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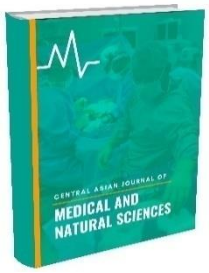

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Breast Cancer and Their Treatment

1. Saodatkhon Tojikhujaeva

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[1] Austin Peay State University

Annotation: Breast cancer is the leading cause of death from cancer in women worldwide, and the second most common cause of death from cancer in women in the United States. Risk assessment tools can identify the risk of breast cancer, and patients at high risk may be candidates for risk-reducing medications. The choice of medication varies with menopausal status. Breast cancer treatment depends on the stage. Stage 0 is ductal carcinoma in situ, which is noninvasive but progresses to invasive cancer in up to 40% of patients. Ductal carcinoma in situ is treated with lumpectomy and radiation or with mastectomy. If ductal carcinoma in situ is estrogen receptor-positive, patients may also receive endocrine therapy.

Keywords: Breast cancer, Sentinel node biopsy, Neoadjuvant treatment, Intraoperative radiotherapy.

Breast cancer is the most prevalent cancer among women worldwide. However, increased survival is due to the dramatic advances in the screening methods, early diagnosis, and breakthroughs in treatments. Over the course of the last decade, many acquisitions have taken place in this critical field of research in the pharmaceutical industry. Advances in molecular biology and pharmacology aided in better understanding of breast cancer, enabling the design of smarter therapeutics able to target cancer and respond to its microenvironment efficiently. Patents and research papers investigating diagnosis and treatment strategies for breast cancer using novel technologies have been surveyed for the past 15 years. Various nanocarriers have been introduced to improve the therapeutic efficacy of anticancer drugs, including liposomes, polymeric micelles, quantum dots, nanoparticles, and dendrimers. This review provides an overview of breast cancer, conventional therapy, novel technologies in the management of breast cancer, and rational approaches for targeting breast cancer.

There are several different types of breast cancer, including:

- Infiltrating (invasive) ductal carcinoma. Starting in your milk ducts of your breast, this cancer breaks through the wall of your duct and spreads to surrounding breast tissue. Making up about 80% of all cases, this is the most common type of breast cancer.
- Ductal carcinoma in situ. Also called Stage 0 breast cancer, ductal carcinoma in situ is considered by some to be precancerous because the cells haven't spread beyond your milk ducts. This condition is very treatable. However, prompt care is necessary to prevent the cancer from becoming invasive and spreading to other tissues.

- Infiltrating (invasive) lobular carcinoma. This cancer forms in the lobules of your breast (where breast milk production takes place) and has spread to surrounding breast tissue. It accounts for 10% to 15% of breast cancers.
- Lobular carcinoma in situ is a precancerous condition in which there are abnormal cells in the lobules of your breast. It isn't a true cancer, but this marker can indicate the potential for breast cancer later on. So, it's important for women with lobular carcinoma in situ to have regular clinical breast exams and mammograms.
- Triple negative breast cancer (TNBC). Making up about 15% of all cases, triple negative breast cancer is one of the most challenging breast cancers to treat. It's called triple negative because it doesn't have three of the markers associated with other types of breast cancer. This makes prognosis and treatment difficult.
- Inflammatory breast cancer. Rare and aggressive, this type of cancer resembles an infection. People with inflammatory breast cancer usually notice redness, swelling, pitting and dimpling of their breast skin. It's caused by obstructive cancer cells in their skin's lymph vessels.
- Paget's disease of the breast. This cancer affects the skin of your nipple and areola (the skin around your nipple).

Breast cancer is one of a few cancers for which an effective screening test, mammography, is available. MRI (magnetic resonance imaging) and ultrasound are also used to detect breast cancer, but not as routine screening tools for people with average risk. Ongoing studies are looking at ways to enhance current breast cancer screening options. Technological advances in imaging are creating new opportunities for improvements in both screening and early detection. One technology advance is 3-D mammography, also called breast tomosynthesis. This procedure takes images from different angles around the breast and builds them into a 3-D-like image. Although this technology is increasingly available in the clinic, it isn't known whether it is better than standard 2-D mammography, for detecting cancer at a less advanced stage.

NCI is funding a large-scale randomized breast screening trial, the Tomosynthesis Mammographic Imaging Screening Trial (TMIST), to compare the number of advanced cancers detected in women screened for 5 years with 3-D mammography with the number detected in women screened with 2-D mammography.

