Exploration of the Classification and Risk Factors of Female Breast Cancer

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Abstract Female breast cancer is one of the most common malignant tumors affecting women globally, and it has a significant impact on women's health. According to data from the World Health Organization, the incidence and mortality rates of female breast cancer are both on the rise worldwide. Therefore, it is crucial for women to understand the definition, classification, risk factors, prevention, and treatment measures for female breast cancer. Women should maintain a healthy lifestyle, undergo regular breast examinations, and seek medical attention as early as possible if any abnormalities are detected. Breast cancer treatment should be based on precise and comprehensive principles, using a combination of various treatment methods tailored to the tumor's biological behavior and the patient's physical condition, to ensure improved efficacy and better quality of life for women. This review focuses on breast cancer, discussing its definition and classification, prevention and risk factors, as well as future prospects for female breast cancer, with the aim of raising public awareness of breast cancer, promoting early diagnosis and treatment, and protecting women's health.

Keywords Female breast cancer; Tumor treatment; Early diagnosis; Survival rate

Breast cancer is the most significant malignant tumor that seriously threatens women's health. Male breast cancer is a rare malignant tumor and accounts for approximately 1% of all breast cancers. In 2018, there were approximately 2.09 million new cases of breast cancer diagnosed in women globally, and approximately 630 000 deaths resulted from the disease. Breast cancer incidence rates vary in different regions worldwide, but all rates show an increasing trend. In China, there were approximately 304 000 new cases of breast cancer in women in 2015, resulting in over 70 000 deaths. Approximately 3~10% of newly diagnosed breast cancer patients have distant metastases at diagnosis. Early-stage patients have a 30~40% chance of developing advanced-stage breast cancer, and the 5-year survival rate for advanced-stage breast cancer is only 20%. Late-stage breast cancer patients face pressure from various aspects, such as the disease itself, psychological and economic factors.

Female breast cancer is a common malignant tumor, and every year, a large number of women are diagnosed with this disease. The incidence of breast cancer gradually increases with age and has shown an increasing trend in recent years, becoming one of the important health issues for women. The occurrence of breast cancer is related to various factors, such as estrogen, genetic factors, and age. Estrogen is an important promoting factor for breast cancer, so women should pay attention to controlling their estrogen intake and avoid long-term use of hormone replacement therapy.

Over the past half-century, significant progress has been made in the basic and clinical research of breast cancer. The development of human genomics, bioinformatics, proteomics, and molecular biology has provided weapons and directions for the basic and clinical research of breast cancer. The progress of translational medicine has also provided theoretical and practical bases for clinical treatment, with a large number of evidence-based medical evidence applied to clinical practice, improving the efficacy of clinical treatment. Breast cancer often has no symptoms in its early stages, so early diagnosis and treatment are key to improving patients' cure and survival rates. Early detection of breast cancer can be achieved through breast self-examination, regular physical examinations, and breast X-ray photography. Once suspected breast cancer is found, it is necessary to undergo

cytological examination, puncture biopsy, and histological examination in a hospital to determine the diagnosis and treatment plan. This review provides more information and support related to female breast cancer by introducing the definition and classification, the prevention and risk factors of female breast cancer, as well as the future prospects for breast cancer. It aims to help women better understand breast cancer and prevent its occurrence.

1 Definition of Female Breast Cancer

Female breast cancer is a malignant tumor that occurs in malignant cells in the breast tissue of women. The breast is an important organ in the female body, which includes the breast, nipple, and areola, and its main function is to secrete and transport milk. Female breast cancer is a malignant tumor that occurs in the breast tissue and is caused by malignant cells. The causes and pathophysiological mechanisms of breast cancer are complex, involving various genetic, environmental, and lifestyle factors. Some factors such as structural abnormalities of the breast, breast hyperplasia, and breast cystic hyperplasia may increase the risk of breast cancer (Li et al., 2021).

