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*Abstract*

# The Effects of Gold Nano Sensitiser Photodynamic Therapy on the Proliferation, Invasion, and Migration of Lung Cancer Stem Cells †

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**Abstract:** Lung cancer relapse and post-treatment dissemination suggest the presence of drug resistant populations of cells called cancer stem cells (CSCs). Cancer metastases and the risk of secondary tumours are the most frequent causes of mortality in many cases. One important feature of lung cancer prognosis is metastases and the invasive ability of the cells, which is driven by CSCs. Considering CSC proliferation and migration associated with metastases, therapeutic strategies targeting these CSCs are considered to improve long-term clinical outcome. A minimally invasive, clinically approved cancer treatment, Photodynamic therapy (PDT), along with the use of a nano drug carrier was used in this study. PDT is based on the principle of light stimulation of a photosensitising drug that induces tumour cell death. Nano-mediated PDT using gold nanoparticles has been seen to induce cell death in lung CSCs. In this study, morphological examination and various physiological experiments including migration, proliferation, cytotoxicity, population doubling time, and cell cycle analysis assay were conducted to determine whether PDT using a gold nano sensitiser prevents CSC migration and invasion. Results show that the use of nanoPDT, using a $AlPcS_4Cl$ and AuNPs conjugate, can inhibit CSC migration and invasion, induce cell cycle arrest, and decrease CSC proliferative abilities. The use of a drug nano carrier in the form of AuNPs can improve the effectivity of PDT cancer treatment, and specifically facilitate the inhibition of metastasis seen in lung cancer caused by CSCs, which can clinically relate to an improved prognosis.

**Keywords:** nanotechnology; nano materials; gold nanoparticles; photosensitiser; photodynamic therapy; metastasis; lung cancer stem cells

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was approved on the 3rd of May 2021, Clearance Number REC-01-472-2020. This study used commercialised cell lines procured from an accredited cell line repository and distributor, the American Type Culture Collection (ATCC) (A549, CCL-185™; Het-1A, CRL-2692™), that adheres to ethical standards for obtaining human biological tissue and is BSI_ISO_9001 certified. The study did not involve humans or animals.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** The datasets generated during and/or analysed during the current study are available from the corresponding authors upon request.

**Conflicts of Interest:** The authors declare no conflict of interest.