



Review

Revolutionizing treatment for triple-negative breast cancer: Harnessing the power of exosomal miRNAs for targeted therapy

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ABSTRACT

Triple-negative breast cancer (TNBC) represents a challenging and aggressive form of breast cancer associated with limited treatment options and poor prognosis. Although chemotherapy is a primary therapeutic approach, drug resistance often hinders treatment success. However, the expanding knowledge of TNBC subtypes and molecular biology has paved the way for targeted therapies. Notably, exosomes (extracellular vesicles) have emerged as crucial carriers of tumorigenic factors involved in oncogenesis and drug resistance, facilitating cell-to-cell communication and offering potential as self-delivery systems. Among the cargo carried by exosomes, microRNAs (miRNAs) have gained attention due to their ability to mediate epigenetic changes in recipient cells upon transfer. Research has confirmed dysregulation of exosomal miRNAs in breast cancer cells compared to healthy cells, establishing them as promising biomarkers for cancer diagnosis and prognosis. In this comprehensive review, we summarize the latest research findings that underscore the diagnostic and prognostic significance of exosomal miRNAs in TNBC treatment. Furthermore, we explore contemporary therapeutic approaches utilizing these exosomal miRNAs for the benefit of TNBC patients, shedding light on potential breakthroughs in TNBC management.

1. Introduction

Triple-negative breast cancer (TNBC) comprises 15–20 % of other types of breast cancer and indicates more aggressive biological features, poorer prognosis, and absence of targeted treatments than other subtypes [1,2]. TNBC is characterized by deficiency of human epidermal growth factor receptor 2, estrogen receptor, and progesterone receptor expression [3,4]. Since there is no targeted treatment for TNBC patients, chemotherapy with platinum or non-objective chemotherapy (alone or in combination) are only available systemic treatments, which offer restricted. Therefore, an effective targeted delivery system is essential for the treatment of TNBC. Despite outstanding progressions in breast cancer detection and treatment, early diagnosis is still a serious

challenge that requires further investigation to substitute modern diagnostic and prognostic instruments [5]. Recent advances in research have led to the identification of specific biomarkers for cancer that can precisely forecast clinical outcomes and treatment responses for primary breast cancer [6]. In this regard, recent studies have indicated up- and downregulation of some microRNAs (miRNAs) in cancer cases provide a sign for breast cancer early diagnosis [7,8]. Thousands of miRNAs are known to play a key regulatory parts in different biological events, such as cell proliferation, differentiation, and apoptosis [9,10]. Exosomes are extracellular vesicles of 30–100 nm that have an endosomal origin, containing lipid, proteins, microRNAs (miRNAs) and mRNAs, secreted from different cells, such as immune cells, epithelial cells, and tumor cells [11,12]. Exosomes are crucial for transmission within the cells,

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