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Current Prospectives of Hormone Therapy in Breast Cancer Treatment

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Abstract

Breast cancer, being a heterogeneous disease, includes an increased proliferation of breast cells, symptoms of which include- lump in the breast, bloody discharge from the nipple area, and changes in the shape or texture of the nipple or breast. The types of breast cancer mainly encompass adenocarcinomas and angiosarcoma. The treatment of this disease depends on the stage. It incorporates local therapy like surgery and radiotherapy and systemic therapy like chemotherapy, hormone therapy, and biological therapy. Oestrogen and progesterone stimulate breast cells to grow and multiply. Hormone therapy is usually provided to patients whose tumors are hormone receptor-positive, meaning the hormones bind extensively to the surface receptors of the tumor cells and cause increased multiplication. Chemotherapy is usually more effective for patients with a high recurrence score, whereas hormone therapy is best used for low recurrence scores. Hormone therapy blocks the interaction of hormones with their specific receptors to prevent the development of tumors and is used in both adjuvant and metastatic cancers. In this our study focused on the course of action to treat breast cancer with hormone therapy is Selective estrogen receptor modulators such as Tamoxifen and raloxifene and other parameters with support of Nano-materials applications in preventing breast cancer.

Keyword: *Prospectives of hormone therapy, Breast Cancer, radiography, adenocarcinomas, angiosarcoma, biological therapy, chemotherapy, nano-technology, alopecia, thrombocytopenia, growth promoter protein.*

1.0 Introduction

With the evolution of environmental and lifestyle factors, such as pollution, smoking, eating habits, there has been a considerable increase in cancer incidence. As a result, it is the second leading cause of death following cardiovascular disease. Breast cancer being one of the most prevalent types of cancer in women is the deadliest after lung cancer leading to morbidity and mortality in women with around 450,000 deaths around and across the world. Breast cancer occurs when cells of the breast tissues divide rapidly. Cancer starts developing in the inner lining of the milk duct or the milk gland. Breast cancer is the most commonly detected cancer by some estimates and accounts for over 25% of the cancers detected in Indian females. Therefore, it is highly recommended that women get regular check-ups and take notice of any irregular lumps in the breast. Many doctors recommend surgical treatment for breast cancer. Surgery may be performed to remove as much of cancer from the breast as possible through a mastectomy, or using a sentinel lymph node biopsy or axillary lymph node dissection to find out whether cancer has metastasized to the lymph nodes under the arm, or breast reconstruction to restore the breast's shape after cancer removal; last resort being surgery to relieve the symptoms of advanced cancer. Some of the conventional methods involved in the cancer treatment include surgery, radiotherapy, chemotherapy and introduction of some antibiotics, but they are not effective as expected because they have low target specificity and have numerous cytotoxic side effects such as alopecia, thrombocytopenia and

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mucositis. The human epidermal growth factor receptor (HER2) is a growth promoter protein which is over-expressed on the external cell membrane of cancer cells. Breast cancer that has the level above HER2 protein is referred to as HER2-positive breast cancer. The over-expression of this protein affects about 1 in 5 women with breast cancer which also grows and spreads rapidly than other types of breast cancer[2].

