International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 08
July 2017

Recent Advantage in Nanomedicine for Cancer Therapy Department of Chemistry

[1]Neha Mittal ,[2]Sapna Chaudhary, [3]Hema jain ,[4]Alka Sharma
[1]Assistant Professor Parishkar College of Global Excellence ,Jaipur

ABSTRACT:

Nanomedicine, defined as the application of nanotechnology in the medical field, has the potential to significantly change the course of diagnostics and treatment of life-threatening diseases, such as cancer. In comparison with traditional cancer diagnostics and therapy, cancer nanomedicine provides sensitive cancer detection and/or enhances treatment efficacy with significantly minimized adverse effects associated with standard therapeutics.

INTRODUCTION:

Nano medicine is the latest medical diligence of nanoparticle based therapeutics. It describes the many multidisciplinary challenges faces Nano medicine and discusses the required collaboration between chemists, engineers and clinicians. Current problems for Nano medicine involve understanding the issue related to toxicity and environmental impact of Nano scalematerials. To solve this problem, innovation in the field of Nanotechnology has emerged, which have considerable benefits other currently used treatment options. Such as in Drug formulation imparts physical advantages like improved solubility, decreased degradation or physiologic clearance rates, decreased systemic toxicity and improved clinical efficacy.

Nanomaterial's can be useful for both in vivo and in vitro biomedical research and application because the size of Nanomaterial's is similar to that of most biological molecules. Nano medicine has shown great impact in possible cure for cancer more than any other medical process.

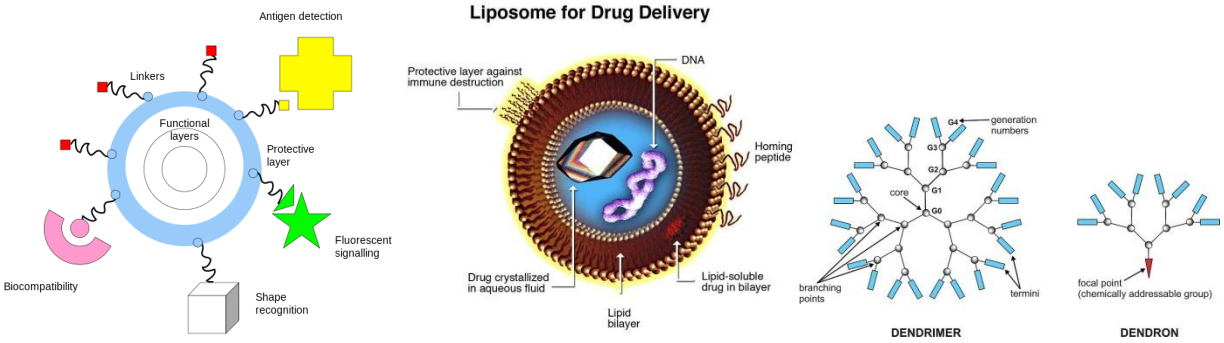
The Research findings are being used to advance the field of targeted drug therapy, until Nano medicine has scientifically proven to be effective to treat cancer in humans.

Nano medicine research is receiving funding from the US National institutes of Health Common fund program, supporting four Nano medicine development centers.

Drug Delivery

Drug delivery describes the method and approach to delivering drugs or pharmaceuticals and other xenobiotic to their site of action with in an organism, with the goal of achieving a therapeutic outcome. Issues of pharmacodynamics and pharmacokinetics are important considerations for drug delivery. Drug delivery system, lipid or polymer based nanoparticles can be design to improve the pharmacokinetics and bio distribution of the drug. The pharmacokinetics and pharmacodynamics of Nano medicine is highly variable among different patients. Nanoparticles have beneficial properties that can be used to improve drug delivery.

Drug are placed in the body and activated on encountering a particular signal.



