

Therapeutic Utilization of Cell Penetrating Peptides to Transport Mesenchymal Stem Cells to Target Tumors: A Systematic Review

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Background/Purpose: Delivering therapeutic agents to tumors has proven itself as a challenge due to the lack of nontoxic and consistently reproducible transfection agents available. However, cell-penetrating-peptides (CPPs) have shown vast potential as delivery systems to transport drug therapies as well as molecules to induce genetic change within Mesenchymal-Stem-Cells (MSCs). This has raised the possibility of introducing anti-tumor agents into MSCs via CPPs and exercising the therapeutic and rehabilitative properties of MSCs, their potential to act as “nurse cells” to tumors, and their combined ability to function as immunomodulatory delivery systems.

Goals: To identify, evaluate, and summarize findings of assorted studies that have examined the utilization of CPPs and MSCs to function as a delivery system to tumor home and confer therapeutic properties at the site.

Methods/Design: A systematic review of literature (2005-2021) was conducted where eligibility criteria included authors published in peer-reviewed journals and in-vitro studies. A computerized search of databases (SciFinder, MEDLINE with Full Text) used keyword terms “nano-peptide (cell-penetrating-peptide)” AND “cell uptake using stem cell (hmsc)” AND “tumor.” Exclusion criteria included articles published prior to 2005, not written in English, and only containing abstracts.

Results/Findings: The data collected shows that CPPs have had considerable success in penetrating cells via various cellular uptake mechanisms. Furthermore, studies have shown that MSCs have inherent tumor homing capabilities as well as anti-tumor properties. Studies have shown that CPPs can effectively enhance the cellular uptake of specific genes and proteins into MSCs and induce anti-tumor changes within MSCs.

Conclusion/Implications: CPPs are promising class of delivery vectors due to their high transduction efficiency and capacity to transfect a variety of agents into cells. Their ability to direct certain molecules into MSCs to induce specific anti-tumor cell differentiation holds strong clinical capabilities. There is promising medicinal potential to be explored in utilizing CPP-MSC mediated delivery of antineoplastic agents that combine the cellular uptake enhancement properties of CPPs and the tumor homing and anti-tumor properties of MSCs.

Learning Objectives

Learning Objectives: 1) Understand the ability of cell-penetrating-peptides to be ideal cargo carriers. 2) Explore the capabilities of MSC to home to tumor targets and express immunomodulatory properties. 3) Investigate the potential of CPPs and MSCs to be efficacious anticancer delivery systems.

References and Resources

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