The female body produces estrogen and progesterone pre-menopause. These hormones are involved in the modulation of the menstrual cycle and secondary sexual characteristics. If there are suspicions of a patient having breast cancer, a biopsy is performed, and the cells taken from the breast tissue of the patient are tested for hormone receptors. Hormone receptors are proteins present on the surface of the breast tissue. Under certain conditions, these receptors become sensitive to estrogen and progesterone. This causes the hormones to bind to the receptors and cause-specific genetic changes in these cells, which leads to uncontrolled proliferation. If the cells are sensitive to estrogen, the cancer is referred to as estrogen receptor-positive (ER-positive), whereas if they are found to be sensitive to progesterone, the type of breast cancer is referred to as progesterone receptor-positive (PR positive). In general, a study found that 67%-80% of the breast cancers in women are hormone receptor-positive (HR-positive).Therefore, it is highly recommended that women get regular check-ups and take notice of any irregular lumps in the breast. Many doctors recommend surgical treatment for breast cancer. Surgery may be performed to remove as much of cancer from the breast as possible through a mastectomy, or using a sentinel lymph node biopsy or axillary lymph node dissection to find out whether cancer has metastasized to the lymph nodes under the arm, or breast reconstruction to restore the breast's shape after cancer removal; last resort being surgery to relieve the symptoms of advanced cancer. Hormone therapy is generally used after a patient has undergone surgery[7]. Hormone therapy is based on the main principle of blocking the hormone receptors in the cancerous tissues and preventing further spread and growth of the tumor. This can either be done by lowering the hormone level (estrogen and progesterone) circulating in the bloodstream or by reducing the sensitivity of the receptors on the surface of the cells to these hormones. The use of nano-materials in the hormone therapy treatment can be implemented since nano-technology is becoming one of the best methods in breast cancer treatment and drug delivery. It has been reported by the researchers that nano-particle is a nano-medicine for cancer treatment, the uptake of these nano-particles (inorganic or organic) can improve the limitations of the traditional therapeutics. Nano-medicine has become a popular domain because of its properties, in particular its small size, reduced toxicity, controlled drug release and easy biological distribution. Nano-particles can target specific multifunctional properties for example the nano-missiles are well equipped with arsenals to accomplish their role in eradicating most of the cancer cells.

2.0 Methodology

Hormone therapy is the method of treating breast cancer that involves suppression of the growing tumor using hormones or hormone suppressing factors. Since most types of breast cancers are hormone receptor-positive, mainly ER-positive (estrogen receptor-positive), hormone therapy uses receptor blockers/degraders to control the growth of the tumor and prevent it from metastasizing to other parts of the body. Hormone therapy prevents the interaction between estrogens and estrogen-dependent stimulating neoplastic cells. The interaction of estrogen with the cells can cause an increase in proliferation. Therefore, the main principle behind endocrine therapy is to block estrogen receptors from coming into contact with estrogen. To target ER receptors on the surface of tumors, we use two methods in hormone therapy: 1. SERM: Selective estrogen receptor modulators. These drug molecules bind to the surface of the estrogen receptors and inhibit estrogen molecules from binding to them. This mechanism is called competitive inhibition of receptors. Tamoxifen, Toremifene, and Raloxifene are the primary SERMs used in hormone therapy (HT). 2. SERD: Selective estrogen receptor degraders. These drug molecules go and bind to the ERs and destroy them rather than inhibiting their active sites. Fulvestrant is one of the approved SERDs used in combination with LHRH agonists in HT. 3. Aromatase inhibitors (AI): In postmenopausal women or women who do not have functional ovaries, primary estrogen production is carried out by aromatase, an enzyme produced by the fat cells. AIs go and bind to aromatase molecules and inhibit their activity, thus lowering estrogen levels in the blood. It is characterized into 2: a) Selective Ais, which inhibit only the aromatase enzyme b) Non-selective Ais that block not only aromatase but also other enzymes in the cytochrome P450. There are many proteins involved in the growth of a tumor. One of the significant protein molecules plays a vital role in tumor growth. Her 2 is a molecule associated with cellular proliferation (rapid multiplication), present on the surface of normal mammary gland epithelium cells and overexpressed by approximately 20% of breast cancers, which determines their genomic instability and excessive proliferation[4]. Currently, Her 2 expression is considered the most important prognostic factor in breast cancer. If the type of breast cancer is HER2 negative, then the cancer is less likely to recur or metastasize. Another factor worth mentioning is the BRCA gene. The BRCA 1 and BRCA 2 genes are responsible for repairing the parts of DNA that cause uncontrolled proliferation of cells that lead to cancer. Mutations in these genes are associated

with breast cancer and ovarian cancer. Oophorectomy (removal of ovaries) can be performed on patients exhibiting these mutations. Chemo prevention using Tamoxifen can reduce the risk of breast cancer by 50% and enhance chances of survival in patients with BRCA 1 and BRCA 2 mutations. Hormone therapy is given to patients whose tumors express HR+, ER+(nuclear transcription factor, 70% of cancer is caused due to overexpression of this and its isomers alpha (frequently associated with cancer). and beta form the normal mammary epithelial cells), PR+ (coded by estrogen-dependent genes).

