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Modifications of Exosome Surface Engineering is used to Improve the Penetration Efficiency into the Central Nervous System

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INTRODUCTION

When exosomes are used as drug delivery devices, the most common route of administration is intravenous injection. For example, brain endothelium-derived exosomes could reach the brain after intravenous injection to deliver doxorubicin to treat brain tumors in zebrafish. In addition, intravenous exosomes have a shorter half-life, therefore, most are still surface modified. One of the most popular is to modify neuron-targeting peptides to improve their ability to target the brain. Intranasal injection enables drug delivery to the brain *via* intranasal deposits, olfactory bulbs, trigeminal nerve, and respiratory epithelium. Therefore, it is often used for brain diseases. For example, exosomes containing cholesterol modifiers could be delivered to the brain when administered intranasally and had therapeutic effects against ischemic brain injury.

DESCRIPTION

A recent study involved the use of a series of patches using autonomously engineered gel microneedles loaded with cultured MSC exosomes for exosome repair in spinal cord injury. MSC exosomes may reduce the neuro-inflammatory response, promote the polarization of microglia toward the M2 phenotype, and reduce glial scar formation to facilitate neuronal injury repair. Exosomes inherit the properties of donor cells and have specific passive targeting capabilities (also called homing capabilities). However, this natural homing ability is weak and can be affected by various factors such as injection method, drug dosage, and individual differences, which can weaken or eliminate the central nervous system targeting ability of exosomes. There is even In addition, intravenously injected naked exosomes have been shown to readily bind RES. An organ like the liver, it was very difficult to reach the central nervous system. Genetic engineering of exosomes involves fusing a functional targeting protein or peptide gene sequence to a selected exosomal membrane protein, after which donor cells transfected with the above plasmids are engineered with targeting ligands on their surface to secrete exosomes. As a means of delivering drugs to the central nervous system, exosomes have several properties compared to synthetic nanoparticles.

It has low immunogenicity, no toxicity, high cargo-carrying capacity, protective capacity, and the ability to cross the blood-brain barrier. Modifications of exosome surface engineering have been widely used to improve the penetration efficiency into the central nervous system. However, the structural and functional stability of engineered exosomes and the mechanisms that enhance CNS targeting efficiency have not been fully investigated. Therefore, further research is needed to improve the stability, safety and standardization of these strategies. Nucleic acids, small compounds doxorubicin, dopamine, natural products curcumin, paclitaxel, resveratrol, proteins catalase, pigment epithelium-derived factor. Different loading methods exist for different types of therapeutic agents and exosomes, both pre and post-secretion of exosomes.

CONCLUSION

Genetic engineering, co-culture, electroporation, sonication, extrusion, and repeated freeze-thaw cycles have been employed. On this basis, the mechanisms of exosome internalization should be further investigated to better understand how they work and to select suitable drug loading methods for different types of therapeutic molecules. There is increasing evidence that exosomes carrying the above therapeutic molecules have provided breakthroughs in various CNS diseases such as brain tumors, neurodegenerative diseases, multiple sclerosis, brain or spinal cord injury, stroke, drug addiction and viral infections increase. However, advances in exosome isolation and purification are needed to fully realize the potential of exosomes in central nervous system drug delivery systems

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