Nanoparticles *(Left)*, liposomes*(middle)*, and dendrimers *(Right)*are some nanomaterial's being investigated for use in Nano medicine

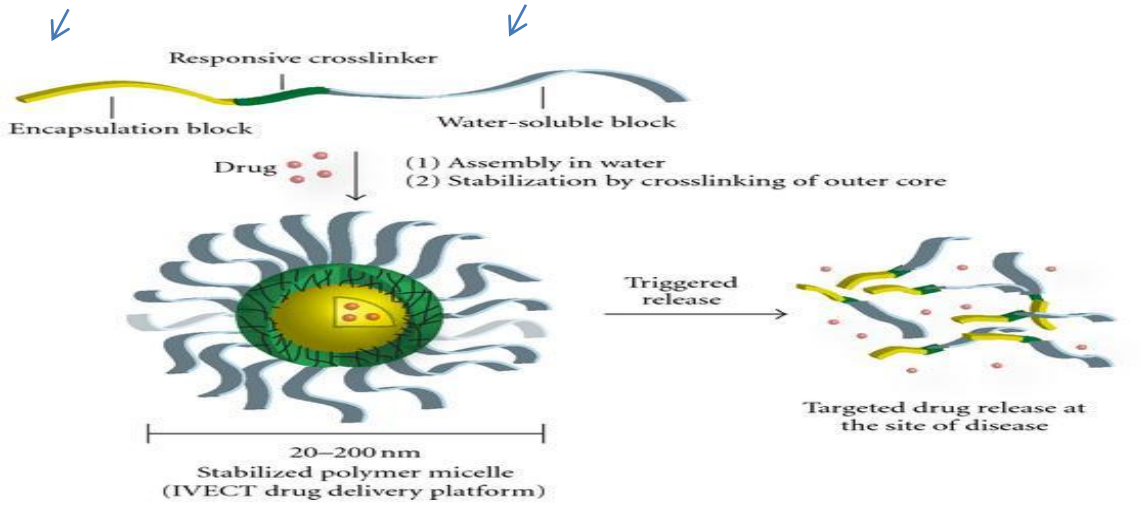
For example- A drug with poor solubility will be replaced by a drug delivery system where both hydrophilic and hydrophobic environments exist, improving the solubility. The structure of nanoparticles as like polymeric Micelles

1. Artificial cell like structure similar to natural carriers.
2. Core/Shell structure with hydrophobic core and hydrophilic shell.
3. Suitable use for drugs that have poor aqueous solubility.
4. Generally made of block Copolymers.
5. Well suited in treating cancer.

Amphiphillic Block Copolymer

Hydrophobic Segment

Hydrophilic segment



Nano Particles are under research for their potential to decrease antibiotic resistance or for various antimicrobial uses. Nano particles might also use to circumvent multidrug resistance (MDR) mechanism.

Applications

Some nanotechnology based drugs that are commercially available or in human clinical trials include:-

- Abraxane, approved by the U.S. food and drug administration (FDA) to treat breast cancer, non-small-cell lung cancer (NSCLC) and pancreatic cancer, is the nanoparticles albumin bound paclitaxel.
- Doxil was originally approved by the FDA for the use on HIV – related Kaposi's & arcoma. It is now being used to also treat ovarian cancer and multiple myeloma.
- C-dots (Cornell dots) are the smallest silica based nanoparticles with the size 10nm.The particles are infused with organic dye which will light up with fluorescence. The C-DOTS as diagnostic tool to assist surgeons to identity the location of tumor cell.
- An early phase clinical trial using the platform of MINICELL nanoparticle for drug delivery has been tested on patients with advanced and untreatable cancer.

PREAMBLE TO NEW CANCER TREATMENT :

We have known that Nano medicine has proven itself beyond the clinical stages in long term and short term treatment, Nano medicine will not become a conventional form of cancer treatment. Because in conventional cancer chemotherapy includes drug resistance, lack of selectivity and lack of solubility. Nanoparticles have the potential to overcome these problems.

The Research on Nano medicine funding have led to creation of a modern treatment of cancer known as targeted cancer therapy, Which involves drugs that target specific biological structures of tumor cells.

Targeted therapy of drugs can detect cells with

genetic mutations which allow them to localize the effects of the drug much like Nano medicine.

Nano medicine rising to prevent the tumor which grow and spread around the body. These targeted therapy drugs can make cancer cell destroy by changing the structure of proteins with in the cells.