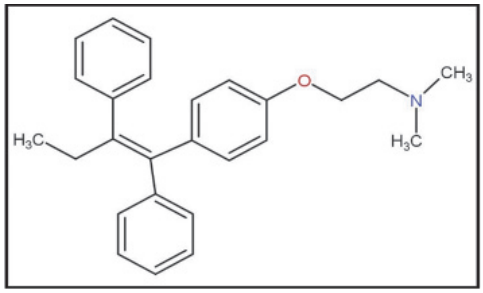
The drugs used in hormone therapy and their mechanism of action and side effects are illustrated below[11].

2.1 Tamoxifen

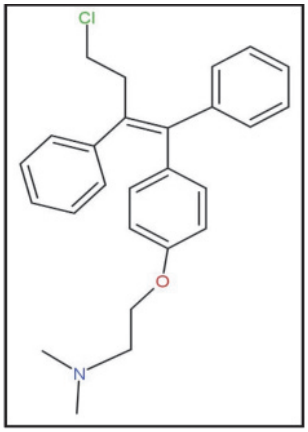
It is a selective estrogen receptor modulator (SERM). Tamoxifen inhibits the estrogen receptors on the surface of the breast tissue cells and prevents them from taking up more estrogen. It also stimulates the other tissues like the uterus and bones to take up more estrogen; hence it is selective. Tamoxifen is used to treat breast cancer patients who have not undergone menopause. When women have undergone breast conservation surgery for ductal carcinoma in situ (DCIS) HR-positive, Tamoxifen is prescribed to them for five years. This reduces the chances of recurrence of DCIS in the same breast or both breasts. This drug is started before surgery (adjuvant therapy) or before surgery (neoadjuvant therapy). Cancer has metastasized to different parts of the body in some cases; this drug can help slow down or stop cancer growth and might even shrink some tumors. Tamoxifen continues to benefit even after the termination of the treatment and is additive and independent of the benefit of chemotherapy. Some of the long-term benefits of Tamoxifen include – A decrease in the risk of recurrence by 41% and risk of death due to breast cancer by 34% compared to people who did not use Tamoxifen. Also, a decrease of 47% of collateral breast cancer was observed in patients subjected to 5 years of adjuvant therapy with Tamoxifen, and this benefit was proven for both lymph node invasion patients and without lymph node invasion patients. Along with the benefits of Tamoxifen, there are also a few side effects of tamoxifen treatment that could limit its use to a certain extent, including the endometrium neoplasm (premalignant lesion of the uterine lining), uterine sarcoma (a disease where the malignant cells form muscles of the uterus) and the thromboembolic risk. Henceforth good monitoring of the treatment is mandatory[8].

2.2 Toremifene (Fareston)

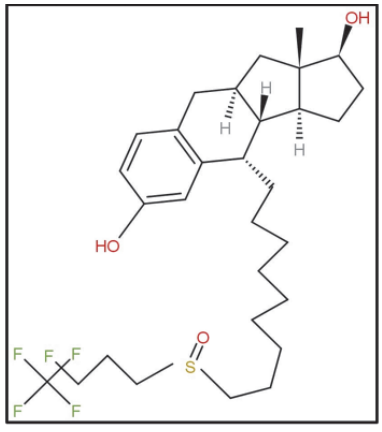
This drug is also a SERM. Unlike Tamoxifen, Toremifene is used to treat postmenopausal women with metastatic breast cancer. Toremifene is a nonsteroidal triphenylethelene anti-estrogen. Toremifene is a competitive inhibitor with estrogen. Toremifene has a pharmacokinetic profile and metabolic pathway, which is different from that of Tamoxifen only because of a difference in structure by only one chlorine atom. Toremifene is an antineoplastic hormonal agent, and a nonsteroidal agent used to check the antiestrogenic property. This toremifene inhibits the induction of mammary carcinoma that is induced by dimethyl benzanthracene in human breast adenocarcinomas; this toremifene fights with oestradiol for the protein ER. Mechanism: Toremifene is a nonsteroidal triphenylethylene derivative. Toremifene binds to estrogen receptors and grants permission to wield estrogenic, antiestrogenic, or both ventures, resting on the duration of situation, animal variety, gender, mark means, or endpoint selected. The antitumor effect of toremifene in feelings malignancy is believed expected for the most part due to allure antiestrogenic belongings; in other words, allure talent to compete with estrogen for binding sites in the tumor, obstructing the growth-exciting belongings of estrogen in the tumor. Toremifene can inhibit Cancer progress through other