Breast cancer is due to abnormal cell proliferation in the breast, leading to the formation of tumors. These tumor cells can invade surrounding tissues and organs, and even metastasize to other parts of the body, causing serious harm to the body. Breast cancer is one of the most common cancers in women and one of the highest causes of cancer-related deaths in women. It can occur in women of any age, but the risk of suffering from breast cancer increases with age. In addition to women, men can also develop breast cancer, but the incidence is very low. The occurrence of breast cancer is complex, and its pathophysiological mechanisms are not yet fully understood. However, some factors are believed to be important in influencing the occurrence of breast cancer, such as age, genetic factors, hormone levels, and lifestyle. In terms of the pathophysiological mechanisms of breast cancer, studies have shown that breast cancer is related to gene mutations, hormone receptors, cell proliferation, and apoptosis. The early symptoms of breast cancer include breast lumps, nipple discharge, skin changes and changes in breast shape, but there may be no obvious symptoms in the early stages. Therefore, regular breast self-examination and regular breast exams and breast X-ray photography can help detect breast cancer early and improve the cure rate (Figure 1).
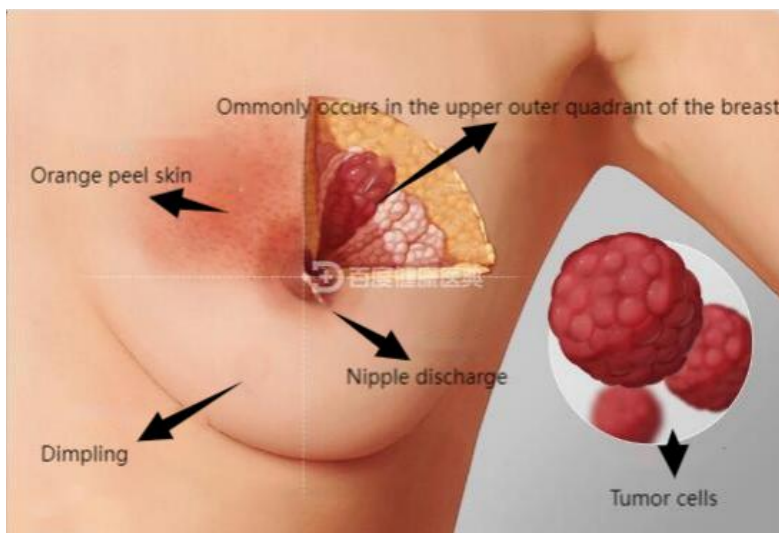

Figure 1 The site of breast cancer lesion

2 Classification of Female Breast Cancer

2.1 Classification by pathological type

The degree of differentiation of breast cancer is closely related to prognosis. Pathologically, histological grading is mainly evaluated from three aspects: the degree of glandular formation, the pleomorphism of cell nuclei, and the mitotic count.

Glandular formation: 1) 1 point for those with most obvious glandular ducts; 2) 2 points for moderately differentiated glandular ducts; 3) 3 points for cells that grow in solid patches or cords.

Pleomorphism of cell nuclei: 1) 1 point for consistency in nuclear size, shape, and chromatin; 2) 2 points for moderately irregular nuclei; 3) 3 points for those with obvious pleomorphism in the nucleus.

Mitotic count: 1) 1 point for 1/10 HPF; 2) 2 points for 2-3/10 HPF; 3) 3 points for >3/10 HPF.

The scores of the three items are added together, and a point of 3-5 is grade I (well-differentiated); 6-7 is grade II (moderately differentiated); and 8-9 is grade III (poorly differentiated).

Breast cancer can be classified into many different pathological types, among which the most common types are ductal carcinoma and lobular carcinoma. Ductal carcinoma is a malignant tumor originating from the breast duct and accounts for more than 80% of all breast cancers. Lobular carcinoma originates from the breast lobules. In addition, there are other rare pathological types, such as papilloma and papillary carcinoma (Figure 2).
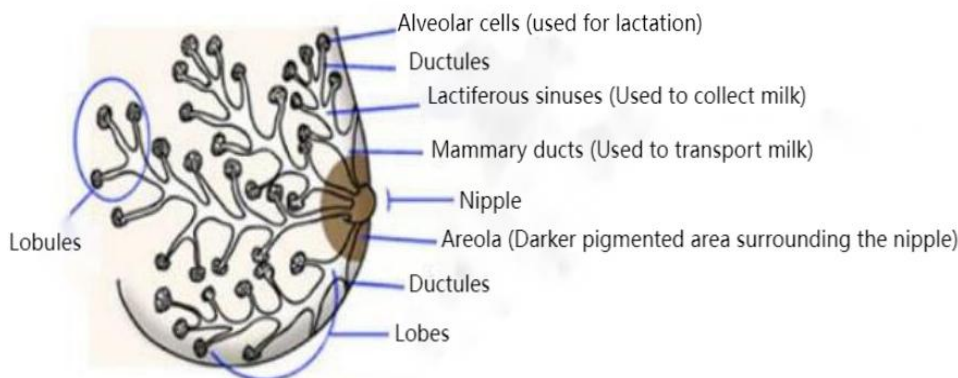
Figure 2 Breast anatomy diagram

