



RECENT ADVANCES IN BREAST CANCER DIAGNOSIS AND TREATMENT

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Abstract: Breast cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide. Significant progress has been achieved in recent years in the early detection, diagnosis, and treatment of breast cancer through advances in imaging technologies, molecular biology, targeted therapies, immunotherapy, and personalized medicine. Early diagnosis combined with appropriate therapeutic strategies has substantially improved patient survival and quality of life. This review aims to summarize recent developments in breast cancer diagnosis and treatment, highlighting modern diagnostic techniques, innovative therapeutic approaches, and future perspectives for improving clinical outcomes.

Keywords: Breast cancer, early diagnosis, mammography, targeted therapy, immunotherapy, personalized medicine, molecular diagnostics, oncology, cancer screening, treatment.

Introduction

Breast cancer is the most frequently diagnosed cancer among women and represents a major global public health challenge. According to recent global cancer statistics, millions of new breast cancer cases are diagnosed each year, making it one of the most common malignancies worldwide. Although the incidence of breast cancer continues to increase in many countries, advances in medical science have significantly reduced mortality through earlier detection and more effective treatment strategies. Early diagnosis plays a crucial role in improving patient prognosis. Modern screening methods, including digital mammography, breast ultrasound, magnetic resonance imaging (MRI), and genetic testing, enable clinicians to identify malignant lesions at earlier stages when treatment is most effective. In addition, biomarkers and molecular profiling have enhanced diagnostic accuracy and facilitated individualized treatment planning. Treatment strategies for breast cancer have evolved considerably over the past decade. Alongside conventional approaches such as surgery, chemotherapy, and radiotherapy, targeted therapy, hormone therapy, immunotherapy, and precision medicine have become integral components of patient management. These innovative treatments improve therapeutic efficacy while minimizing adverse effects and enhancing patients' quality of life. The purpose of this review is to examine recent advances in



breast cancer diagnosis and treatment, discuss emerging technologies, and evaluate their impact on clinical practice and patient outcomes.

Materials and Methods

This review article was prepared through a comprehensive analysis of recent scientific literature on breast cancer diagnosis and treatment. Peer-reviewed articles published between 2020 and 2026 were collected from internationally recognized databases, including PubMed, Scopus, Web of Science, and Google Scholar. The literature search was performed using the keywords "breast cancer," "early diagnosis," "mammography," "targeted therapy," "immunotherapy," "precision medicine," and "breast cancer treatment." Articles written in English with full-text availability and focusing on recent advances in breast cancer diagnosis or treatment were included. Studies unrelated to the research objective, duplicate publications, and articles with insufficient methodological quality were excluded. The selected publications were critically evaluated and synthesized to identify current diagnostic methods, treatment strategies, and future research directions.

Results

The reviewed literature demonstrates remarkable progress in breast cancer diagnosis and treatment over recent years. Advances in digital mammography, breast ultrasound, magnetic resonance imaging (MRI), and molecular diagnostic techniques have significantly improved the early detection of breast cancer. The incorporation of genetic testing, particularly BRCA1 and BRCA2 mutation analysis, has enabled more accurate risk assessment and individualized screening strategies. Therapeutic innovations have also transformed clinical management. Targeted therapies, such as HER2-directed agents and CDK4/6 inhibitors, have shown substantial improvements in progression-free and overall survival among selected patient populations. Immunotherapy has emerged as a promising treatment option, especially for patients with triple-negative breast cancer. In addition, precision medicine approaches based on molecular profiling have facilitated personalized treatment selection, resulting in greater therapeutic effectiveness and reduced treatment-related toxicity. Overall, the findings indicate that multidisciplinary care integrating advanced diagnostic technologies with personalized therapeutic approaches leads to improved clinical outcomes and better quality of life for patients with breast cancer.

Discussion

Recent advances in breast cancer research have significantly changed the approach to diagnosis and treatment. Early detection remains the most effective strategy for reducing breast cancer mortality, as patients diagnosed at an early stage generally have higher survival rates and better treatment



outcomes. The widespread use of advanced imaging techniques and molecular diagnostics has enhanced diagnostic accuracy and supported earlier intervention. The development of targeted therapy and immunotherapy represents a major milestone in modern oncology. Unlike conventional chemotherapy, these treatments selectively target cancer cells or enhance the body's immune response, thereby improving efficacy while minimizing damage to healthy tissues. Precision medicine further supports individualized treatment by considering each patient's genetic and molecular characteristics. Despite these achievements, several challenges remain, including limited access to advanced diagnostic technologies in low- and middle-income countries, the high cost of novel therapies, and the development of treatment resistance in some patients. Future research should focus on discovering new biomarkers, improving early detection methods, expanding access to innovative therapies, and developing more effective personalized treatment strategies. In conclusion, continued scientific research and technological innovation are expected to further improve breast cancer diagnosis, treatment, and patient survival in the coming years.

Conclusion

Breast cancer continues to be one of the most significant global health challenges despite considerable progress in diagnosis and treatment. Recent advances in imaging technologies, molecular diagnostics, targeted therapy, immunotherapy, and precision medicine have substantially improved early detection, treatment effectiveness, and patient survival. Early diagnosis remains the cornerstone of successful breast cancer management, emphasizing the importance of regular screening and increased public awareness. Personalized treatment strategies based on the genetic and molecular characteristics of tumors have revolutionized clinical practice by improving therapeutic outcomes while reducing adverse effects. However, challenges such as unequal access to advanced healthcare services, high treatment costs, and therapeutic resistance continue to affect patient care worldwide. Future research should focus on identifying novel biomarkers, developing more effective targeted therapies, integrating artificial intelligence into diagnostic systems, and expanding access to modern treatment options. Continued international collaboration and investment in breast cancer research will contribute to reducing mortality and improving the quality of life of patients affected by this disease.

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