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MicroRNAs in nephrology; new concepts

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Key point

MicroRNAs play an important role in kidney physiology and pathology. In fact, targeting of abnormal miRNAs in patients is applicable for treatment of related disorders. It means that, administration of antagomirs as miRNA inhibitors could modulate the effect of miRNAs. Therefore it has therapeutic effect, but there is not sufficient data on the safety of these antisense oligonucleotide inhibitors. However, more studies in animal models and more clinical researches in this field are necessary.

A microRNA (miRNA) is a solitary stranded, non-coding RNAs molecule (containing around 21 nucleotides) detectable in plants, animals and various viruses that acts in RNA silencing and post-transcriptional regulation of gene expression. These small molecules have an important role in defining and maintaining cellular differentiation and identity. MicroRNA acts in gene regulation via multiple mechanisms such as targeting protein synthesis at multiple post-transcriptional stages of gene expression (1). MicroRNAa may inhibit the initiation step of translation (2). MiRNAs can also affect gene elongation (3). Another mechanism which is mediated by miRNA is promotion of mRNA deadenylation, degradation and/or mRNA sequestration (4).

Single nucleotide polymorphism (SNP) within miRNA genes can potentially affect miRNA expression, maturation and function and therefore has an important role in human disorders. Misexpression of this molecule may lead to presentation of cancer, immunologic and non- immunologic abnormalities such as CNS disorders, viral infections and cardiovascular or metabolic diseases. In some disorders miRNA has upregulation pattern and contrary to some others, downregulation is prominent.

Recent investigations showed miRNA participates in kidney development, homeostasis and disease (5). Specific miRNAs in renal tissue and peripheral blood mononuclear cells (PBMCs) are upregulated or downregulated in different kidney diseases (6).

In fact intrarenal expression of miRNA affects renal physiology. Expression of miRNAs between the cortex and medulla is different. For example higher expression of mir-192 in cortex than medulla of the kidney tissue are contributed to Na transport (7). MiR-155 appears to suppress expression of the type 1 angiotensin II receptor and subsequently influences systemic blood pressure (8). In another example, intrarenal expression of miRNAs in immunoglobulin A nephropathy patients is characterized by downregulated miR-200c and upregulated miR-141, miR-192 and miR-205. Accordingly, 66 miRNAs were found differentially expressed (36 upregulated and 30 downregulated) in lupus nephritis (9). In a recent study, in 11 Iranian patients with lupus nephritis (LN), we found, no relationship between intrarenal expression of miRNAs 638,146 a, 198,731 and appearance of disease was existed (10). Expression of specific intrarenal miRNAs is established in glomerulosclerosis (mir-200 a,b), tubulointerstitial nephritis and also diabetic nephropathy (mir-192) (11). MicroRNAs also contribute to chronic kidney disease (CKD) progression via regulating mRNAs involved in renal homeostasis. It has been shown that mir 190,194,140-3p, 204 and 206 are downregulated in patients with progressive CKD (12).

Various miRNA expressions have been

shown in patients suffering from renal cell carcinoma (RCC) such as mir-199a and mir-205(13).

The miRNA profile has been mentioned in PBMCs of various disease such as IgA nephropathy and LN (14). It has been detected that miRNA expression profile in urine of patients with LN and acute T cell-mediated renal allograft rejection is different with normal condition. Hence, urinary miRNAs might represent an attractive, non-invasive tool for the early diagnosis of various disease (15).

In conclusion miRNAs play an important role in kidney physiology and pathology. In fact, targeting of abnormal miRNAs in patients is applicable for treatment of related disorders. It means that administration of antagomirs as miRNA inhibitors could modulate the effect of miRNAs. Therefore it has therapeutic effect, but there is not sufficient data on the safety of these antisense oligonucleotide inhibitors. However, more studies in animal models and more clinical researches in this field are necessary.

Author's contribution

SH wrote the manuscript lonely.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

Conflicts of interest

The author declared no competing interest.

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