2.2 Classification by molecular subtype
Breast cancer can be classified according to molecular characteristics, which can help doctors better judge the prognosis and treatment options of patients. According to molecular subtypes, breast cancer can be divided into four types: hormone receptor-positive/HER2-negative, hormone receptor-negative/HER2-positive, hormone receptor-negative/HER2-negative, and triple-negative. Among them, hormone receptor-positive/HER2-negative is the most common type.

Molecular subtyping of breast cancer is closely related to the risk of recurrence and metastasis, and the prognosis and treatment decisions for different molecular subtypes of breast cancer are also different. Based on the results of pathological immunohistochemistry, breast cancer can be divided into four subtypes:

Luminal A: ER-positive, PR-positive (>20%), HER2-negative, Ki-67<30%. This subtype of breast cancer has a good prognosis, with a low recurrence rate and sensitivity to endocrine therapy, which is the main treatment option.

Luminal B: 1) ER-positive, PR-negative or low expression (<20%), HER2-negative, Ki-67 >30%. The prognosis of this subtype is also good, second only to Luminal A, and the treatment is mainly chemotherapy combined with endocrine therapy. 2) ER-positive, HER2-positive, with no restrictions on PR and Ki-67 indicators. Patients with this subtype are sensitive to both endocrine and targeted therapies, and comprehensive treatment with chemotherapy, targeted therapy, and endocrine therapy is needed.

HER2 overexpression: ER-negative, PR-negative, HER2-positive. Patients with this subtype are mainly treated with chemotherapy and targeted therapy.

Triple-negative: ER-negative, PR-negative, HER2-negative. This subtype accounts for about 20% of all breast cancers, has the highest risk of recurrence, and has a poor prognosis. Treatment options are limited, mainly consisting of chemotherapy. In recent years, immunotherapy has shown some efficacy in triple-negative breast cancer.

2.3 Classification by stage of disease
The stage of breast cancer is evaluated based on factors such as the size of the tumor, lymph node metastasis, and distant metastasis. According to the TNM staging system, breast cancer can be divided into stage 0, stage I, stage II, stage III, and stage IV. Stage 0 is the earliest stage of breast cancer, while stage IV is the latest stage of breast cancer (Figure 3).

Figure 3 Breast changes due to breast cancer

The outcome of breast cancer cannot be summarized by a single sentence of "whether it is serious", and the stage of breast cancer alone cannot fully represent the prognosis of breast cancer. Currently, breast cancer is a type of malignant tumor with relatively comprehensive treatment options and an overall good prognosis. The treatment of breast cancer is gradually moving towards precision medicine, often requiring comprehensive evaluation based on the patient's staging, molecular subtype, and related high-risk factors to make reasonable treatment decisions. Standardized diagnosis and treatment, precise individualized treatment are the cornerstone of improving the prognosis of breast cancer patients.

3 Risk Factors of Female Breast Cancer
The causes and pathophysiological mechanisms of breast cancer are very complex and not fully understood at present. However, some factors are considered important in affecting the development of breast cancer, such as age, genetic factors, hormone levels, lifestyle, etc. Pathologically, breast cancer is related to gene mutations, hormone receptors, cell proliferation, and apoptosis. As women age, the incidence of breast cancer also increases, and breast cancer mainly occurs in women over 40 years old. This may be related to the continuous development, growth, and differentiation of breast tissue during pregnancy and lactation. In addition, as age increases, the body's immune function gradually declines, which may also increase the risk of breast cancer.

