

Various Approach for the Treatment of Cancer- Using Nano-Technology

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Abstract— the credential part of the paper reviews about the advanced methods for the treatment of cancer using nano devices and nano technology technique. The advanced technology which could be the best to treat cancer is the treatment using nano-technology the molecular scale properties and the interface between the chemical, biological and the physical sciences are the important concerns of nano-technology. The application in the treatment of cancer using nano- technology is promising more than the ordinary treatments. This paper also proposes the use of nano-robots in medical field is the fast, best, and safe method for the treatment of different diseases in the human body. The main stress given in the paper is the comparison of the latest treatment in curing cancer using nano-technology.

Key words: treatment of cancer, nano, Nano Particles.

I. INTRODUCTION

- Nano means very small.
- In units of measure it has the specific sense “one billionth”.

II. NANOTECHNOLOGY

Nanotechnology is the study and application of extremely small things and it can be used in various fields like ‘chemistry’, ‘biology’, ‘physics’ and ‘engineering’. It is used to control every individual atoms and molecules. It is the manipulation of matter on an atomic, molecular and super molecular scale.

A. Nano devices:

- Nano device is nothing but a device whose scale is measured in ‘Nanometer’.
- Some of Nano devices are ‘Nano robots’, ‘Nano sensors’, ‘Nano pumps’, etc.

B. Nano robots:

A Nano robot is a tiny machine designed to perform a specific task with precision in dimension.

1) Advantages:

- Durability.
- A Nano device remains same for many years, decades or centuries.

2) Source of power for the Nano robot:

The nuclear power is carried onboard to supply required amount of energy for the operation of the device. This would be relatively easy to shield given the amount of fuel involved, and it has other advantages as well. The same radioactive material could be used for power and tracking, since the casing must be hotter than body temperature to produce power and there would be no worries about running out of power, or insufficient power to get the job done. At the micro scale, shielding and power conversion are relatively easy, making this method extremely practical.

III. CURES OF CANCER USING NANOTECHNOLOGY

A. Using Nano Particles:

Nano particles help us to identify the cancer cells. The nano particle used here is ‘Polymeric Nanoparticle’. These nanoparticles are stuffed with even small particles of semiconductors and therefore after filling these nanoparticles it starts to shine with different colors depending upon the molecules we attach.

The nanoparticles glows in Red(R), Yellow(Y), Blue(B). When the nanoparticles begin to glow we can track the movements of the light ray and can range the molecules in a cancer cells under microscope.

Hence these nanoparticles are used to observe the development of cancer at the molecular level, giving us a clue in how to stop or treat the cancer.

B. Once the cancer is diagnosed:

The most effective way is injecting drugs into the people. Once the tumor is diagnosed the drug is injected into the affected person.

C. Necessary treatment:

The most common treatment given today is the chemotherapy. It usually involves the combination of Toxic drugs which kills the cancer cells.

D. Rebuilding of normal tissues:

Once the chemotherapy is done, the cancer cells are destroying, but along with the cancer cell normal tissues are also damaged. And so we are injecting a Nano-engineering gel which helps in the re-growth of normal tissues.

E. Genes Becomes Abnormal Due To Cancer:

1) During initial stage:

- Immunity fails.

2) Oncogenes:

- It is called cancer genes which helps the cells to double or multiply. It also helps to repair the damaged cells.

3) Tumour suppressor genes:

- It stops the multiplication of cells. It stops the repair of the damaged cells.

4) DNA repair genes:

- It is used to repair the other damaged cells.

5) During secondary stage:

- Vast growth of tumor cells takes place.
- Normal tissues started converting into tumor cell.

Here we have two types of tumor growth,

6) Benign growth:

- Benign is non-cancerous and it can be cured by surgical operation.

7) Malignant growth:

- Malignant is a cancerous in nature.

- It spreads into the surrounding tissues.
- Later it starts destroying the surrounding tissues.

This is the cause for the growth of tumor cells.

IV. GENERAL METHOD FOR CURING CANCER

A. Surgical

- Normal surgical method is followed here.

B. Chemotherapy

- Curing through medicine or drugs.

C. Radiation therapy

- Through radiation high energy particles or waves is passed to destroy the tumor cells.

D. Immunotherapy

- In this method, the immune system which is present inside our body is helps to fight against the cancer.

E. Hyperthermia

- We are inducing heat to treat the cancer.

V. VARIOUS APPROACHES FOR CURING CANCER

In the treatment for cancer various methods are been approached. Though we have introduced countless numbers of drugs in the market for eliminating this lethal disease, but most of the drugs are toxic in nature. The drugs which is being sold in the market as side effects which may result to death of the patients. And also, these drugs will damage the normal cells along with the tumor cells. The major strength of nano medicine is the ability of the proper distribution of the drugs.

A. Target delivery:

The idea behind this target delivery is that chemotherapy drugs. The drugs is made to direct to the cancer cells. But the problem in chemotherapy is solubility, low bio availability, toxic solvent formulation.

