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Short Communication

Nanomedicine and Nanotechnology Approaches in the Field of Breast Cancer in USA

Suraj Bharti*, Swetha G

Department of Biotechnology, Lovely Professional University, Punjab, India

ABSTRACT

Globally breast cancer is one of the most common cancers caused in women. In breast cancer research, nanomedicine has brought forth new potential and hope to detection and therapy. The extremely small size of nanoparticles makes it advantageous and potentially superior to use in tumor detection and imaging. One of the more extensively studied particles is quantum dots, semiconductor crystals which are capable of enhanced labeling and imaging of cancer cells. In addition, due to serious toxicity of chemotherapeutic agents, nano-formulations of breast cancer chemotherapy are under investigation and development. This may provide easier administering route and reduced frequency of drugs. With the use of nanoparticles, drug delivery can be carried out in a minimally invasive fashion and treatment regimens can be made much more targeted and specific for each patient. The major disadvantage of chemotherapies is they cause great harm to non tumour cells, healthy cells surrounding tumour cells. And the major hurdle for treatment for cancer is appropriate drug delivery methods that can reach specifically to target and interact with them. In this review article, we provide an overview on the role nanomedicine played in breast cancer and mention some of the latest diagnostic and treatment modalities researched to date.

Keywords: Nanomedicine; Nanoparticle; Breast cancer; Cancer treatment

INTRODUCTION

Breast cancer is one of the most common diseased found in females in USA. More number of female died due to breast cancer which makes it more highlighted and more concern about the treatment of breast cancer. In USA female suffering from different types of breast cancer like ductal carcinoma *in situ*, lobular carcinoma *in situ*, invasive ductal carcinoma, tubular carcinoma of the breast, medullary carcinoma of the breast, mucinous carcinoma of the breast etc. and papillary carcinoma of the breast, cribriform carcinoma of the breast, invasive lobular carcinoma, inflammatory breast cancer etc. are less common breast cancer types [1].

According to American college of surgeons, lobular carcinoma is more common than ductal carcinoma. Lobular carcinoma is identified 3.2% whereas ductal carcinoma is identified as 2.1%. Most of the breast cancer (almost 70%) is treated with expression of ER (Estrogen Receptors) and PR (Progesterone Receptors). Some of the breast cancer is treated by trastuzumab. Breast cancer is treated by surgery and different types of therapy like radiation, chemotherapy, hormonal and targeted therapy. Many types of drugs are also used for cancer treatment but the drugs have many side effects like anaemia, digestion problem, tongue or mouth ulcers, hair loss, nausea and vomiting, heart disease or heart block, allergy, joint pain, etc. Chemotherapy also kills the healthy cells with cancer cells. Scientists have discovered a natural innovative, self-alternative breast cancer treatment by medical application of nanoparticles. Treating breast cancer using nanotechnology and nanomedicine is most prevailing methods these days [2].

Correspondence to: Suraj Bharti, Department of Biotechnology, Lovely Professional University, Punjab, India; E-mail: surajbharti915@gmail.com

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DESCRIPTION

Treatment of breast cancer by paramagnetic nanoparticle

So far there is no target specific therapy or agent for imaging the triple negative breast cancer cells Meser M Ali with his co-workers developed a new approach for imaging, therapy of a subtype of cancer-triple negative breast cancer which lacks appropriate target. The options for treatment of TNBC are limited to chemotherapy which inturn harm healthy cells [3].

At present most studies have found that MRI has been most promising techniques for detecting, imaging breast cancer. Though nanotechnology is booming and expected to address treatment, therapy, diagnosis for cancers, the challenge comes to therapy such as targeted therapy, proper drug delivery system to deliver the drug, the drug to reach and sustain in tumour micro-environment. For effective drug delivery-liposomal aggregates, protein aggregate based drug delivery, usage of dendimers etc are few examples of drug delivery methods employed and researched for effective nanotechnology based drug delivery.

A JIST of method and description of Meser and his co-workers is worked on developing treatment using dendimer probe [4].

A conjugate of a contrast agent to a dendimer was prepared, the conjugate was studied using MALDI TOF spectroscopy. The conjugate was developed and studied when injected intravenously in mice. When studied for its activity through fluroscence imaging it shown that the nanoparticles accumulated in the tumour and were showing high fluroscence signal targeting the TNBC tumour. It was concluded that TNBC tumor selective drug delivery and imaging can be accomplished by using a G4 dendrimerbased nanoparticles that possess long blood half-lives.

Triple negative breast cancer type is the cancer type in which cancer cells are tested negative to all the receptor tests like estrogen receptors, progesterone receptorsand HER2 (HER2-). This kind of breast cancer cannot treat by using above receptors. Scientists developed the techniques to diagnose the triple negative breast cancer by using nanomedicine and nanotechnogy [5].

Mesar Ali, et al. developed nanoparticle called dendrimer based nanoparticle (GdDOTA) 42-G4-DL680 and deliver to target cancer cells and they observed this techniques is less side effects and toxic effect to normal tissue or healthy tissue.

Treatment of breast cancer cells without harming healthy cells

Worldwide breast cancer is very big issue for woman and treatment is very difficult. All the treatment method was harmful and patients were suffering from many another problems during the breast cancer treatment. Moses, et al. used Trisodium Citrate Dehydrate (TSCD) reduction capped gold nanoparticle for drug delivery to induce the cytotoxicity in breast cancer cell line and without harming the normal or healthy cells in body [6].

Though chemotherapy has proved to be best alternate way to treat cancer, it has a major disadvantage of causing severe damage to healthy cells along with the damage of cancer cells. In nanomedicine, matter is manipulated in supra molecular scale to enhance the properties at atomic and molecular levels.

In one the methods researched by scholars-drug delivery using metal nanoparticles have proved to be promising in clinical therapy and also diagnostics to treat breast cancer [7]. A list of the method used is given below:

The aim of the study was to investigate the cytotoxic effect of gold nanoparticles coupled with *Boswellia sacra* and *Commiphora myrrha* extracts on breast cancer cells. Cancer patients lack the expression of receptors-estrogen, progesterone or HER2.

The study used *Boswellia sacra* and *Commiphora myrrha* conjugated with gold nanoparticles which promoted apoptosis of breast cancer cells. A significant morphological changes were observed in tumour cells ultimately leading them to apoptosis, retaining the healthy cells which were detected using relief contrast microscopy.

The study shows that the aggressive phenotype with the triple-negative MDA-MB 231 cells respond more effectively to the compounds when compared to less aggressive phenotype. A reduced cytotoxicity was observed when non-oncogenic MCF10A cells were exposed to extra strength healthy cell mixture, suggesting a promising therapy to patients with breast cancer with estrogen, progesterone, TNBC with higher potential for more aggressive TNBC without causing damage to healthy cells [8].

CONCLUSION

Meser Ali and his co-workers have concluded from their experimentations that using a G4 PAMAM dendimer with a relevant contrast agent can be a potential nanocarrier for drug delivery, increasing the TNBC tumour target specificity. They have also taken consistent results from Kobayashi, et al. for developing the PAMAM dendrimer-based agents from generation G1 to G4 are excreted through kidney. Sherita, et al., has concluded that cytotoxicity caused to non-tumour cells can be remarkably reduced by receptor specific therapies to address their malignancy. This increases the scope for target specific therapies and reduces the harm caused by chemotherapy treatments which cause high cytotoxiciy.

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