The Potential Therapeutic Effects of RNA Nanoparticles on Triple-Negative Breast Cancer

Tiankui Wen*

Department of Biological Science & Technology, Tianjin University of Traditional Chinese Medicine, Tianjin, China

Corresponding Author*

Tiankui Wen,

Department of Biological Science & Technology,

Tianjin University of Traditional Chinese Medicine,

Tianjin, China

E-mail: wentiankui@258.com

Received: 29-Jun-2023, Manuscript No. JBTW-23-110827; **Editor assigned:** 03-Jul-2023, PreQC No. JBTW-23-110827 (PQ); **Reviewed:** 17-Jul-2023, QC No. JBTW-23-110827; **Revised:** 24-Jul-2023, Manuscript No. JBTW-23-110827 (R); **Published:** 31-Jul-2023, DOI: 10.35248/2322-3308-12.4.008.

Description

Triple-Negative Breast Cancer (TNBC) is a highly aggressive subtype of breast cancer characterized by the absence of Estrogen Receptor (ER), Progesterone Receptor (PR), and Human Epidermal Growth Factor Receptor 2 (HER2) expression. This subtype is associated with poor prognosis and limited treatment options. Recent advancements in nanotechnology have opened avenues for the development of innovative therapeutic approaches, including Ribonucleic Acid (RNA) nanoparticles. In this study, researchers have explored the potential of RNA nanoparticles carrying the α9- Nicotinic Acetylcholine Receptor (α9-nAChR) aptamer and anti-MicroRNA-21 (miR-21) to target TNBC cells and evaluate their therapeutic effects.

RNA nanoparticles and their role in cancer therapy

RNA nanoparticles have gained significant attention as versatile therapeutic carriers due to their inherent biocompatibility, ease of modification, and ability to target specific cellular receptors. These nanoparticles can be engineered to carry various payloads, such as Small Interfering RNAs (siRNAs) and MicroRNAs (miRNAs), which can modulate gene expression and contribute to the inhibition of oncogenic processes in cancer cells.

Targeting α9-nAChR: The α9-nAChR aptamer, a short single-stranded RNA molecule, has been identified as a promising ligand for targeting TNBC cells. This receptor is overexpressed in various cancer types, including TNBC, making it an attractive target for specific delivery of therapeutic agents. The α9-nAChR aptamer, when incorporated into RNA nanoparticles, allows for the precise and targeted delivery of therapeutic cargo to TNBC cells, potentially reducing off-target effects and improving treatment efficacy.

Inhibition of miR-21: microRNA-21 (miR-21) is a well-characterized oncogenic miRNA that is frequently upregulated in various cancers, including TNBC. It plays a critical role in promoting tumor growth, invasion, and metastasis by suppressing the expression of tumor-suppressive genes. In this study, anti-miR-21, a synthetic RNA molecule designed to specifically bind and inhibit miR-21, is loaded into the RNA nanoparticles. The aim is to block the oncogenic functions of miR-21, thereby reversing its detrimental effects on TNBC progression.

Tumor targeting and cellular uptake

The RNA nanoparticles carrying the α9-nAChR aptamer and anti-miR-21 are designed to effectively target TNBC cells. The α9-nAChR aptamer serves as a homing device, guiding the nanoparticles to the overexpressed α9-nAChR receptors on the surface of TNBC cells. This active targeting strategy enhances the specificity of nanoparticle delivery, minimizing exposure to healthy tissues. Upon reaching the target cells, the nanoparticles are internalized through endocytosis, ensuring efficient uptake and subsequent release of the therapeutic cargo.

Therapeutic assessments

To evaluate the therapeutic efficacy of the RNA nanoparticles, a comprehensive set of assessments is conducted both *in vitro* and *in vivo*. In cell culture experiments, TNBC cells are treated with the RNA nanoparticles, and various parameters such as cell viability, proliferation, migration, and invasion are analyzed. Additionally, changes in gene expression profiles associated with miR-21 inhibition are measured to validate the effectiveness of anti-miR-21 therapy. In animal models of TNBC, the RNA nanoparticles are administered to assess their ability to inhibit tumor growth and metastasis. Tumor volume measurements, histopathological analyses, and examination of metastatic spread provide insights into the nanoparticles' overall therapeutic impact.

Conclusion

The study on the therapeutic effects of RNA nanoparticles on TNBC represents a promising avenue for precision cancer therapy. By utilizing the α9-nAChR aptamer for targeted delivery and anti-miR-21 to counteract the effects of the oncogenic miR-21, researchers aim to address the challenges associated with TNBC treatment. The outcomes of this study could contribute significantly to the advancement of personalized and effective therapeutic strategies for TNBC patients, potentially improving clinical outcomes and overall survival rates.

Cite this article: Wen T. The Potential Therapeutic Effects of RNA Nanoparticles on Triple-Negative Breast Cancer. J Biol Todays World, 2023,12(4), 001