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ISSN: 2167-7956
Journal of Biomolecular Research & Therapeutics

Commenatry

Nano Therapeutics for Head and Neck Squamous Cell Cancer Carcinoma in Reactive Oxygen Species

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DESCRIPTION

The most prevalent type of head and neck cancer is Head and Neck Squamous Cell Carcinoma (HNSCC) (HNC). The standard course of treatment for HNSCC entails surgical excision either in conjunction with or without chemo radiotherapy. The unique position of head and neck tumors means that trauma from surgical intervention frequently disrupts physiological functions and results in disfigurement which has a significant negative impact on patients with HNSCC's quality of life. According to studies, Reactive Oxygen Species (ROS) at high concentrations induce apoptosis, autophagy, necroptosis and ferroptosis all of which lead to the death of cancer cells. This has led to a lot of interest in various non-invasive Nano therapeutics that could encourage the production of ROS with or without external stimulation, harming biological macromolecules to eradicate cancer cells.

High amounts of reactive oxygen species produced by photodynamic therapy, radiation therapy, chemodynamic therapy and equivalent synergistic modalities could stop the progression of head and neck Squamous Cell Carcinoma (SCC). Additionally some ROS-sensitive Nano systems for drug release may enhance the intended therapeutic effect Head and Neck Cancer (HNC) affects a number of organs in intricate anatomical sites, including the paranasal sinuses, lips, oral cavity, salivary glands, nasopharynx, oropharynx, hypopharynx, oesophagus and larynx which play intricate and important roles in physiological functions like speaking swallowing and breathing. Squamous cell carcinoma of the head and neck is the most prevalent kind of HNC. Surgery, radiation, chemotherapy, immunotherapy and targeted therapy are currently used to treat HNSCC. Over the past three decades the 5-year overall survival of HNSCC patients has increased however this improvement may be partially attributable to the emergence of HPV-associated HNSCC rather than advancements in treatment methods and approaches.

On the one hand because newly diagnosed HNSCC patients are typically at an advanced stage, they are at a higher risk of metastasis and recurrence. However the effectiveness of chemotherapy and radiation therapy for HNSCC is constrained by intrinsic or acquired therapeutic resistance. A generic term for highly bioactive compounds that result from the incomplete reduction of oxygen is Reactive Oxygen Species (ROS). Exogenous ROS are linked to exposure to Ionising Radiation (IR), chemotherapeutic agents and environmental insults while endogenous ROS are primarily produced by the mitochondrial respiratory chain, nicotinamide adenine dinucleotide phosphate oxidases peroxisomes and endoplasmic reticulum. Numerous physiological processes, including cell growth, differentiation, development and death depend on ROS. While unusually enhanced ROS may act in a pro-tumorigenic manner further elevated ROS may destroy different bio macromolecules, such as nucleic acids, proteins and lipids leading to the death of cancer cells.

As a result, numerous studies have been exploring various ways to increase intracellular ROS levels in order to abort cancer cells. Numerous studies have identified the dual functions of ROS in recent years which are evident in both the oxidative stress induced cellular damage that occurs during the development of cancer and the ROS-dependent malignant transformation. Physiological amounts of ROS are essential for several chemical reactions and biological processes and may serve as secondary messengers to aid in cellular signaling. On the other hand ectopic ROS levels in the early stages might cause tumor genesis and promote tumor growth. Exogenous and endogenous ROS that are upregulated may cause DNA alterations that inactivate tumor suppressor genes or activate oncogenes which would aid in the development of cancer. Additionally, evidence suggests that carcinogenesis. Additionally with the alternative modality offers a silver lining for individuals who have undergone surgery or RT alone but failed it or simply cannot handle it. Various strategies for the treatment of HNSCC have been developed to date as a result of the interaction between nanotechnology and ROS overexpression, and these strategies have been discussed in this article. Even if positive results have been achieved, there are still a number of problems that need to be resolved.

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Received: 01-Nov-2022, Manuscript No. BOM-22-18961; **Editor assigned:** 04-Nov-2022, Pre QC No. BOM-22-18961(PQ); **Reviewed:** 18-Nov-2022, QC No. BOM-22-18961; **Revised:** 28-Nov-2022, Manuscript No. BOM-22-18961(R); **Published:** 05-Dec-2022, DOI: 10.35248/2167-7956.22.11.245.

Citation: Min F (2022) Nano Therapeutics for Head and Neck Squamous Cell Cancer Carcinoma in Reactive Oxygen Species. J Biol Res Ther. 11:245.

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