(1) Tamoxifen



(2) Toremifene



(3) Fulvestrant

machines in the induction of apoptosis, rule of oncogene verbalization, and growth determinants. Side effects: hot flashes, sweating, nausea, vomiting, decreased appetite, weight gain, insomnia, mood swing, etc., are the most common side effects observed. A severe side effect of toremifene is blood clots, deep vein thrombosis, and pulmonary embolism, but these conditions are infrequent.

2.3 Fulvestrant

This is used for treatment in premenopausal women. Unlike the above two, Fulvestrant is a selective estrogen receptor degrader (SERD). This drug goes and binds to the estrogen receptors and destroys them instead of blocking them. This is combined with the Luteinizing- hormone-releasing hormone (LHRH) to turn off the ovaries. Ovaries are the primary source of estrogen in premenopausal women. Ovarian ablation (suppression) can be done surgically through an oophorectomy or by treating with Gonadotropin-releasing hormone (GnRH) agonists or LHRH agonists. Ovarian suppressing drugs may include goserelin (Zola Dex) and leuprolide (Lupron). Fulvestrant can be given alone or in combination with Tamoxifen or CDK4/6 inhibitors or P13K inhibitors when the cancer is metastatic. Mechanism: fulvestrant-persuaded conformational change of the ER disrupts two together AF2- and AF1-accompanying transcriptional action. Moreover, the complex formed when fulvestrant binds to the ER is doubtful, developing in allure increased shame. Fulvestrant then acts together with an ambitious enemy and a discriminating estrogen receptor degrader (SERD), reducing natural ER beginning levels[3]. Also, it acts nearly particularly as an ER enemy, as Tamoxifen is further a biased agonist. Fulvestrant has a relatively extreme binding similarity to the ER, 89% that of oestradiol. It too impairs dimerization of the receptor through obstructing allure primary localization, and the doubtful complex results in accelerated depravity of the ER protein. So, fulvestrant binds, blocks, and degrades the ER, chief to complete restriction of estrogen indicating through the ER. Side effects: the common side effects include headache, nausea, loss of appetite. constipation, diarrhea, fatigue, abnormal liver tests, Uti, etc In a few people, vaginitis, weight gain, joint pain, pelvic pain, thromboembolic problems were reported.

2.4 Aromatase Inhibitors (AIs)

Patients with estrogen receptor-positive cells are frequently prescribed aromatase inhibitors to control the advanced disease and prevent relapse after treatment with localized breast cancer. Aromatase inhibitors are used to lower estrogen levels. Besides the ovaries, estrogen is also produced in the adipose cells by aromatase. It also inhibits the activity of aromatase in both pre-and postmenopausal women. The present generation aromatase inhibitors are ready to reduce circulating plasma estrogen concentrations in postmenopausal women to below appreciable limits and significantly inhibit aromatase, the enzyme responsible for estrogen synthesis, in normal breast tissue and breast tumors. The newer aromatase inhibitors have proved cost-effective compared to the older treatments in early-stage and advanced/metastatic breast cancer. The aromatase inhibitors suppress the function of ER and reduce the risk of recurrence but also is inevitable in patients with metastatic disease. In primary tumors, the resistance of AI can be detected by measuring on treatment tumor Ki67 expression[6].

2.5 Chemotherapy vs Hormone Therapy

2.5.1 Chemotherapy

Pauses anti-cancer drugs to kill/destroy the cancerous cells or slow down their growth. Chemotherapy is recommended before surgery or after, depending on the condition of the patients. Tests such as Oncotype DX can help determine which women will likely benefit from chemo after breast surgery. Chemo may be second-hand as the main situation for women whose malignancy has spread outside the conscience and underarm extent to distant organs like the liver or body parts. Chemo may be likely when feelings of malignancy are diagnosed or later primary situations. The treatment time depends on how well the chemo is active and by what well you allow it. Chemotherapy is given in pill forms and cycles, including short-term and then 3 to 4 weeks off before beginning another cycle. The side effects include hair loss, low blood counts, mouth sores, and tiredness. Long-term side effects include infertility, heart damage, leukemia, etc[5].

