Indian Journal of Novel Drug Delivery

IJNDD

An Official Publication of Karnataka Education and Scientific Society

Editorial

Drug delivery in cancer therapy

According to World Health Organization (WHO) cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer. Cancer affects everyone-the young and old, the rich and poor, men, women and children-and represents a tremendous burden on patients, families and societies. Cancer is one of the leading causes of death in the world, particularly in developing countries.

Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths (around 13% of all deaths) in 2008. Lung, stomach, liver, colon and breast cancer cause the most cancer deaths each year. About 30% of cancer deaths are due to the five leading behavioral and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, alcohol use.

Among the physical methods for drug delivery, electric field induced membrane permeabilisation (electro-permeabilisation, electroporation) appears as one of the most mature ones. For almost 20 years, it was developed for an in vivo use and clinical applications. This is now a loco-regional therapy for disseminated cutaneous and subcutaneous tumor lesions (such as melanoma). Electro-permeabilisation allows the free access of polar compounds to the cytoplasm by a reversible alteration of the cell membrane. It is now used in clinics for the eradication of cutaneous solid tumors. New developments predict its future applications for other anti-cancer treatments.

Rationally designed vehicles have been demonstrated successful in nuclear entry, particularly in in vitro. Thus, nuclear-targeted drug delivery may be promising clinical chemotherapy with high therapeutic efficacy. However, the development of nuclear-targeted drug delivery systems useful for clinics is hampered by a limited understanding of the details about the biological barriers and the mechanisms involved in drug transportation.

Injectable polymers that have biocompatibility and biodegradability are important biomaterials for drug delivery system (DDS) and tissue engineering. Reports reveal that the preparation of an injectable in situ forming DDS using human serum albumin and tartaric acid derivative using doxorubicin for cancer chemotherapy; is possible.

Cell-penetrating peptides (CPPs) can be used for intracellular delivery of a broad variety of cargoes, including various nanoparticulate pharmaceutical carriers. Literature indicates that light illumination can be used to enhance penetration of the polymer-CPP conjugates into target cells and to promote effective intracellular delivery of proapoptotic anticancer drugs.

Nanoparticles (size in nanometer range) provide a new mode of cancer drug delivery functioning as a carrier for entry through fenestrations in tumor vasculature allowing direct cell access. These particles allow exquisite modification for binding to cancer cell membranes, the microenvironment, or to cytoplasmic or nuclear receptor sites. This results in delivery of high drug concentrations to the targeted cancer cell, with reduced toxicity of normal tissue. Several such engineered drugs are in clinical practice, including liposomal doxorubicin and albumin conjugate paclitaxel. The carrier mediated paclitaxel has already shown significant efficacy in taxane resistant cancers, an approach highly relevant in prostate cancer, where taxanes are the treatment of choice. Other modifications including transferrin receptor and folate receptor targeted drug delivery molecules are in study. This new technology provides many exciting therapeutic approaches for targeted high concentration drug delivery to cancer cells with reduced injury of normal cells.

Magnetic nanoparticles (MNPs) possess unique magnetic properties and the ability to function at the cellular and molecular level of biological interactions making them an attractive platform as contrast agents for magnetic resonance imaging (MRI) and as carriers for drug delivery. Recent advances in nanotechnology have improved the ability to specifically tailor the features and properties of MNPs for these biomedical applications. To better address specific clinical needs, MNPs with higher magnetic moments, non-fouling surfaces, and increased functionalities are now being developed for applications in the detection, diagnosis, and treatment of malignant tumors.

With respect to oncology therapeutic drug delivery, nanoparticles have many more capabilities including uses in imaging and sensing, diagnosis, targeting, radiotherapy, and transport of genetic material.

Jameel Ahmed S. Mulla
Associate Editor, IJNDD

Department of Pharmaceutics,
K.L.E.University's College of Pharmacy, Hubli,, INDIA