Liposomes as a drug delivery system in photodynamic therapy for colon cancer treatment

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INTRODUCTION: Photodynamic therapy (PDT) uses a drug termed a photosensitizer (PS), light (laser) of an appropriate wavelength and molecular oxygen (tissue) to elicit cell death of cancer cells [1]. Liposome preparations are currently used as an effective drug delivery system or carrier in PDT. Liposome consists of an aqueous core and lipophilic space between the lipid bilayer. These properties make liposomes a powerful drug delivery system as it encapsulates both hydrophilic and hydrophobic drugs in high loading capacity [2].

The objective of this study was to evaluate the enhancement of PDT efficiency by using a liposome drug delivery system with different drug concentrations in contrast to treatment excluding the use of the drug delivery system on a colon cancer cell line.

METHODS: DLD-1 (colon cancer cell line) cells were seeded in 24-well cell culture plates and incubated for 24 hours, after which they were pretreated with different concentrations of the PS (zinc tetrasulfophthalocyanine/ZnTSPc) containing egg yolk lecithin (liposome drug delivery system). Control cells were pretreated with the same PS concentrations but without the liposome drug delivery system. The photosensitized cells were incubated for 2 hours before irradiation with a 672nm diode laser. The output power of the continuous wave laser was 33mW. A beam diameter of 1cm was used to deliver 4.5J/cm^2 in 107 seconds. Post-irradiated cells were incubated for 24 hours before cell death was measured using the Cell Titer-Blue ^{TM} Viability Assay from Promega Corporation.

RESULTS:

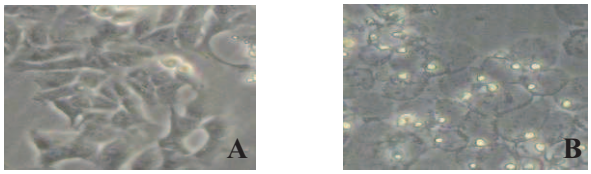

*Fig. 1: The micrographs (32x) shows the cell morphology of DLD-1 cells untreated **(A)** and after liposomal – mediated PDT treatment **(B)**.*

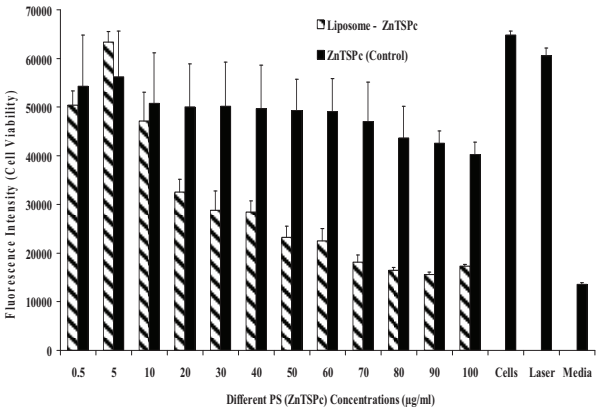

Fig. 2: The cell viability of DLD-1 cells photosensitized by liposome-mediated ZnTSPc and controls prior to light activation.

DISCUSSION & CONCLUSIONS: DLD-1 cells treated with liposome-mediated ZnTSPc were able to decrease cell viability more extensively than the control cells (Fig. 2). This showed that the efficiency of the photodynamic effect was enhanced with liposome-mediated PS prior to light activation. DLD-1 cells subjected to liposome-mediated PS manifested morphological changes indicating cell death via the secondary necrosis mechanism (Fig. 1). This indicates that the use of liposome drug delivery system is advantageous as it enables lower drug concentrations to be administered with enhanced PDT activity, thus reducing the side effects and causing less damage to healthy tissue. This concludes that the use of liposome as a drug delivery system can enhance PDT efficacy and safety by using lower concentrations of the PS (ZnTSPc) to destroy the cancer cells.

REFERENCES: [1] A.S.L. Derycke and P.A.M. De Witte (2004) *Advanced Drug Delivery Reviews* **56**: 17-30. [2] B. Chen, B.W. Pogue and T. Hasan (2005) *Expert Opinion Drug Delivery* **2**: 477-487.

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