2.5.2 Hormone therapy

According to worldwide guidelines, endocrine healing endures are the first choice for first-line real situations for MBC in the dearth of visceral crunch. ER+HER2 negative conscience malignant tumors are considered less alert and destructive if distinguished to other subtypes, in the way that threefold negative and HER2 positive tumors. Little dossiers are accessible concerning a direct comparison between cytotoxic cure and hormonal powers in the neoadjuvant setting.

2.6 Hormone Therapy and its Side Effects

Hormone therapy refers to either the treatment alone or a combination of estrogen and progesterone. These hormones, estrogen and progesterone, promote the growth of some breast tumors. Hormonal therapy is given to prevent or block these hormones from causing tumors. With the tremendous benefits

of hormone therapy, some side effects prevent it from being used over long periods. Side effects associated with hormone therapy tend to be less severe than those caused by chemotherapy. They typically settle within a few weeks or months. The side effects depend upon the type of hormone therapy used, and they often vary from drug to drug. The short-term effects of hormone therapy in breast cancer include:

- Hot flashes - sudden rush of warmth to the neck, back, face, upper chest, including sweating. These are the most common side effects of hormone therapy. This may last for years, even after the completion of the treatment. The treatment for this involves the usage of antidepressants like venlafaxine. Megestrol acetate, gabapentin, clonidine, phytoestrogens can be used.
- Nausea and fatigue- Hormonal therapy leads to severe tiredness and lack of energy. Anemia can also be one of the reasons for fatigue. Nausea is less common in hormonal therapy compared to chemo.
- Pain in the knees, back, joints, and problems in the digestive system- Due to the continuous exposure of the body to injections, one might get general body pain, and patients often face problems in their digestive system such as loss of appetite, constipation, diarrhea which may finally lead to weight gain.
- Other short-term effects include vaginal dryness, erectile dysfunction, breast tenderness or pain, mood swings, menstrual changes, and so on. The long-term effects of hormonal therapy in breast cancer include -
- Osteoporosis is the condition where the bones become porous and break more easily. Postmenopausal women have an increased risk of bone loss. Hormone therapies such as Tamoxifen help lower bone loss in postmenopausal women; however, other therapies may not help prevent osteoporosis. Therefore, postmenopausal women with breast cancer should undergo bone mineral analysis to determine if they require preventive therapy.
- Stroke- Usage of hormone therapy such as Tamoxifen can lead to stroke with the symptoms such as slurred speech, sudden severe headache, weakness, numbness in limbs.
- Blood clot- Some hormone treatments involve a low risk of developing blood clots in the deep blood vessels in the legs and groin. Clots may shatter and spread to the lungs. Other long-term effects of hormone therapy include endometrial cancer, effects on the eye, hair thinning, memory problems, increased risk of cardiovascular diseases.

The above use cases are applicable for HR positive breast cancer treatment measures. But when the cancer is not caused due to the over stimulation of the hormone receptors like eostrogen and progesterone, this kind of breast cancer is called HR negative breast cancer[13].

3.0 Use of Nano-technology for the Treatment of Hr. Negative Breast Cancer

Nano-materials are defined as materials possessing at least one external dimension as 1-100 nm. Nano-materials can naturally occur or can be artificially produced by combustion reactions or nano-tech engineering. Their applications range from imaging, therapeutics, diagnosis, detection, informatics, etc to targeted therapy and treatment of cancer tissues[17]. This advancement in the field of nano-technology has given women a chance at not only survival, but battling this disease that affects so many. Around 10-20% of breast cancers are said to be triple negative breast cancer (TNBC).

TNBC patients suffer from poorer prognosis compared with patients suffering from other types of breast cancer. Cancers usually originate due to genetic alterations which may be caused by intrinsic (predisposition to the disease due to familial history) or extrinsic factors (mutagens like UV radiation). In TNBC, the TP53 gene known for its DNA damage repair, is deleted or mutated. When there is DNA damage, TP53 gene transcribes to form a P53 functional terapeptide that binds to the promoter of P21 and causes its transcription. The P21 inactivates cyclins and ceases the cell cycle, therefore inhibiting the damaged DNA from replicating. P53 also binds to the promoter of the Bax gene that triggers cell apoptosis. In this way, P53 becomes the most essential gene for the prevention of cancer[18].