But nanotechnology created a great impact to solve these inherent problems. Doxil, Abraxane are the nano-formulated drugs which are currently available in the market. It as already created a worldwide impact. Doxil is formulated in nano-liposome and Abraxane(albumin bound nanoparticle) which is 100nm in size. It is formulated in paclitaxel. It is mainly used to treat breast cancer. The main advantage is that it evades hypersensitivity reaction.

The two types of target delivery,

1) Active targeting:

It has the capability of changing the current cancer treatment.

2) Passive targeting:

Its size and surface properties of nanoparticles plays a vital role.

B. Approach 1:

1) Using Gold Nano shells:

Gold Nano shell is used to detect the presences of cancer, using infrared light. It is used to treat breast cancer.

2) Steps:

- The gold nanoshell is injected into the tumor cells.
- The irradiated light with 820nm is passed through.
- Then the temperature as to increased when irradiation with light. It will destroy the tumor cells without any damage to the normal cells.[2]

C. Approach 2:

1) Using Optical Nanoparticles and Indocyanine Green (Icg):

Firstly, the optical nanoparticles are mainly used for better cancer diagnosis. It easily interacts with tumor cells. X-ray, tomography requires mutagenic agents on cells which lead to cancer. To avoid this, optical nanoparticles is being used. We are preparing a Nano particulate drug system in laboratory. It should be capable of photo exciting to produce singlet oxygen for detection. And therefore we are using optical nanoparticles which are a fresh idea for diagnosis of cancer.

Secondly, the ICG (Indocyanine Green) is the binding properties which interact with the plasma proteins like albumin, lipoproteins since it easily allows ICG. The ICG molecules is a fluorescent molecules, hence it is used to detect the tumor. Due to this property it is a easy way for diagnosis. And even a tiny point of tumor cells can also be easily seen with the help of fluorescent signal.[1]

D. Approach 3:

1) Using Monoclonal Antibody:

Monoclonal antibody is drug which is used to treat tumor cells. The monoclonal antibody is made in laboratory. For treating the tumor cells, the monoclonal antibody is fused together as one in the laboratory and then used in the treatment.

The cancer is diagnosed through Nano sensor which is a Nano device. After the tumor cells are identified, a Nano robot which is also Nano device used to carry the drug to the tumor cells. The Nano robot carry the monoclonal antibody to the affected part of the patients Ana inject the drug into the body. This monoclonal antibody will destroy the tumor cells. Once the tumor cells are being destroyed the Nano sensor is used to check whether there is any existence of tumor cells in the body.

If there is any tumor cell still existing in the body, the Nano pump which is a Nano device used to pump out the tumor cells which are still remaining in the body. Using this method the tumor cells are destroy without any damage to the normal tissue. [7].

E. Approach 4:

1) Using Gold Nanoparticles:

The gold nanoparticles (GNPs) are used as bio-imaging due to their optical properties. It is enhanced with strong surface-Plasmon and it as the capable of absorbing and scattering due to their powerful imaging. The GNPs as more biocompatibility, less cytotoxic, and resistant to photo bleaching. GNPs absorb and scatter light due to their size and shape. Hence it is used for diagnosing the cancer. GNPs are mostly studied in the field of medicine. It is also used as biosensors, for cancer therapy, cancer imaging and drug delivery. Epidermal growth factor

receptor (EGFR) which is a biomarker used for cancer targeting in vivo tumor targeting.

The GNPs is versatile molecular imaging agent. A 5'-thiol-modified and 3'-NH₂-modified oligonucleotides are coated over the nanoparticles, due to the coating the nanoparticles become effective in nature.

GNPs are a molecular imaging agent, similar to that the gold film which is used for detecting cancer biomarker proteins. By Applying multileveled detection antibody magnetic bead bio conjugates, an ultrasensitive electrochemical immunosensor for cancer bio protein is being designed. The magnetic beads is being combined with horse radish peroxide(HRP) and secondary antibody gives multi number of enzyme label for anti-prostate specific antigen(PSA) for detecting. On the surface of GNP the antibodies PSA antigen is attached. When voltage is given it produces immunosensor which is used to detect the in vivo tumor. It is used as photothermal cancer treatment agent.

F. Biomarker:

Biomarker is an indicator which is used to detect a particular biological state of disease. It is mainly used to target the disease. Biomarker with nanotechnology is used for cancer targeting and drug delivery.

1) Using Quantum Dots:

An quantum dots is a light emitting nanocrystal. It is a powerful molecular imaging agent same as GNPs. Since it has high resistance to photobleaching, broad band absorption it is said as better cancer diagnosis.

The multifunctional nanoparticles with biomolecules combined to quantum dots are used for cancer targeting and drug delivery.

