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Perspective

Nanoparticles and their Types to Treat the Cancer System

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ABOUT THE STUDY

Nanoparticles technology is one which deals with matter whose size is at the scale of 1 billionth of a meter. The reduction in size changes the properties of matter. These change if found to be beneficial to improve health or improved properties of drug are being utilized for improved development of improved dosage forms. Nanoparticles are therefore used as a physical approach to alter and improve the quality of life. Nanoparticles can be defined as particles whose is in the range of 10 to 1000 nm. While particles are size range from 1 to 2000 micrometre. Microparticles can be administered by different routes, good solubility profiles. They have high specific area and have high quality of functional groups what chemical reaction. Besides sharing the aforementioned advantages of microparticles the capacity to supersede several limitations of microparticles. Formulations containing nanoparticles are more easily and mister are most suitable for parenteral administration since the blood capillaries are 5 to 6 micrometre in diameter. The uptake of nanoparticles when administered orally is 15-250 times higher than microparticles. Some properties which are dependent on size found in nanoscale such as optical response or magnetism.

Nanoparticles made up of metals have different physical and chemical properties from bulk metals i.e. they have low melting point, high specific surface area, specific optical properties, changed mechanical strength and magnetization. Nanomedicine is a subset of nanotechnology which utilizes these small size particles; size smaller than 10 million times then the human body. They are smaller than living cells. This size range in nanomedicine have brought improvement in treatment. Nanomedicine has potential to fight against all types of cancer, neuro-degenerative disorders and other diseases. Biocompatible nanoparticles, nanorobots for various applications including diagnosis delivery sensory or actuation purposes in a living organism.

Nanotechnology make possible to create engineering materials (e.g. drug delivery, systems, disease imaging probes, tissue engineered constructs) that have size in scale of biomolecules and these materials regulates function of cells. The small size of nanoparticles exhibits unique physicochemical and biological properties (more ability to cross cell and tissue barrier and increased surface area) make them a favorable material for biomedical applications. Drug that are transformed into a nano range offer some unique features which lead to prolonged circulation, improved drug localization, enhanced drug efficacy. Various pharmaceutical nanotechnology based systems which are being developed or studied are polymeric nanoparticles, liposomes, metallic nanoparticles, carbon nanotubes, Quantum dots and dentrimers. They have brought revolution in drug delivery as well as medical service sector. Nanotechnologies have the potential to improve whole care process that starts from diagnosis to therapy and follow-up monitoring.

Types of nanoparticles

Nanoparticles can be classified on the basis of their physical and chemical characteristics as following:

- Carbon based nanoparticles carbon nanotube (2D) and fullerene.
- Metal based nanoparticles gold silver and copper.
- Ceramic nanoparticles
- Semiconductor nanoparticles
- Polymeric nanoparticles
- Solid lipid nanoparticles
- Protein nanoparticles
- Quantum dots

Nanoparticles for the treatment of cancer

Various nanoparticles system under investigation with the emphasis on cancer gold and silver nanoparticles iron oxide magnetic has been successfully tried for treatment of cancer. This has greatly revolutionized the cancer therapy, surmounted the limitation of conventional chemotherapy which lacks the specificity to localise the cancer cells and their effect on normal healthy tissues.

Nanoparticles accumulate in the tumour site by passive diffusion and ligand based targeting mechanism. For proven clinical use many polymer based nanoparticles are in market. They have tailor made drug delivery vectors which provides site specific targeted delivery of drugs. This reduces large doses of chemotherapeutic agents. A potent dose of drug can be

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administered or sent to specific area and engineered to release for planned period to get maximum efficacy, effectiveness and patients' safety. Chemotherapeutic drugs containing nanoparticles allowed the drug to traverse the blood brain barrier for treatment of brain tumor. Pictures have reported use of chemotherapy attached to nanodiamonds to treat brain tumours. Researchers are testing the use of chemotherapy drugs to 14 leukaemia.

Nanoparticle allow cancer specific drug delivery by the phenomena of passive targeting nanoparticles provide site specific improve bioavailability of the central drugs leading to improve therapeutic efficacy. They have enhanced intracellular penetration, stimuli sensitive and carrier mediated visualization. Though they are small in size but they are large enough to encapsulate many small molecules or compound which can be of multiple type. Due to large surface area they have enhanced bioavailability. Surface area can be functionalized with ligands, including small molecules, DNA or RNA strands, aptamer, peptides and antibodies. These ligands may be used for treatment and curing effect and they can also direct fortune of nanoparticles in vivo application. Not only helps in effective delivery of chemotherapy drugs but also is helpful to deliver immunostimulatory or immunomodulatory molecules in combination with chemotherapeutic agents for radiotherapy for as adjuvant to immunotherapy.

Nanoparticulate vaccines has been developed which raise T-cells response to remove tumours through delivery of antigens. Combined development of innovative nanomedicine is enabled only after development of nanoparticles packages as well as active pharmaceutical ingredients for chemotherapy. In addition immunogenic cargo and surface coating are being investigated as both adjuvant to nanoparticles mediated and traditional radio and chemotherapy. Designed nanoparticulated artificial antigens have been developed *in vivo* depot of immunostimulatory factors that exploid nanostructured architecture for prolong antitumour activity. The early age use of nanotechnology now used for nanoformulations has lead to improved pharmacokinetics also decreased systemic toxicities moreover leads to targeting and delivery of anticancer drugs carrier and increases drug overall therapeutic index. Reduced size and increased surface area increase the therapeutic capabilities of chemotherapeutic agents by nanotechnology the small size increases tumour vesculature permeability, allowed nanoparticles to accumulate in tumour microenvironment hands reduced size of tumour nanotechnology also provide enhanced permeability and retention effect of chemotherapeutic affect.

CONCLUSION

In this study, passive localisation of many drugs and Carriers due to extra vasation relation through leaky vasculature works very well for tumour by nanotechnology. As tumours mass expands rapidly a network of blood vessel needs to expand quickly to lodge tumour cells which need for oxygen and nutrients. The abnormal and poorly regulated vessels results in large for vessel wall. Nanoparticles extra vasate through these pores into tumour masses and drug present in them exhibits enhanced therapeutic effect. Most of the nanomedicines discovered/invented or nano-formulated currently used in the treatment of solid tomours. These depend on EPR effect which ensures high drug accumulation in tumour cells and hence better therapy. Passive accumulation due to EPR effect is best approach for tumour treatment widely accepted. Effect is beneficial for solid tumours, not exhibit curative effect for Central region of metastatic or larger tumours due to extreme hypoxic condition.