Breast cancer has a certain genetic predisposition, and some gene mutations may lead to the development of breast cancer. For example, BRCA1 and BRCA2 gene mutations are associated with the development of breast cancer, and women carrying these gene mutations have a much higher risk of breast cancer than normal women. Hormones are also an important factor in the development of breast cancer, and changes in hormone levels may

lead to the development of breast cancer. For example, estrogen is a key hormone for the proliferation and differentiation of breast cancer cells, and high levels of estrogen may increase the risk of breast cancer.

Lifestyle is also an important factor affecting the development of breast cancer. Behaviors such as high-fat, high-calorie diet, lack of exercise, obesity, alcohol consumption, and smoking may increase the risk of breast cancer. Pathologically, the development of breast cancer is related to gene mutations, hormone receptors, cell proliferation, and apoptosis. Breast cancer may be related to gene mutations. For example, BRCA1 and BRCA2 gene mutations may lead to the development of breast cancer. In addition, mutations in other genes may also be related to the development of breast cancer. Breast cancer cells usually have estrogen and/or progesterone receptors. These receptors can bind to hormones in the body to promote the growth and proliferation of breast cancer cells. Cell proliferation is a key process in the development of breast cancer. During the process of cell proliferation, some genes and proteins are regulated and controlled, such as proliferation-related proteins, tumor suppressor genes, and transcription factors. Apoptosis is part of the body's self-regulatory mechanism, which can help the body clear abnormal cells. However, breast cancer cells usually cannot undergo normal apoptosis, which may be related to abnormal expression of some genes and proteins, such as p53, Bax, Bcl-2, etc. In summary, the causes and pathological mechanisms of breast cancer are very complex and not fully understood at present. However, understanding these factors and mechanisms can help people better prevent and treat breast cancer, and improve the cure rate of breast cancer (Mutebi et al., 2020) (Figure 4).
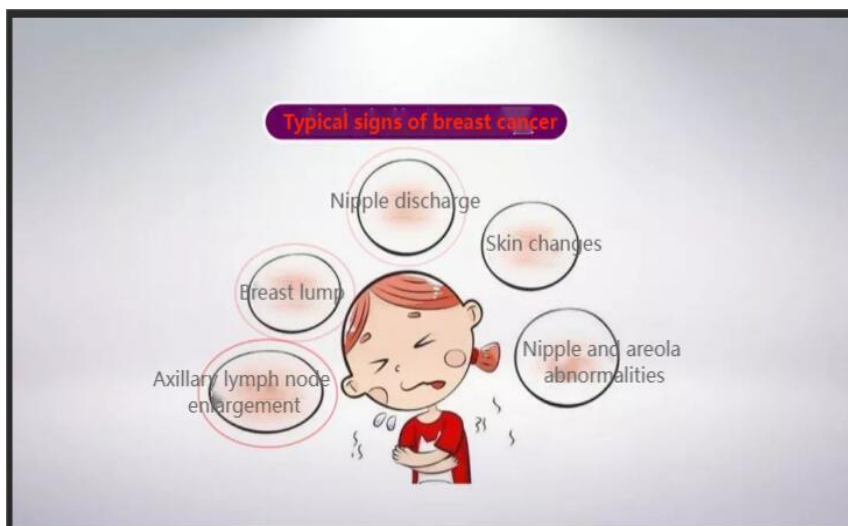

Figure 4 Typical signs of breast cancer

4 Prevention and Treatment of Female Breast Cancer

Breast cancer screening refers to the use of effective, convenient, and cost-effective breast examination measures to identify and detect pre-cancerous lesions and early invasive cancer patients with progression potential in asymptomatic women, in order to achieve early detection, diagnosis, and treatment, with the ultimate goal of reducing the mortality rate of breast cancer in the population. Screening is divided into population screening and opportunistic screening. Population screening refers to the organized and planned screening of eligible women in a jurisdiction or institution, while opportunistic screening refers to the provision of breast cancer screening services by medical institutions in combination with routine outpatient work.

