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Cytotoxicity in Cancer Drug Delivery

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Introduction

Cytotoxic chemotherapeutic drugs cause cardiotoxicity or cardiac toxicity and affect other organs like the spleen and the liver. Cytotoxicity is a needed aspect of a drug targeting a tumor, as the cytotoxic characteristic is what kills tumor cells. Doxorubicin is a drug used in tumor patients that have been established to cause cardiotoxicity. Including doxorubicin, several cytotoxic drugs that cause cardiotoxicity[1-10]. The very nature of the cytotoxic drug administered into tumor patients is to kill cells. However, aspects like multi-drug resistance can result in a need to increase drug delivery for achieving better cytotoxicity, and consequentially this enhances cardiotoxicity and an array of cytotoxicity concerns.

Drug formulations targeting tumors can still be toxic to patients. While the drug target cancer cells and kills them, it can also affect surrounding tissues and other healthy cells as well. It affects the heart health, the liver and spleen performance, and weight and the rest of the organs. Researchers have studied the effect of QTsome nanoparticle on chemotherapeutic drug delivery and found that the delivery of the QT/AM-21 showed reduced cytotoxicity[11-16]. It did not affect essential organs. Combinatorial delivery of the PTX and QT/AM-21 demonstrated better control of cytotoxic effects and hence influenced the impact of chemotherapeutic drug actions. The QTsome nanoparticle /AM-21 treatment induced better tumor regression and enhanced anti-cancer activity and at the cost of lesser toxicity[17-21].

Peptide ligand reformulations are effective for safely using existing chemotherapeutics. Doxorubicin DOX is used for treating malignant tumors and has a success rate with tumors like leukemia and Hodgkin's lymphoma. The adverse impact of this drug is that it causes severe cardiotoxicity and sometimes less efficient alternatives are sought for this reason. In the analysis of other options and effective formulations, researchers have argued that PEGylated liposomes of DOX could be just as active and be less cardiotoxic. Below is a presentation of the modification of the liposomal DOX with active ligands. Below is the representation of the modified pegylated liposomal DOX (Figure 1)[22-26].

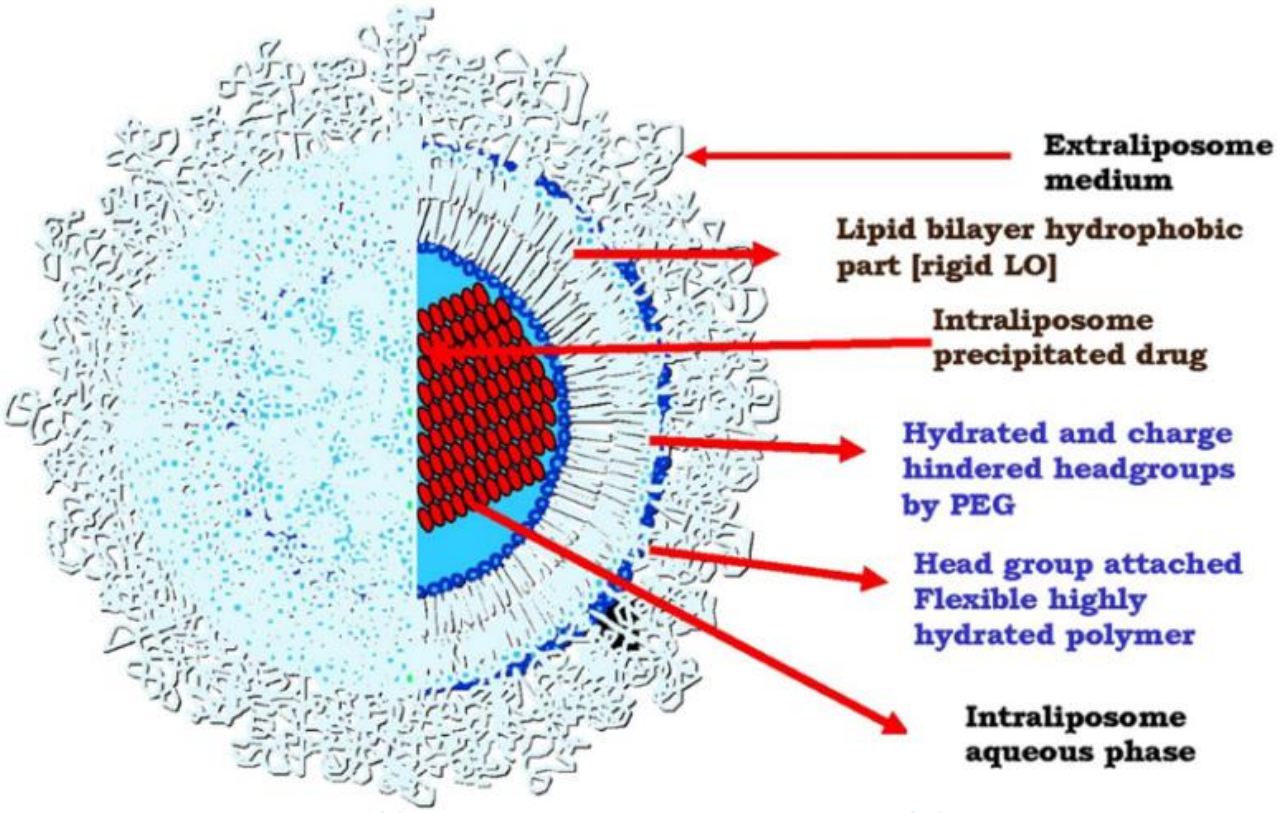

Figure 1: Schematic representation of pegylated liposomal doxorubicin showing the extra- liposome medium, the lipid bilayer, and the intra-liposome aqueous phase.

Research work on drugs and multi-drug resistance have identified ways to improve the sensitivity of cancer cells such that they can be targeted into apoptosis by thermophoretic drugs. More specifically, the work focused on Redox-triggered mitoxantrone prodrug micelles and how multi-drug resistance (MDR) can be handled by using a re-sensitization system. Preferential transportation of the drug led to stronger anti-cancer activity and increased the cytotoxicity of the cancer cells[27-32]. This study highlighted how in addition to drug delivery, sensitivity increasing formulations are necessary to direct cytotoxicity to cancer cells, thus reducing the toxicity to healthy cells.

Thus, cytotoxicity in cancer drug delivery can be enhanced and focused on cancer cells while at the same time, ensuring that vital organs are not affected. This has immense potential in maintaining the quality of health of the cancer patient as they receive their treatments for cancer[33-36].

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