A10 RNA, aptamer accepts prostate specific membrane antigen (PSMA) combined to quantum dots is used to target the cancer cells. Doxorubicin (DOX) is an anthracycline drug which as the property of producing fluorescent. The DOX within A10 RNA combined with quantum dots gives the fluorescent of both DOX and RNA. Using this drug is delivered within the cancer cells. The Quantum dots are also made into nano-bio-chip (NBCs) that can detect multiple cancer biomarkers. This is the new technique as be introduced. [4]

G. Approach 5:

1) Multi-Target Inhibitors (MTIs):

There are many recent new and advanced techniques as been introduced for the cancer therapy. Some of the successful technique is Zelboraf used in the treatment of advanced melanoma, monoclonal antibody for human epidermal growth factor receptor 2 (HER2) breast cancers, imatinib for break cluster region, etc. For curing a disease like cancer single-target agents cannot fight, hence multi-target inhibitors (MTIs) are being introduced. And it's unique by more effectiveness and less prone. [5]

2) Using Polymeric Nanoparticles:

The polymeric nanoparticle is used to identify the cancer cells. The polymeric is stuffed with hydrophobic core, which is suitable for water insoluble multi-target inhibitors. Nanoparticles as high stability, high loading capacity, sub cellular rice distribution. It is general fabricated with synthetic polymers. Some of the polymers

are chitosan, polysaccharides, polypeptides which are all drug delivers used to treat cardiovascular disease, cancer, etc. The epidermal growth factor receptor(EGFR) polymeric nanoparticles is stuffed with indamine and paclitaxel, the nanoparticles glows and shows the direction of the cancer cells in breast cancer and ovarian cancer. PLGA nanoparticles stuffed with vincristine and verapamil will show the reverse direction on MCF-7/ADR cells. [6]

VI. COMPARISON OF THE APPROACHED TECHNIQUES

While comparing all the technique that as mention above, the best approach among all is using monoclonal antibody technique. This method is an advanced technique for curing tumor cells. The monoclonal antibody is an drug which is going to cure the cancer affected cell. For carrying the monoclonal antibody, Nano robots are being used. The Nano robots will first diagnosis the cancer affected cell, then it carries the monoclonal antibody to the cancer affected area. The Nano robots will inject the antibodies into the affected area. After the process is over the Nano sensor will sensor the affected area, if there is any chance of existing tumor cells, by using Nano pumps the existing cancer cells are being removed. And therefore, tumor cells are destroyed without any damage to the normal tissues.

VII. CONCLUSION

Nanotechnology is the most advanced technology which as already made a worldwide impact can bring a vast change in future. Usual methods are not enough for this scientific world. Nanotechnology is the best preference in future for curing all kinds of diseases especially in cancer therapy. It can be cured in the initial stage by using nanotechnology. Though it as made a great impact, some more steps as to be taken for future survive.

REFERENCES

- [1] Akin Aliosmanoglu and Iiker basaran(2012). "Nanotechnology in cancer treatment". *Nanomedicine and Biotherapeutic discovery* ISSN:2155-983XJNBD. Vol:2. doi:10.4172/2155-983X.1000107.
- [2] Shaker A.Mousa and Dhruva J.Bharali(2011). "Nanotechnology-based detection and targeted therapy in cancer: Nan-bio paradigms and applications. *Cancer* ISSN2072-6694. *Cancers* 2011,3,2888-2903;doi:10.3390/cancers 3032888.
- [3] Shubhadeep Banerjee, Gavin P.Jones, Robertson(2013). "Use of Nanotechnology to develop multi-drug inhibitors for cancer therapy". *Nanomedicine ana Nanotchnology* ISSN:2157-7439 JNMNT. Vol:4. doi 10.4172/2157-7439.1000184.
- [4] Young-Eun Choi, Ju-Won Kwak and Joon Won Park(2010). "Nanotechnology for early cancer detection". *Sensors* ISSN:1424-8220. *Sensors* 2010,10,428-455;doi:10.3390/s100100428.
- [5] Milane L, Duan Z,Amiji M(2011) Development of EGFR-targeted polymer blend nano carriers for combination Paclitaxel/Ionodamine delivery to treat multi-drug resistance in human breast and ovarian tumor cells. *Mol Pharm* 8:185-203.

- [6] Song X, Cai Z, Zheng Y, He G, Cui FY, et al (2009) Reversion of multidrug resistance by co-encapsulation of vincristine and verapamil in PLGA nanoparticles, *Eur J Sci* 37:300-305.
- [7] K.Ganesh Kumar, R.Arvind, N.Hari Prasad, T.Arun Kumar, Mr.A.Deepak(2014),” Nano Technology Treatment of Cancer- A Future Vision In The Usage of Chemotherapy Drug ,IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 06, 2014 | ISSN (online): 2321-0613 .
- [8] Cristina Buzea, Ivan Pacheco, and Kevin Robbie (2007). "Nanomaterials and Nanoparticles: Sources and Toxicity". *Biointerphases* 2: MR17. doi:10.1116/1.2815690. PMID20419892.
- [9] Binnig, G.; Rohrer, H. (1986). "Scanning tunneling microscopy". *IBM Journal of Research and Development*30:4.
- [10] "Press Release: the 1996 Nobel Prize in Physics". Nobelprize.org. 15 October 1986. Retrieved 12 May 2011.
- [11] Kroto, H. W.; Heath, J. R.; O'Brien, S. C.; Curl, R.F.; Smalley, R.E. (1985). "C60: Buckminsterfullerene". *Nature*318(6042):162–163. Bibcode1985Natur.318..162K. doi:10.1038/318162a0.