Regular breast self-examination and professional examination, maintaining a healthy lifestyle, and preventive measures for high-risk populations are important health issues for preventing breast cancer in women. The following are some preventive measures: Regular breast self-examination and professional examination: Breast self-examination is a simple and quick method that women can use to check for abnormalities such as nodules and lumps by touching their breasts. Professional examinations include breast X-ray examinations, breast ultrasound examinations, magnetic resonance imaging examinations, etc., which can detect abnormalities early and improve

the success rate of treatment. Maintaining a healthy lifestyle: Maintaining a healthy lifestyle can reduce the risk of developing breast cancer, including: healthy diet: eat less high-fat, high-sugar, and high-salt foods, and eat more vegetables, fruits, and whole grains. Control weight: Obesity is one of the risk factors for breast cancer, and maintaining a healthy weight can reduce the risk of developing the disease. Adhering to moderate exercise: Moderate aerobic exercise can reduce the risk of breast cancer, such as brisk walking, running, swimming, cycling, etc.

The incidence of breast cancer in Chinese women is relatively low globally, but it is increasing year by year. With the significant changes in women's lifestyles as a result of social and economic development, breast cancer-related risk factors are widespread. It is expected that the incidence and mortality rates of breast cancer in China will continue to rise for a long time in the future, especially in rural areas, where the original base is low, making the rate of increase in incidence and mortality significantly higher than that in urban areas. The lack of diagnosis and screening opportunities in rural areas will widen the gap in breast cancer survival rates between urban and rural areas, and the upward trend in mortality rates will be difficult to curb. The foundation of breast cancer research and prevention in China should be established on a sound disease monitoring and registration system. If possible, more characteristic registration content should be added for breast cancer, such as diagnostic staging, molecular subtyping, and histopathology; regions conducting breast cancer screening should establish a screening registration system to collect breast cancer-related risk factors for women participating in the screening. This can not only assess the individual's breast cancer risk, but also better understand the prevalence of breast cancer risk factors in the population, providing a basis for targeted prevention and control measures. Breast cancer can be detected, diagnosed, and treated early through population screening, significantly improving survival (Zheng et al., 2013).

5 Summary and Outlook

Female breast cancer is a serious disease that affects women's health. However, measures such as regular breast self-examination and professional medical examination, maintaining a healthy lifestyle, and taking preventive measures for high-risk populations can effectively reduce the risk of developing breast cancer. If breast cancer is diagnosed, comprehensive treatment should be carried out as early as possible to improve the success rate of treatment. Therefore, we should attach great importance to the prevention and treatment of female breast cancer and advocate that women pay attention to self-examination and prevention. Individualized treatment for breast cancer in China must also consider the patient's economic status, the medical facilities and technological level of medical units, and formulate practical and feasible individualized plans to ensure treatment compliance and completeness (Shah et al., 2023).

Innovative drugs for breast cancer are constantly being developed, and clinical trials are changing rapidly. Interdisciplinary and multi-omics data fusion has brought new insights to breast cancer research, and also brings dual benefits of efficacy and quality of life to breast cancer patients. With the rapid development of medicine, the continuous enrichment of treatment methods, the continuous updating of treatment concepts, and the continuous improvement of treatment effects, our clinical practice is changing to a large extent. Early breast cancer patients can not only live longer and pursue a cure, but also under the guidance of the concept of classification treatment and precision diagnosis and treatment, they are more likely to receive the smallest side effects, the best efficacy, the most comprehensive care (such as breast preservation, cosmetic reconstruction, genetic counseling, psychological counseling, fertility counseling, etc.), and ultimately achieve better living and physical and mental healing.

In addition, attention to late-stage breast cancer is increasing year by year in academia and clinical practice. Currently, China has launched the selection and construction of the first batch of 200 standardized breast cancer diagnosisand treatment centers, which will provide standardized diagnosis and treatment services for patients with breast cancer. In the future, we need to continue to improve the diagnosis and treatment of breast cancer, strengthen the monitoring and registration of breast cancer, promote the popularization of breast cancer

knowledge, and improve the awareness of breast cancer prevention and screening among women, especially in rural areas. With the joint efforts of medical workers, researchers, and the whole society, we can effectively prevent and control breast cancer and improve the quality of life of patients.

Authors' contributions

WW was responsible for the relevant literature and material researching, organizing, and the writing for the first draft of this review; JLF participated in discussions and paper revisions; JLF was the person in charge of this review, guiding the writing and revision of the paper. Both authors read and approved the final manuscript.

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