International Pharmaceutical Students' Federation

Eastern Mediterranean Regional Office

Breast Cancer *Handbook*

Your guide for Therapy Advancement

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Therapy Advancement

Typically, cancer is named for the body part where it first manifests; hence, breast cancer (BC) refers to the abnormal growth and proliferation of cells that begin in the breast tissue.(1)

Just as with other forms of cancer, there are several conditions that might increase the chance of developing BC: significant family history (2), genetic causes as some people inherit genetic and DNA flaws, including the BRCA1, BRCA2,* and TP53 genes among others (3) and environmental causes where a modest increase in risk was reported in women who work with low doses of radiation for an extended length of time, such as X-ray technicians (4)
There are many types of BC according to sites such as Ductal carcinoma and lobular carcinoma (5) and according to presence or absences of receptors as illustrated in the figure below.

Suppose a cancer cell is a home. To go inside and remove the disease, we must break through three front-door locks: estrogen, progesterone, and HER2

If a tumor tests positive for these three locks, known as receptors, certain medicines have a few keys that may be used to enter inside the cell and destroy it.

Those locks aren't present if you have triple-negative breast cancer. As a result, the typical keys will not operate. Chemotherapy, on the other hand, is still a viable choice [6].

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BC may or may not cause symptoms. Some women could have the disease on their own, while in other cases the anomaly might be found during a screening check. The following are often seen BC symptoms: Breast thickening, inverted nipple (as a change from previous appearance), Redness or nipple discharge, Red color, alterations in the skin of the breast (7,8)

Despite the therapeutic options breakthroughs, breast cancer treatments available in the market are still not very satisfactory due to the serious side effects and cytotoxicity reported in patients(9).

Hence, creating new nanocarriers is crucial to enhance the efficacy and reduce adverse effects caused by conventional free drugs. Doxorubicin (DOX) is considered the most widely used anthracycline in chemotherapy(10). Perspicaciously, DOX nano-formulation marketed under the name Doxil® was the first nano-drug ever to be approved(11). Meanwhile, DOX has the lion's share of the research market so far. Doxil®, followed by Myocet®, is considered to be the most common nanocarriers of DOX(12,13).
These approved nano-drugs demonstrated better promising results in terms of pharmacological efficacy and decreased side effects and toxicity compared to the conventional DOX formulations(14).

Currently, researchers are competing to come up with new nanoformulations of DOX that can even exceed what the available approved nanoforms showed: (Glutathione pegylated liposomal doxorubicin) 2B3-101 , anti EGFR immunoliposomes, Talidox, Thermodox and IMX-110 are defined as Doxorubicin nanocarriers formulations that stills uner clinical trials with demonstrated efficacy comparong with conventional therapy.

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Differences established between nanoformulations paved for substantial ones in the PK, PD, efficacy with an enhanced permeability retention effect, and more targeting exposure to DOX in tumour cells(15). This advancement created different BC degree indications of the same active ingredient based on the nanoformulation of each form corresponding to the exact diagnosis of each patient's case which means a variety of choices and more accurate therapeutic plans would be established in the near future. Also, it should be noted that it is reasonable to expect better results in a population with less advanced diseases than the ones chosen for the clinical trials(16). Plus, Competition has a positive impact on the future of new drugs and would drive a better selection of the most suitable drug for each clinical indication. Due to the importance of all mentioned aspects, application of the discovered technologies may be possible and beneficial as well in other medications than DOX or in other cancer types(17)

Considering the potential toxicological effects of these nanomaterials. Scientists feel that hefty study about the mechanisms of cell harm is required. Hence, scientists become more and more interested in isolating reliable, non-toxic, and eco-friendly nanocarriers as an alternative, without damaging them during the manufacturing process(18); with the same distinctive performance as the synthesized ones. This will take years to be ready for clinical use but it remains an objective in order to improve the health care of patients.

On the other hand, the decision to devote health-care resources to liposomal anthracycline therapy must thus take cost-effectiveness and possible cost savings from enhanced tolerability into account.

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Finally, Thanks to breakthroughs in nanomedicines, the potential to identify illnesses and even combine diagnostic and therapy has grown significantly. futuristic nanocarriers present a real promise in cancer therapy compared to what is available now, along with taking into account overcoming the technical and biological obstacles that obstruct the therapeutic goals while creating them.

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BRCA: BReast Cancer Gene
PK: PharmacoKinetic
TP53: Tumor Protein genes
PD: phatmacodynamic
HER: Human Epidermal growth Receptor
EGFR: Epidermal Growth Factor Receptor