But, extensive research has now caused scientists to shift their focus on the POLR2A gene, an essential neighbor of TP53. Deletions of the TP53 gene are usually accompanied by co-deletion of a few areas of the POLR2A gene. This gene is essential for the survival of the cell, and its mutation causes the cancer cell to weaken and become susceptible to POLR2A inhibition. This would mean that POL2A inhibition could potentially kill TNBC cells and spare the rest.

When the cancer is not caused by the estrogen, progesterone or the functionality of the HER2 receptor, hormone therapy cannot be employed as an effective therapeutic for treatment. This is where nano-technology comes into the picture[12].

3.1 Types of Nano-technology Targeting Methods

3.1.1 Passive tumor accumulation

The treatment of cancer is considered effective, when the drug/therapeutic being delivered, accumulates in the area of the affected tissue and does not cause any harm to the regions of healthy tissue that surround it. As the tumor grows rapidly, it starts developing a network of blood capillaries

before it can metastasize. This abnormal growth results in the formation of vasculature with larger pores (40nm to 1um) which allows the nano-materials to seep through. The drug to be administered can be adsorbed onto the surface of a suitable nano-particle and can be injected into the bloodstream to target the breast cancer site. This passive localization of anticancer drugs due to their extravasation through leaky vasculature is called the Enhanced Permeability and Retention [EPR] effect[16].

3.1.2 Active Tumor Targeting

EPR effect does promote localization of the drug in the required breast cancer tissue, but does not promote the uptake of the drug. Nano-particles can be designed to attach selectively to certain proteins, peptides, antibodies, etc that bond with the target receptors located on the surface of the cancer cells. The ligand bound nano-particle binds to the surface receptor. It enters the cell by primary endosome formation and then forms an acidified endosome. The fusion of the lysosome causes enzymatic digestion of the nano-particle which releases the drug into the cell[14].

3.2 Types of Nano-carriers

3.2.1 Graphene based nano-materials

Graphene-based nano-materials (GBNs) are potential drug carriers due to properties like target selectivity, easy functionalization, chemosensitization and high drug-loading capacity[15]. They play an important role in treating breast cancer. These stand out due to their unique chemical structure. Graphene consists of a single sheet of sp2 bonded carbon atoms which gives them a 2D structure. This provides them with a larger surface area of 2630 m2/g, good electrical conductivity and excellent optical performance.

Properties of GBNs used for cancer treatment:

- Graphene and its derivatives are widely used in the biomedical field due to their high surface area; simple surface functionalization and unique biological, electrical, thermal and mechanical properties.
- These properties make GBNs attractive, especially for breast cancer treatment. GBNs have intrinsic anticancer properties and can enhance cell adhesion and capture breast cancer cells.
- The toxic effects of graphene on tumor cells may occur through oxidative stress and autophagy.
- GBNs can reduce the activity of macrophages, resulting in oxidative damage.
- Moreover, they can inhibit the migration and invasion of breast cancer cells and inhibit tumor growth and metastasis by inhibiting mitochondrial respiration.
- After exposure to GBNs, the permeability of the tumor cell membrane increases, which is conducive to drug delivery.
- In addition, GBNs can activate the immune system by inducing the maturation of dendritic cells to promote antitumor immunity, creating opportunities for immunotherapy.

3.2.2 Inorganic/metal based nano-materials

The Iron-oxide nano-materials are classified as superparamagnetic iron oxide (SSPIOs) (60–150 nm), superparamagnetic iron oxide (USPIO) (5–40 nm), and ultra-small and monocrystalline iron oxide (MION) (10–30 nm). The iron oxide (IO) is degraded into Fe+ ions by the acidic components of the body. This reduces the potential toxicity of the nano-material drug carrier which is a major downside of nano-technology. The magnetic flux density and permeability of external magnetic fields should be optimized such that the nano-particles are able to penetrate through biological membranes and barriers easily.

