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Short Communication

Nanotherapeutic agent for cancer: *Miracle or catastrophe*

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Nanotechnology is a smart technology in the field of biomedical engineering used for the diagnosis and treatment of diseases. Nanodrugs provide better encapsulation of drug and efficiency at low dosage to kill the targeted tissue/cells. However, the chances of chronic toxicity and high cost of treatment limits its applicability [1]. To overcome these problems still, the experts of the scientific community have been working on it, to design the best one and cost-effective treatment for the human welfare.

Nanotechnology is the latest field of science based on the designing of nanosize molecules/particles or devices for the wide range applications. In the field of TERM (Tissue engineering and regenerative medicine) nanometer (5 to 500nm) size small nanoparticles are used as nano drugs and nanodevices for the targeted therapeutic agent [2]. In the past, researchers focused on the fabrication of drug molecules incorporated nano-particles for the sustained release of the drug molecule to the targeted tissue or organ [3,4]. Various biocompatible and biodegradable polymers (e.g, gelatin, collagen, cellulose, Polycaprolactone) have been used as delivery or carrier matrix for the drug molecule. The techniques used to integrate the drug molecule are nano-vectors, nanofibers, nanotubes, nano-micelles, liposomes and dendrimers [5].

These approaches provide a smart technology both for in vitro and in vivo diagnostic and therapeutic system [6]. The efficiency of the nanodrug system is significantly better than the normal drug delivery system [7]. Nanodrugs have a large surface area for better interaction among the cell receptor and ligand molecule [8,9]. Thus, for a better encapsulation efficiency and controlled release profile of the drug, nano-matrixes are the advanced system.

Cancer cells have hyper-proliferative property along with the genetic transformation, dysregulation in cell cycle pathways, uncontrolled proliferation, invasion, angiogenesis and metastasis [10]. Therefore, it becomes a major public health problem that causes significant death rate and disability. It was reported that the death rate of cancer is more than the combined AIDS, tuberculosis, and malaria, and worldwide out of eight deaths cases one death is due to cancer. According to the clinical survey data, it is shown that globally new cancer cases by 2050 are expected to grow to 27 million [11,12].

At a clinical level, different aspects and management options are used for the fit against this crucial disease [13]. Majorly treatments are surgery, chemotherapy, radiotherapy and palliative care to kill the cancer cell/tissue [14]. The criteria to choose the best one treatment is totally depends upon the type of cancer- metastatic or benign, location- lymphatic or sarcoma and exaggeration of the cancerous cell as well as the immune system of an individual.

For the treatment of cancer, nanotechnology helps to design innovative methods or techniques for diagnostic and curing of disease [15-17]. Nano-sized drugs have

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better invasion capacity and easily exude into the targeted cancerous tissue through the vascularized system, by the enhanced permeability and retention (EPR) effect [18]. Nano drugs EPR effect improves the delivery of the drugs molecule and its effectively at very less concentration [19].

Researchers also found that the synergistic effect for the nanosized formulation of chemotherapeutic agents i.e., nanotheranostic formulation with other cancer therapy like photothermal, for better diagnosis and eliminating the tumours [20,21]. These approaches of nanosized drugs act as Carrier-assistant drug delivery systems (DDSs) that are progressively established for cancer diagnosis and treatment [22,23]. It was reported that exogenous and endogenous stimuli applied for the better drug release and activation of drug molecule under in vivo conditions [24]. Although there are many advantages of nanotechnology for cancer treatment- better drug efficiency, low degradation rate and less toxicity to surrounding tissue [25]. Nanotechnology-based drug delivery is new hope for a cancer patient but the higher treatment cost, chances of chronic toxicity and limited clinical testing data and report are the cons that edge the commercial applicability [26,27].

Thus, to overcome these limitations researcher have to work on the fabrication technology—non-toxic, cost-effective, biomimetic interactions between the cellular components and drug or engineered materials, have better EPR effect along with the pre-clinical and clinical study of the designed drug system. Development of active nano-sized drugs without any nanocarriers are the newest approach that has been studied by many scientists, that might be the beneficially to promote nanotechnology therapeutic perspectives [28].

Conclusively, nanotechnology is booming smart technology in the field of medical science but the proper and intellectual utilization of this technique helps to fight against the world deadliest diseases- Cancer.

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