Safety Optimisation of a hybrid nanoparticle based on thermo-responsive delivery system for pancreatic cancer treatment.

Rachel Onchuru [1], Dr. Clare Hoskins[2]

Department of Pure and Applied Chemistry, University of Strathclyde, Glasgow G1 1QL, Scotland, United Kingdom.

Background:

Pancreatic cancer is the 4th most aggressive cancer in the western world. In the United States, it is the third leading cause of cancer-related deaths in the United States. The overall 5-year rate of survival for this type of cancer is 9%; very low in comparison to other cancers [1]. The lack of symptoms results in a delayed diagnosis and therefore, a delay in treatment of the cancer. Current therapies for pancreatic cancer include: fluorouracil, gemcitabine and nab-paclitaxel. Nanotechnology offers the benefit of enhancing drug delivery to the targeted tissue because of increased drug permeability. This also reduces side effects and sustains drug release over a long period of time [2]. Theranostics are a new discovery which offer the added benefit of diagnosis alongside therapy for the cancer which leads to a decrease in requisite time for treatment.

[1] Campbell, D., Isch, E., Kozak, G. and Yeo, C., 2021. Primary Pancreatic Signet Ring Cell Carcinoma: A Case Report and Review of the Literature. Journal of Pancreatic Cancer, 7(1), pp.1-7.

[2] Kadam, R., Bourne, D. and Kompella, U., 2012. Nano-Advantage in Enhanced Drug Delivery with Biodegradable Nanoparticles: Contribution of Reduced Clearance. Drug Metabolism and Disposition, 40(7), pp.1380-1388.

Methods:

From previous experimentation conducted in the labs, the charge needed to render the system (charged bis-naphthalimide drug molecules on hybrid iron oxide-gold nanoparticles) both stable and reversible upon heat stimulus has been investigated. In order to make headway with this information, it would be vital to develop an optimised formulation which possesses a higher safety profile until triggered heating and drug release. The possibility of addition of specific targeting ligands which will allow for active transport of the nanomedicines to the tumour site will be explored. Hence, the hybrid particles will be surface engineered to protect the drug molecules from metabolism until they are heated and drug release occurs. There will also be addition of targeting peptides onto the hybrid surface in order to enable site specific ability. The most favourable formulations will be tested both in vitro and in vivo.

Results:

The experiment is currently ongoing therefore, no conclusive results yet.

Conclusions:

This is a revolutionary area for nanotechnology therapies to be applied in the treatment of cancers particularly pancreatic cancer.