3.2.3 Lipid based nano-carriers

These drug delivery systems have special characteristics like biocompatibility, biodegradability and the ability top entrap both hydrophilic and hydrophobic drugs. The membranes of the lipid nano-carriers consist of amphiphilic compounds like phospholipids and glycolipids which are responsible for their biodegradable property. The bio distribution and the pharmacokinetics is improved by the liposomal drug formulation and higher drug concentration can be achieved while reducing the concentration of the drug within the tumors in normal cell.

3.2.4 Polymers

These are manufactured from biocompatible and biodegradable polymeric compounds such as such as poly D L-lactic-co-glycolic acid (PLGA), poly D L-lactic acid (PLA), and poly ethylene glycol (PEG). The polymeric nano-carriers include: micelles, dendrimers, and polymer-drug conjugates. Chitosan, alginate and pectin have also been used to encapsulate these particles. Dendrimers have three main parts: A central core with two or more repeating units attached to it called the generations, peripheral functional groups which determine its interactions and surface functional groups that can be modified to obtain both hydrophilic and hydrophobic charges. Dendrimers are widely used because of their modifiable properties and their ability to be manufactured in various sizes. A successful study using dendrimers was demonstrated in 2005 when methotrexate was conjugated to polyamidoamine (PAMAM) dendrimers. This caused a 10-fold reduction in tumor size compared with that achieved using free systemic methotrexate.

3.3 How Nano-technology can be used to Improve Hormone Therapy

Recent studies have shown the application of nano-particles in hormone replacement therapy which is used for relieving menopausal treatments[13]. But this formulation can also be applied to delivery of drugs for hormone therapy which is used to treat breast cancer. If the cancer cells are in fact ER positive, hormone therapy is a viable option. But this form of therapy can be made better using nano-particle delivery mechanisms. A recent study conducted used an estradiol formulation as a form of hormone replacement therapy. The main composition of this emulsion is based on the nano-particulated hormones (estriol/estradiol) and oleic acid, phospholipids, protein and bionutrients compatible with the dermal structure. The transdermal estrogen therapy protocol is an effective treatment for relieving menopausal symptoms, particularly in those women for whom the adverse effects of the orally administered drugs are seen as an impeditive factor, since hormones are cleared in this stage when orally administered[19]. The first-pass metabolism is a phenomenon related to drug metabolism where the concentration of the drug is greatly reduced before it reaches the systemic circulation. Since nano-particles have the major advantage of the ability to increase concentration of the drugs in the tumorous tissue, we can fairly hypothesize that when these drug formulations are administered using nano-particles, the drugs have more chance of being effective. Estradiol is used in treatment of breast cancer. So our conclusion is that nano-particles could be used as a delivery mechanism to increase the efficacy of estradiol treatment. Active targeting could be used, since hormone therapy targets estrogen receptors and blocks them from increasing the growth of cancer cells[10].

4.0 Conclusion

Hormone therapy is an effective treatment for people with HR positive breast cancer. This works by blocking production of hormones which encourage the growth of the cancer cells.This paper explores the concepts of hormone therapy and nano-particles and their use in the treatment of breast cancer specifically. As an interdisciplinary domain in rapid development, cancer nano-technology brings diverse perspectives beyond conventional breast cancer treatment that are potentially safer and more efficient. The CDC (Centers for Disease Control and Prevention) suggests that breast cancer can be treated by: surgical removal of the cancerous tissue, chemotherapy – where special chemicals are used to kill/shrink the cancer cells, hormone therapy-which involves blocking the cancer cells from receiving the hormones they need to grow, biological therapy – which works with the immune cells of the body to aid in fighting the cancer and radiation therapy that uses high energy radiation to kill the tumor. Recent advancements have included nano-therapy as a viable treatment option for specific types of breast cancer. Nano-medicine is a new option for treating breast cancer that can reduce the toxicity and chemo resistance of traditional therapies while increasing the anti-cancer efficacy of the drug. This review paper aims to bring together various important domains of treatment of breast cancer, and provides an overview on the mechanism of action of the enumerable forms of treatment. In conclusion, the versatility of nano-particles makes it possible to administer multiple active agents which are capable of targeting different types of cancer. This improves the effectiveness and the progress of diagnosis and treatment.These unique properties make nano-medicine difficult to investigate, but at the same time attractive to the scientific community seeking to improve patient outcomes.

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