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A Short Note on Role of Exosomes in Cancer

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Abstract

Exosomes are extremely tiny extracellular vesicles that are widely dispersed in a variety of bodily fluids and are released by several cell types. Exosomes may help control the tumour microenvironment and have an effect on the growth and spread of tumours, according to recent studies. Exosomes have come into attention in the hunt for a novel cancer therapy strategy because of their widespread involvement in cancer formation. Small chemicals, proteins, and RNAs can be therapeutically delivered to cancer cells with great efficiency using exosomes. Proteins, lipids, and nucleic acids transported by exosomes are being investigated as prospective targets for cancer treatment as well as promising biomarkers for cancer diagnosis and prognosis. Additionally, several exosome sources display a range of abilities in cancer applications. We describe the precise method by which exosomes alter the interaction between tumours and the microenvironment in this review, as well as the therapeutic and diagnostic uses of exosomes in cancer.

Keywords: Exosomes; Tumor; Microenvironment; Cancer; Cells

Introduction

Due to rising cancer death rates worldwide, cancer has emerged as a serious danger to human health [1]. Through information exchange that promotes tumour cell proliferation, angiogenesis, and distant metastasis, the tumour microenvironment (TME) is crucial to the development and spread of cancer [2]. Additionally important in some disease processes is cell communication. Cancer cells do, in fact, need to communicate with one another, with normal cells, and with the immune system in order to live, grow, and spread [3]. Exosomes have received a great deal of attention due to the unique biological functions they play in cell-to-cell communication. The TME is altered as a result of communication between the tumour and exosomes, encouraging tumour growth, survival, immune-escape, and invasion [4].

Exosomes have been shown to have specific roles in tumour initiation, development, metastasis, angiogenesis, and treatment resistance, making them one of the most important TME components [3]. Exosome-related growth factors and cytokines might either stimulate or inhibit immune cells and lymphoid components of the TME, such as B and T lymphocytes, natural killer cells, and macrophages. This would lead to immunosuppression and the development of tumours [5,6]. Exosomes have also been widely recognised for their use in medication delivery [7,8]. Exosomes' ability to get around drawbacks including low bioavailability, non-targeted cytotoxicity, and poor immunogenicity of drug carriers actually makes them the optimal drug delivery vehicles [9,10]. They have been created to deliver various medications, including small molecules, nucleic acids, and proteins, for the treatment of cancer in animal models. Under addition, different cell types release exosomes both in healthy and unhealthy settings. Exosomes contain cell-specific proteins and genetic materials that can reflect the origin and physiological state of the cells that made them. These materials could be investigated as preclinical biomarkers in a variety of cancers, including lung cancer, hepatocellular carcinoma, pancreatic cancer, colorectal cancer, melanoma, breast cancer, prostate cancer, ovarian cancer, glioblastoma, and nasopharyngeal carcinoma. Alternative therapeutic approaches have also been proposed as innovative cancer treatments, including the suppression of exosome synthesis and the blocking of exosome absorption to certain receptors. All in all, the extensive use shows that a number of possible therapeutic approaches that block the synthesis, release, or absorption of tumor-derived exosomes are attractive avenues for the future development of anticancer medicines [11]. Exosomes can be produced by a variety of cells, including macrophages, dendritic cells, tumour cells, mesenchymal stem cells, epithelial cells, mast cells, endothelial progenitor cells, platelets, lymphocytes, and fibroblasts, according to growing data. Exosomes produced by various cells display a variety of traits and abilities. MSCs are the most frequent source of exosomes for cancer therapy among these cells of origin. Melanoma, breast cancer, and glioma are only a few of the tumours that are employed in labs for animal model. Exosomes from milk and cancer cells are also employed in the treatment of many illnesses in animals, in addition to those formed from MSCs [12]. Exosomes can all mediate the process of tumour growth or suppression through a variety of signal pathways, regardless of where they come from.

The TME, which includes tumour cells, different stromal cells, and the milieu in which they live, is well recognised to be exceedingly diverse. Tumor cells interact with the whole tumour microenvironment throughout the growth and spread of a tumour. Exosomes are essential for the control of the TME, according to mounting data. In fact, they can change how immune cells, stromal cells (CAFs, CSCs, and MSCs), and extracellular matrix (ECM) express themselves in the TME. Exosomes primarily control the TME by altering the expression of immune cells among them. By controlling the interaction between T lymphocytes, B lymphocytes, macrophages, natural killer (NK) cells, and the TME, exosomes can further control carcinogenesis and metastasis.

One of the most crucial cells in controlling the immune system is the T cell. In the context of infection, cancer, and autoimmune disorders, they mediate important immune responses. The close relationship between exosomes and T cells has steadily drawn a lot of attention in recent years. By secreting natural cytokines and growth factors, tumor-derived exosomes (TEXs) can shield T cells from cancer cells induced apoptosis, eventually triggering the immune system and preventing

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tumour start and dissemination. Cytotoxic T cells commonly referred to as cytotoxic T lymphocytes (CTLs), are crucial components of the adaptive immune system [13]. Cytotoxic T cells can also be produced as a result of exosomes. For instance, antigen-presenting molecules (MHC-I, heat shock protein 70), tumour antigens (MAGE-1), and adhesion molecules are found in exosomes produced from malignant gliomas (ICAM-1). These drugs may cause CD8+ T cells to develop into glioma cell-killing CTLs.

B lymphocytes play a variety of roles in tumour immunity and are mostly involved in initiative immunity mechanisms. To boost or inhibit tumour immunity, they can produce immunoglobulins (antibodies), present antigens, deliver costimulatory signals, and release cytokines. It has been established that exosomes can mediate the aforementioned pathways to control how B cells' immunological responses to malignancies are regulated.

The primary immune cells in the TME that regulate inflammation are called macrophages. They exhibit the M1 and M2 broad phenotypes. Compared to M2 macrophages, which encourage tumour development and spread, M1 macrophages can destroy tumour cells. Exosomes can affect M1 and M2 macrophage polarisation to control the TME, according to several studies [14].

Conclusion

Exosomes are becoming important therapeutic targets in a way that is strongly related to the advancement of precision medicine. But there are still a lot of issues that need to be fixed. It is yet unclear how exosomes in the TME affect distant cell interactions within the tumour microenvironment. Exosome drug loading techniques and targeted modification technology still need to be improved for clinical use; the use of exosomes as cancer biomarkers in diagnosis is technically constrained by their size, heterogeneity, and labelling; and choosing which sources of exosomes are safe and biocompatible for drug delivery systems is still an unsolved problem. Finding RNAs and proteins that are suitable for use as tumour inhibitors and cancer biomarkers is challenging, and finding clinically relevant exosomes among the numerous other populations of exosomes secreted by nearly all body cells is also challenging. This is primarily because there are not enough sensitive and quick analysis platforms available. Exosomes' affordability, quick separation, and ease of purification continue to be the key barriers to their adoption in therapeutic applications. The involvement of exosomes from various sources also requires additional research because the exosome ideas are strongly associated with origin cells and source.

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Conflict of Interest:

Author declares no conflict of interest.

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