



Exploring Exosomes as a Next-Generation Therapeutic and Diagnostic Tool

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Opinion

Volume 5 Issue 2

Received Date: March 25, 2021

Published Date: April 01, 2021

DOI: 10.23880/vij-16000274

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Communication is indispensable for exchange of information in today's world. Like the 3G and 4G network, which uses data packets to send and receive digital information, cellular communication also acts in a similar manner by exchanging biological materials via similar small Nano-vesicles called exosomes. These exosomes are secreted by almost all types of cells and their content mirror the content of their parent cells. Exosomes are small, 30–100 nm cell-derived vesicles that first captured the attention of biologists about 30 years ago, when it was initial thought to be excreted by cells to remove junk materials [1]. But eventually it is being considered as gold mines to study novel intercellular communication strategies and is also being exploiting as a diagnostics and therapeutic tool.

These exosomes are present in biological fluids and have been proposed to play diverse pathophysiological roles, such as immune modulation, angiogenesis, tissue repair, and tumor metastasis [2]. Identification of mRNA, DNA, lipids, and proteins has ignited their potential to be used as a tumor diagnostic tool. The relative ease and minimally invasive nature of obtaining liquid biopsies makes it an attractive alternative source of tumor materials relative to direct tumor biopsies. Sequencing tumor specific DNA from exosomes may help us to easily identify genetic mutation in tumors without taking painful biopsy samples [3]. Identification of secreted information within exosomes may help in early identification of the disease much before clinical manifestation. Furthermore, identification of functionally active transcription factors, miRNA, and mRNA supports their role as an inducer of phenotypic switch which can alter the recipient cell phenotype and in turn support tumor growth [1].

These secreted DNA and RNA are more stable within the exosomes does high quality of the materials can be isolated for further high-throughput techniques. Tumor-derived exosomes also transfer immunosuppressive molecules like TGF- β , IL-10, FoxP3 all of which has the potential to modulate the host immune response to favor tumor growth [4]. A comparative study in case control groups and tumor patients may help in identification of the expression level of these immunosuppressive markers in healthy cohorts and tumor cohorts. If the ranges are found to be non-overlapping this may provide the necessary sensitivity for such an early warning system for cancer.

Exosomes have also generated international headline in the field of tumor therapeutics. Exosome-based delivery systems have high specificity and stability [1,5]. Exospores have high stability in the blood that allows them to travel long distances within the body under both physiological and pathological conditions. Due to their hydrophilic core, they are suitable to carry water-soluble drugs.

Chemotherapeutic drugs such as paclitaxel and doxorubicin have been efficiently packaged with exosomes and have effectively targeted cancer cells. Next-generation genome editing methods such as CRISPR-CAS9 and RNAi are also being employed to alter the secreted content of the exosomes to boost its anti-tumor properties. Packaging of miRNA, lncRNA, shRNA and gained quiet a lot of impetus in the recent years and many such bio-engineered exosomes are also in the clinical phase of development.

But given the complexity of these Nan vesicles most of the proposed diagnostic and therapeutic approaches are

still in the preclinical stage or in clinical trials. Furthermore, packaging of the cargo within exosomes in the desired quantity remains a challenge till date. Exosomes comprise heterogeneous components and may show immunogenicity based on its composition. Another drawback of exosome based therapy is to maintain the homogeneity between the various batches of the drug.

Poor pharmacokinetics of exosomes when loaded with bioactive agents was also observed. Producing exosomes that specifically target cancer cell may address several concerns related to non-specific targeting of drug-loaded exosomes [1,6]. Addressing these issues will ensure wide-scale therapeutic applicability and acceptance of exosome-based therapy

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