Along with chemotherapy, there are various types of target therapies. Each with their own specific function, as in photodynamic therapy, particle is placed within the body and is illuminated with light from the outside. The light gets absorbed by particle and if the particle is metal, energy from the light will heat particles and surrounding tissues. Light may also be used to produce high energy oxygen molecules which will chemically react with and destroy most organic molecules that are next to them (like tumors). This therapy is appealing for many reasons. It does not leave a TOXIC TRAIL of reactance molecules throughout the body (chemotherapy) because it is depicted where only the light is shined and the particles exist. Photodynamic therapy has potential for a noninvasive procedure for dealing with disease, growth and tumors

In other respect Hormone targeted therapy prevent the growth of tumors which depends on the growth of tumors which depend on the production of hormones. These targeted drugs are designed to block the growth and spread of cancer cells. These drugs work differently from chemotherapy drugs. Which attack all cells that are growing quickly (including cancer cell). They are used along with certain hormone therapy drugs called aromatase inhibitors such as letrozole or fulvestrant

Signal transduction therapy blocks the signals produced within tumor cell to reproduce and survive.

In general targeted therapies are most effective when combined with another conventional form of therapy. Nano medicine surely may be the future of cancer treatment.

NANOMEDICINE FOR EARLY DIAGNOSIS OF CANCER:

Cancer biomarkers are indicators produced by tumor cells spreading in the body and are commonly used in cancer detection. However they are present in too low concentrations to be efficiently detected in early phases. However the targeted delivery of specific nanoparticles in to the tumor can induce a local interaction with cancer cells and forces them to significantly increase the production of these biomarkers.

Biomarkers detection become thus much easier and can provide an earlier diagnosis to doctors than biopsies. Early detection of cancers allows early and less burdensome treatment, increasing also the chances of recovery.

NANOMEDICINE FOR ACCURATE CANCER IMAGING:

Iron oxide nanoparticles are one useful too against cancer because, When NANO engineered with a specific coating, they bind particularly well to the tumors. Their magnetic properties make them suitable imaging agents with MRI – SCANS while their size and concentration in the tumor allow a very high resolution and an accurate mapping of lesions. Surgeons

can thus rely on this to select properly patients and plan the surgical removal of the tumor.

ADVANTAGES OF NANO MEDICINE:

1. The advantage of nanoparticles in medicine is that have a far greater surface area to volume ratio over larger particles.

2. The other advantage of Nano medicine is specific binding of drug to targets in cancer cells or the tumor.

3. By the use of Nano medicine we reduced the mortality and morbidity rates. And in return increased the long vitality rate.

CONCLUSION:

Nano medicine has come a long way in its brief history. As detailed in this review, there are a large number of Nano medicine that have advanced in to clinical trials, many show promising results even through only a small number of preclinical systems ultimately gain regulatory approval, The sheer number of existing preclinical studies suggests that many new Nano medicines should eventually come to market, There are still many challenges facing the translations of novel therapeutics, advances in Nano medicine have the potential to drastically alter the clinical landscape and improve our therapeutic and diagnostic armamentarium Innovations in new cancer treatment can also lead to a greater understanding of biological system of the human body, which can lead to the creation of cures for other diseases and health issues.

References

[1] Press Release (1 April 2015). "Kala Pharmaceuticals Announces Positive Results from Phase 3 Trial of KPI-121 in Cataract Surgery" (PDF).

[2] Press Release (19 June 2014). "Kala Pharmaceuticals Initiates Phase3 Clinical Trial for Treatment of Post-Surgical Ocular Inflammation and Phase 2 Clinical Trial in Dry Eye Disease" (PDF).

[3] Nguyen-Ngoc T, Raymond E (2015). "Reinvention of chemotherapy: drug conjugates and nanoparticles". CurrOpin Oncol. 27: 232–42. PMID 25783982

[4] Stendahl, J. C.; Sinusas, A. J. (2015). "Nanoparticles for Cardiovascular Imaging and Therapeutic Delivery, Part 2: Radiolabeled Probes". Journal of Nuclear Medicine. 56 (11): 1637–1641. PMC 4934892

[5] News Release (22 October 2015). "FDA approves new treatment for advanced pancreatic cancer

[6] Lee J.-J.; et al. (2014). "Synthetic Ligand-Coated Magnetic Nanoparticles for Microfluidic Bacterial Separation from Blood". *Nano Lett.* **14**: 1–5. doi:10.1021/nl3047305

[7] Stacy Shepherd,"Harvard Engineers Invented an Artificial Spleen to Treat Sepsis", *Boston Magazine*. Retrieved on 20 April 2015

[8] VIII National Science and Technology Council Committee on Technology, The National Nanotechnology Initiative: Research and Development Leading to a Revolution in Technology and Industry, Office of Sciences and Technology Policy, Washington, DC, USA, 2005