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Commentary

Recent Advancement in Drug Delivery for Treatment of Leukemia

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DESCRIPTION

Globally leukemia in the 10th most prevalent cancer type. Based on the maturity stage of the cells chronic and acute phase [1-3]. Over the years, chemotherapeutic agents were considered as the best choice of treatment. Recently the treatment regimens were compromised due to side effects and chemo resistance to name a few [4]. With increase in targeted based therapies which includes but not limited to antibodies and pathway specific inhibitors the role of drug delivery system has found importance in treatment of leukemia [5,6]. The critical factors in design and development of drug carrier system is the target site and fastest mode to delivery. Along with-it nature of the tissue surrounding, estimated drug release and retention time. Compatibility of the drug molecule with carrier system, interactions and drug load capacity. Bulkiness of the molecules has inherit distinctive dis-advantages.

Liposomes are efficient drug carried systems composed of phospholipids [7]. The bioavailability of the drug molecule is reduced when it is loaded in the carrier system. The major advantages of this being

- Reduction of exposure to healthy tissues;
- Escape from the chemical inactivation induced by immune response;
- Avoid metabolic degradation [8-10]. Currently, Thermo DoxTM, is in clinical trials (clinicaltrials.org identifier: NCT00617981) which consists of doxorubicin. This is used on the treatment of hepatocellular carcinoma [11,12].

Micelles are another class of biocompatible Nano-carriers. The different methods of micelle carriers can be either

- Conventional liposomes with a encapsulated hydrophobic drug;
- Poly (ethylene glycol) PEGylated liposomes with PEG phospholipids inducing satirical stability;
- Ligand targeted liposomes with a conjugation of carbohydrates, peptides or antibodies for targeted delivery
- Theranostic liposome which can be both used for therapeutic and imaging applications.

Currently, there are no drugs leads encapsulated with polymeric micelles for drug delivery. Apart from this clinical trials are on-going for SN-38 and Doxorubicin for breast cancer and osteosarcoma to name a few [13,14]. Nano systems are a relatively modern and an effective mode of targeted drug delivery. Factors of importance are of nanomaterials to be compatible, biodegradable and non-toxic in nature. The current drugs of nanomaterial formulations which are FDA approved are exclusively for parental application. Polymeric nanomaterials range from 1 to 1000 nm. Here the drugs molecules can either be conjugated or dispersed within the polymer matrix. In this type drug release usually occurs *via* erosion, degradation, diffusion and swelling for polymer matrix. Solid Lipid Nanoparticles (SLN), are composition of lipids, surfactants, stabilizers and co-surfactants on specific requirements. A major drawback of this lies in reduced drug loading capacity and drug expulsion during long term storage. To overcome the disadvantages inorganic nanoparticles have been used as effective replacement to SLN. These contain silica nanoparticles and most the drug formulations are in either pre-clinical or clinical trials. AZD2811® composed of Azacitidine in under phase II clinical trials (NCT03217838) [15,16].

In the coming years, targeted delivery of drugs will be a major "go to" mode in delivering the active molecules. Role of in *silico* techniques and workflow is a crucial in designing the carrier system. Open source tools like GROMACS [17], with algorithms are available to achieve this. Simulation studies for up to 1-3 micro seconds should be a gold standard to verify the stability of drug carrier systems. This process helps in screening and shortlisting the library of carrier systems and makes the validation process cost-effective. The research community needsto be proactive in embracing the change in research and positively provide more scientific insights *via* advanced research.

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