In 2020, there were 2.3 million women diagnosed with breast cancer and 685 000 deaths globally. As of the end of 2020, there were 7.8 million women alive who were diagnosed with breast cancer in the past 5 years, making it the world's most prevalent cancer. There are more lost disability-adjusted life years (DALYs) by women to breast cancer globally than any other type of cancer. Breast cancer occurs in every country of the world in women at any age after puberty but with increasing rates in later life.

Breast cancer mortality changed little from the 1930s through to the 1970s. Improvements in survival began in the 1980s in countries with early detection programmes combined with different modes of treatment to eradicate invasive disease. Breast cancer is not a transmissible or infectious disease. Unlike some cancers that have infection-related causes, such as human papillomavirus (HPV) infection and cervical cancer, there are no known viral or bacterial infections linked to the development of breast cancer.

Approximately half of breast cancers develop in women who have no identifiable breast cancer risk factor other than gender (female) and age (over 40 years). Certain factors increase the risk of breast cancer including increasing age, obesity, harmful use of alcohol, family history of breast cancer,

history of radiation exposure, reproductive history (such as age that menstrual periods began and age at first pregnancy), tobacco use and postmenopausal hormone therapy.

Behavioural choices and related interventions that reduce the risk of breast cancer include:

- prolonged breastfeeding;
- regular physical activity;
- weight control;
- avoidance of harmful use of alcohol;
- avoidance of exposure to tobacco smoke;
- avoidance of prolonged use of hormones; and
- avoidance of excessive radiation exposure.

Unfortunately, even if all of the potentially modifiable risk factors could be controlled, this would only reduce the risk of developing breast cancer by at most 30%. Female gender is the strongest breast cancer risk factor. Approximately 0.5-1% of breast cancers occur in men. The treatment of breast cancer in men follows the same principles of management as for women. Family history of breast cancer increases the risk of breast cancer, but the majority of women diagnosed with breast cancer do not have a known family history of the disease. Lack of a known family history does not necessarily mean that a woman is at reduced risk.

Certain inherited "high penetrance" gene mutations greatly increase breast cancer risk, the most dominant being mutations in the genes BRCA1, BRCA2 and PALB-2. Women found to have mutations in these major genes could consider risk reduction strategies such as surgical removal of both breasts. Consideration of such a highly invasive approach only concerns a very limited number of women, should be carefully evaluated considering all alternatives and should not be rushed.

Breast cancer most commonly presents as a painless lump or thickening in the breast. It is important that women finding an abnormal lump in the breast consult a health practitioner without a delay of more than 1-2 months even when there is no pain associated with it. Seeking medical attention at the first sign of a potential symptom allows for more successful treatment.

Generally, symptoms of breast cancer include:

- a breast lump or thickening;
- alteration in size, shape or appearance of a breast;
- dimpling, redness, pitting or other alteration in the skin;
- change in nipple appearance or alteration in the skin surrounding the nipple (areola); and/or
- abnormal nipple discharge.

There are many reasons for lumps to develop in the breast, most of which are not cancer. As many as 90% of breast masses are not cancerous. Non-cancerous breast abnormalities include benign masses like fibroadenomas and cysts as well as infections. Breast cancer can present in a wide variety of ways, which is why a complete medical examination is important. Women with persistent abnormalities (generally lasting more than one month) should undergo tests including imaging of the breast and in some cases tissue sampling (biopsy) to determine if a mass is malignant (cancerous) or benign.

Advanced cancers can erode through the skin to cause open sores (ulceration) but are not necessarily painful. Women with breast wounds that do not heal should have a biopsy performed. Breast cancers

may spread to other areas of the body and trigger other symptoms. Often, the most common first detectable site of spread is to the lymph nodes under the arm although it is possible to have cancer-bearing lymph nodes that cannot be felt. Over time, cancerous cells may spread to other organs including the lungs, liver, brain and bones. Once they reach these sites, new cancer-related symptoms such as bone pain or headaches may appear.

Breast cancer treatment can be highly effective, achieving survival probabilities of 90% or higher, particularly when the disease is identified early. Treatment generally consists of surgery and radiation therapy for control of the disease in the breast, lymph nodes and surrounding areas (locoregional control) and systemic therapy (anti-cancer medicines given by mouth or intravenously) to treat and/or reduce the risk of the cancer spreading (metastasis). Anti-cancer medicines include endocrine (hormone) therapy, chemotherapy and in some cases targeted biologic therapy (antibodies).

