vast majority of the genome. Short ncRNAs are noncoding RNAs with a transcript length of 200 nucleotides or less. Long noncoding RNAs provide a variety of activities and are classified according to regulatory element link, chromosomal position, and structural or sequence conservation. The classification of small ncRNAs is determined by their size or cellular location. They are typically 22 nucleotide length noncoding RNAs that base pair with the target Messenger RNA (mRNA) and influence the expression of the posttranscriptional gene. microRNA (miRNAs) are typically transcribed by RNA polymerase II as primary transcripts or prior miRNAs. miRNA is a sort of negative regulator that has been found to give a natural mechanism to regulate gene expression. Hundreds of miRNAs and thousands of target mRNAs have been identified in the human genome, revealing the role of miRNAs in cytopathology, cell creation, death, and proliferation. miRNAs are involved in the pathophysiology of a wide range of human illnesses. The most recent advancements in miRNA technology, as well as the detection and alteration of chemical compounds, have opened up new avenues for their use in prediction, diagnosis, and treatment.

miRNA is found in practically all creatures, including nematodes, viruses, fish, plants, flies, mice, and humans, and it is involved in a variety of physiological and evolutionary activities. To specify specific miRNA profiles, miRNA microarrays are used to completely analyse the genetic profiles of cells and tissues at various developmental or categorization stages, metabolic states, and disease models. miRNAs were formerly assumed to be primarily responsible for inhibiting target mRNA translation; however, it has recently been demonstrated that their primary role in the mammalian cell is to diminish targeted mRNA levels. Humans have 1,000 to 20,000 distinct miRNA genes, with miRNA targets accounting for 20%-30% of all human mRNA. As a result, most mRNAs are expected to be regulated in some way by miRNAs. Because their expression is carefully controlled, miRNAs are well regulated to function as immunomodulators. miRNA was recently shown to be a critical link in both the innate and acquired immune systems, and "dysregulation of miRNA" has substantial value in illness aetiology. In cardiac disease models, the effect of miRNAs on cardiac remodelling, which includes fibrosis and hypertrophy, has been examined When the number of miRNAs reaches 300, Quantitative Polymerase Chain Reaction (qPCR) is a widely used technology that is unquestionably one of the most accurate but also one of the most difficult to use. Furthermore, other immunoprecipitation assay-based techniques, such as crosslinking and immunoprecipitation RNA immunoprecipitation and RNA-Chromatin Immunoprecipitation (RNA-ChIP), were developed to achieve the same goal.

Microarrays are now the most often used approach. These approaches are highly accurate and enable large-scale miRNA analysis. The use of miRNA-targeted therapies for long-term risk reduction demands comprehensive assessment of numerous potential side effects. Multiple protein macromolecular complexes were necessary for the analysis and development of all miRNAs during the intricate biogenesis process, as was already mentioned. Cell death, nervous system patterning, developmental timing, cell proliferation, hematopoiesis, and other aspects of appropriate cellular homeostasis all benefit from miRNA. miRNAs have the ability to change chromatin as well as regulate genes after the post-genetic transcription phase. Furthermore, because of the development of genome-wide screening methods, abnormal levels of miRNA have been found in a variety of illnesses when compared to normal equivalents. miRNA malfunction is likely to be linked to cancer given the importance of miRNAs in controlling cell proliferation and differentiation. As an oncogene or tumour suppressor, miRNA regulates cancer. miRNAs, in particular, have a role in the cellular response to oxidative stress, starvation, and Deoxyribonucleic Acid (DNA) damage. Chronic stress is linked to a variety of health symptoms, including "heart disease," "immune

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system disease," "inflammatory bowel disease," and "brain dysfunction."

Glucocorticoids are well-known mediators of the effects of cellular stress on neurological function and behaviour because they structurally affect the structure of brain cells crucial to emotion, cognition, and memory. Single-stranded antisense oligonucleotides, similar to those used to silence mRNA gene transcripts using small interfering RNA, can effectively inhibit miRNAs. Various chemical modifications have been developed to stabilise these anti-miRNA molecules, reduce the effective dose for *in vivo* delivery, and increase their toxicity and tissue absorption. Although various treatment structures and pharmaceuticals are used to treat and relieve care concerns, they are typically utilised to postpone the beginning of the disease or achieve dependable treatment, particularly in persons with a family history of hereditary coronary artery disease. Because miRNAs are involved in the pathophysiology of the aforementioned cardiovascular risk factors, they may be appealing therapeutic targets. Because of the diversity of miRNAs, repair treatment necessitates the use of inhibitory and mimic miRNA compounds with favourable pharmacokinetic properties. Acute miR-15 antagonism may aid in heart repair and function by boosting cardiomyocyte proliferation after a heart attack. Long-term anti-miR-15 treatment, on the other hand, can stimulate whole-cell proliferation and increase tumour growth. These unfavourable systemic effects can be avoided by using anti-miR-15 targeted medicines and fast-metabolizing medications that temporarily lower miR-15 following a myocardial infarction. Anti-miR122 (miraversen) has a high level of safety and efficacy. According to phase II results, more than half of patients treated with anti-miR122 had undetectable hepatitis C virus levels after treatment.

CONCLUSION

miRNAs influence the progression and development of ventricular failure and hypertrophy, making them important regulators of cardiac responses to pathological stresses. Using miRNAs to improve heart regeneration while also increasing cardiac contractility and decreasing fibrosis opens up new therapeutic opportunities.