Extended Abstract Journal of Cancer Biology and Therapeutic Oncology 2021
Vol.5 Issue1

Gold nanoparticle mediated radiation response among key cell components of the tumour microenvironment for the advancement of cancer nanotechnology

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Introduction

Statement of the Problem: Radiotherapy (RT) aims to deliver high doses of ionizing radiation to cancerous tissue. One of the major issues in RT is the close proximity of adjacent organs at risk, resulting in treatment doses being limited by significant tissues' toxicities, preventing dose escalation needed for local control.

Methodology: In an effort towards reducing the normal tissue toxicity while increasing the damage to the tumour, encapsulating high atomic number materials such as gold nanoparticles (GNPs) as radiosensitizers in tumour tissue has shown promising results. Moving forward, understanding of the complex biological system present in and around the tumour is also essential for optimizing the use of theradiosensitizing GNPs, as outlined by a consortium of labs, including our own. In this work, we discuss the importance of looking into GNP uptake and radio sensitization in cellular components within the tumour microenvironment. The ultimate goal of our research was the incorporation of GNPs into current RT protocols, to not only to enhance killing of tumour cells but also to target Cancer Associated Fibroblasts (CAFs), while protecting the Fibroblasts (FBs)

Background of the Research

Our results shine light on using GNPs as radiosensitizers to destroy tumour cells and CAFS while preserving FBs. The CAFs had the largest uptake of the GNPs per cell, with almost triple that of our cancer cell line, while fibroblasts had a relatively small amount. This translated to a larger increase in DNA damage in the CAFs compared to the other cell lines..

This study showcases that GNPs, as a radiosensitizer, allows for more damage to be propagated to the CAFs, an element that has shown to be largely influential to the progression of cancer. We believe that this work will be a building block towards a more effective treatment regime in the near future.

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The role of postoperative radiotherapy (PORT) in the treatment of patients with completely resected non-small cell lung cancer (NSCLC) was not clear. A systematic review and individual participant data meta-analysis was undertaken to evaluate available evidence from randomised controlled trials (RCTs). These results were first published in Lung Cancer in 2013 economic value of their unpaid work has been estimated at $257 billion in 2000 dollars Cisplatin-based chemotherapy was previously considered as the standard adjuvant therapy for improved overall survival (OS) in patients with non-small cell lung cancer (NSCLC) after surgery. However, the benefit was limited due to high risks of recurrence and adverse events. In the present study, the efficacy of adjuvant epidermal growth factor receptor tyrosine kinase inhibitors (EGFR-TKIs) for EGFR-mutant patients after surgery was investigated using the latest updated data.

Lung cancer is one of the most common cancers in the world, causing over 1.7 million deaths in 2018. Thus far, no effective treatments against lung cancer for advanced stages have been found. For early stages, although surgery is considered the gold standard treatment, 30-55% of patients develop recurrence within the first 5 years of surgery. Our aim is to assess whether cancer stem cells (CSC) display overexpression of a pool of genes that were previously identified for adenocarcinoma recurrence in patients with early and locally advanced stages of non-small cell lung cancer (NSCLC).