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Progress and future directions in breast cancer research and treatment

Regina Appiah-Opong

[1] Department of Clinical Pathology, Noguchi Memorial Institute for Medical Research, College of Health Sciences, University of Ghana, Accra, Ghana

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Breast cancer remains a major prevalent and challenging disease worldwide including in the field of oncology [1]. Although significant progress has been made in diagnosis and treatment, the disease continues to pose substantial challenges in research and clinical fields. This commentary aims to highlight recent breakthroughs, current challenges, and future directions in breast cancer research and treatment.

The advent of genomic and molecular profiling has revolutionized our understanding of breast cancer [2]. The next-generation sequencing technique, for instance, allows for the detailed characterization of tumour genomes, leading to the identification of specific mutations and alterations that drive cancer progression. Such insights have made it possible to develop target therapies such as HER2 and PARP inhibitors, exhibiting significantly improved outcomes for some patients. Immunotherapy, particularly immune checkpoint inhibitors has shown promise in breast cancer treatment, especially triple-negative breast cancer [3]. The latter has traditionally been difficult to treat due to the absence of hormonal receptors and HER2 expression. Thus, introducing pembrolizumab and atezolizumab, both immune checkpoint inhibitors, has opened new avenues for treatment. Current research in this area is focused on identifying biomarkers and predicting responses to immunotherapy, thus, optimizing patient selection and efficacy of therapies. Also, Precision medicine is emerging as significant in breast cancer care. This treatment is based on the individual characteristics of patients and their

tumours [4]. Multigene assays, including Oncotype DX and MammaPrint, may be used to assess the risk of recurrence and guide decisions about adjuvant therapy. Overtreatment is avoided when these tests are carried out and the side effects of unnecessary chemotherapy are reduced. In addition, Advances in imaging and surgical approaches have led to the adoption of minimally invasive procedures for breast cancer diagnosis and treatment [5]. Sentinel lymph node biopsy and oncoplastic surgery are some techniques that not only improve cosmetic outcomes but also reduce surgical morbidity. Moreover, techniques such as Magnetic Resonance Imaging and ultrasound have enhanced the accuracy of tumor localization and biopsy.

One of the commentaries in this issue of the Journal has stated that cancer is among non-communicable diseases (NCDs) of growing concern in Ghana [6]. According to the authors, the major underlying causes of the increasing prevalence of NCDs in Ghana are obesity and unhealthy diet. The continuing increase in NCD prevalence is anticipated, therefore, Ghana is at risk of overtaking several high-income countries. This issue also contains an original research article on a study that aimed to profile serum lactate dehydrogenase in breast cancer patients as a chemotherapy response index [7]. The researchers reported that serum LDHA mRNA levels and total LDH activity in breast cancer patients were reduced after the third cycle of chemotherapy. The serum mRNA level decreased significantly compared to the enzyme activity. The change in the LDHA mRNA level ratio identified serum LDHA mRNA as a good candidate for predicting chemotherapy response in patients.

* *Corresponding author*
Email: rappiah-opong@noguchi.ug.edu.gh

Resistance to therapy, whether intrinsic or acquired, remains a significant challenge in cancer therapy [1]. Notwithstanding the efficacy of targeted therapies and chemotherapies, several patients develop resistance, leading to disease progression. Understanding the mechanisms underlying resistance and developing strategies to overcome it are crucial areas of current research. Disparities in breast cancer outcomes also persist across different populations [8]. Socioeconomic status, race, and geographic location appreciably influence access to care, therapeutic options, and survival rates. Addressing these disparities through improved access to screening, education, and treatment is necessary to ensure equitable care for all patients. Another challenge to breast cancer treatment is the psychosocial impact of breast cancer diagnosis and treatment. Some patients face significant emotional, psychological, and social challenges, which can affect their quality of life and treatment adherence. Thus, integrating psychosocial support into cancer care is necessary to address the holistic needs of patients and improve their overall well-being.

For future directions, early detection remains a goal for successful breast cancer treatment. Research into novel biomarkers and imaging techniques which is ongoing is important to improve the sensitivity and specificity of early detection methods. Additionally, liquid biopsies, which detect circulating tumour DNA (ctDNA) in the blood, are promising for early diagnosis, monitoring treatment response, and detecting minimal residual disease. A combination of different therapeutic modalities, for example, targeted therapy, immunotherapy, and hormone therapy, could enhance treatment efficacy and overcome resistance. Currently, some clinical trials on such combination therapies are ongoing. Personalized cancer vaccines, designed to elicit an immune response against tumor-specific antigens, are also an emerging area of research. The needs of breast cancer survivors must be addressed by developing survivorship care plans and integrating them into routine care. Although the fight against breast cancer has seen significant progress, several challenges remain. Continued research and innovation are essential to overcome resistance to therapies, reduce disparities, and improve the quality of life for patients. Through collaboration among researchers, clinicians, patients, and policymakers, we can drive further advancements and move closer to a future where breast cancer is effectively managed and cured.

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