In the past, all breast cancers were treated surgically by mastectomy (complete removal of the breast). When cancers are large, mastectomy may still be required. Today, the majority of breast cancers can be treated with a smaller procedure called a “lumpectomy” or partial mastectomy, in which only the tumor is removed from the breast. In these cases, radiation therapy to the breast is generally required to minimize the chances of recurrence in the breast.

Lymph nodes are removed at the time of cancer surgery for invasive cancers. Complete removal of the lymph node bed under the arm (complete axillary dissection) in the past was thought to be necessary to prevent the spread of cancer. A smaller lymph node procedures called “sentinel node biopsy” is now preferred as it has fewer complications. It uses dye and/or a radioactive tracer to find the first few lymph nodes to which cancer could spread from the breast.

Medical treatments for breast cancers, which may be given before (“neoadjuvant”) or after (“adjuvant”) surgery, is based on the biological subtyping of the cancers. Cancer that express the estrogen receptor (ER) and/or progesterone receptor (PR) are likely to respond to endocrine (hormone) therapies such as tamoxifen or aromatase inhibitors. These medicines are taken orally for 5-10 years, and reduce the chance of recurrence of these “hormone-positive” cancers by nearly half. Endocrine therapies can cause symptoms of menopause but are generally well tolerated.

Cancers that do not express ER or PR are “hormone receptor negative” and need to be treated with chemotherapy unless the cancer is very small. The chemotherapy regimens available today are very effective in reducing the chances of cancer spread or recurrence and are generally given as outpatient therapy. Chemotherapy for breast cancer generally does not require hospital admission in the absence of complications.

Breast cancers may independently overexpress a molecule called the HER-2/neu oncogene. These “HER-2 positive” cancers are amenable to treatment with targeted biological agents such as trastuzumab. These biological agents are very effective but also very expensive, because they are antibodies rather than chemicals. When targeted biological therapies are given, they are combined with chemotherapy to make them effective at killing cancer cells.

Radiotherapy also plays a very important role in treating breast cancer. With early stage breast cancers, radiation can prevent a woman having to undergo a mastectomy. With later stage cancers, radiotherapy can reduce cancer recurrence risk even when a mastectomy has been performed. For advanced stage of breast cancer, in some circumstances, radiation therapy may reduce the likelihood of dying of the disease.

The effectiveness of breast cancer therapies depends on the full course of treatment. Partial treatment is less likely to lead to a positive outcome. According to the statistics of the World Health Organization, breasts in the world breast cancer is the second leading cause of women's death after

lung cancer among cancer diseases, it ranks 1st. Every year in the world 800,000 -1,000,000 new the disease state is recorded. Scientists say that breast cancer the risk is especially high in the age range of 50-60 years and is 70%. Every 121 woman suffers from this disease. This disease excludes men not passed The probability of meeting in men is 0.5-1%, and they have a disease 15% of the output is genetic predisposition.

Breast cancer is the most common type of cancer in the UK. Most women diagnosed with breast cancer are over the age of 50, but younger women can also get breast cancer. About 1 in 8 women are diagnosed with breast cancer during their lifetime. There's a good chance of recovery if it's detected at an early stage. For this reason, it's vital that women check their breasts regularly for any changes and always have any changes examined by a GP.

The recent ten to twenty years have seen a substantial progress in the diagnosis and treatment of breast cancer. A rapid development of various curative options has led to the improvement of treatment outcomes, while paying more and more attention to the aspects of quality of life and cosmetic effect. In our publication, we wish to outline certain trends in the development of modern treatment of breast cancer. Among topics discussed are new forms of molecular diagnostics, new approach to the idea of sentinel node biopsy, as well as new techniques for delivery of medical procedures, the increasing use of nomograms, progress in the techniques of breast conservative treatment, modern approach to occult breast lesions, the increasing use of neoadjuvant treatment and intraoperative radiotherapy.

The objective of the WHO Global Breast Cancer Initiative (GBCI) is to reduce global breast cancer mortality by 2.5% per year, thereby averting 2.5 million breast cancer deaths globally between 2020 and 2040. Reducing global breast cancer mortality by 2.5% per year would avert 25% of breast cancer deaths by 2030 and 40% by 2040 among women under 70 years of age. The three pillars toward achieving these objectives are: health promotion for early detection; timely diagnosis; and comprehensive breast cancer management.

By providing public health education to improve awareness among women of the signs and symptoms of breast cancer and, together with their families, understand the importance of early detection and treatment, more women would consult medical practitioners when breast cancer is first suspected, and before any cancer present is advanced. This is possible even in the absence of mammographic screening that is impractical in many countries at the present time.

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