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Editorial

New Developments in the Diagnosis and Management of Breast Cancer: From Precision to Patient-Centered Care

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1. Introduction

Breast cancer is the most frequently diagnosed cancer among women worldwide and remains a major cause of cancer-related deaths. GLOBOCAN 2022 estimated approximately 2.3 million new cases in women and 670,000 deaths. The burden is expected to increase, with particularly serious consequences in settings where screening, diagnostic services, and treatment are less accessible [1,2]. These figures describe more than a global health statistic. They point to the continuing need to improve not only what medicine can offer, but also who can reach it and whether it can be delivered in a timely and sustainable way.

The clinical landscape has changed substantially. Breast cancer is no longer approached as a single disease defined mainly by its anatomical stage. Histopathology, receptor status, molecular features, and response to therapy now inform increasingly individualized decisions [3]. Imaging has become more sophisticated [4], targeted agents and neoadjuvant regimens have altered treatment pathways [5], and genomic and computational approaches are creating new ways to estimate risk. For many patients, these developments have improved the prospect of effective treatment and prolonged survival.

Yet precision is not simply a matter of collecting more measurements. A test is useful when it helps clinicians and patients choose between meaningful options, as well as when that choice improves outcomes without imposing avoidable harm. In practice, uncertainty remains at several points: whether a suspicious lesion requires excision [6], how best to identify residual or recurrent disease, which patients can safely receive less treatment, and how to respond when a tumor adapts to therapy [7]. These questions are especially consequential because the same label of breast cancer can encompass very different biological behaviors and very different experiences of care.

This Special Issue, "New Developments in Diagnosis and Management of Breast Cancer," was assembled against that background. Its contributions do not resolve these questions, nor should a collection of studies be expected to do so. Their value lies in showing where evidence is accumulating, where findings remain preliminary, and what types of validation are needed before promising observations can change routine practice.

2. Recent Developments and the Evidence Gap

One defining development in breast oncology is the movement from broad treatment categories toward decisions informed by tumor biology and treatment response. In hormone-receptor-positive disease, endocrine therapy remains central, but resistance may emerge through multiple biological routes [7]. In HER2-positive disease, neoadjuvant targeted

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treatment has changed the significance of the response assessment: the amount and nature of residual disease can inform prognosis and subsequent management [5]. At the same time, the growing range of therapies makes treatment selection and sequencing more complex. A biomarker may be biologically plausible yet still fail to identify, with sufficient reliability, the patients who will benefit from a particular intervention.

Imaging and pathology are also becoming more closely connected. Mammography remains fundamental to screening, while digital methods and artificial-intelligence models are being tested as supports for lesion detection and classification [4]. The potential attraction is clear: improving sensitivity while reducing false-positive findings, especially in dense breasts. But accuracy estimates do not by themselves establish clinical value. The relevant questions include whether a model works across scanners and populations, whether it changes biopsy decisions, whether it misses clinically important cancers, and how its performance compares with the complete workflow in which clinicians would use it. A high-performing algorithm in a selected dataset is a beginning, not a substitute for prospective evaluation.

A parallel challenge arises in lesions of uncertain malignant potential. These findings occupy an uncomfortable space between clearly benign and clearly malignant disease. Excision can provide diagnostic certainty, but it also carries costs, anxiety, and procedural risk. Observation may spare some patients an operation, but it requires confidence that a lesion with meaningful upgrade risk will not be overlooked [6]. Risk estimates therefore need to be more than averages: they should be calibrated to the lesion, the patient, the sampling method, and the clinical setting.

Finally, outcome measurement is broadening, though not yet consistently. Survival and recurrence remain indispensable, but they do not capture the burden of treatment or the quality of life people experience during and after it [8]. Fatigue, functional limitations, distress, time in hospital, and disruption to family and working life are not secondary concerns simply because they are harder to measure. They can shape whether treatment is acceptable, whether it can be completed, and what a patient considers a good outcome. The central knowledge gap, then, is not a shortage of potentially useful technologies. It is a shortage of evidence connecting biological or technical promise to durable, patient-relevant benefits across different care settings.

3. Contributions of the Special Issue

The twelve contributions in this collection approach that gap from complementary directions. Rather than treating them as a catalog of separate findings, it is useful to consider the questions they collectively bring into view.

First, the imaging and biopsy studies illustrate both the promise of improved classification and the need to test it against decisions made in practice. A convolutional neural network applied to two-dimensional mammograms reported strong lesion-detection and classification performance, with particular attention to false positives in dense breasts [4]. A systematic review and meta-analysis examined AI-assisted mammography alongside conventional screening approaches, emphasizing the importance of external validation before such systems are used to guide biopsy or screening decisions [9]. A prospective correlation study of BI-RADS categories and histopathology found that BI-RADS 5 lesions were overwhelmingly malignant and that Ki-67 values tended to rise with higher imaging categories [10]. Together, these studies underscore that imaging categories become more clinically informative when they are interpreted alongside tissue and biological characteristics. They also leave open the practical question of how such combinations should be tested prospectively.

The analysis of 10,531 consecutive biopsies addresses a different but related uncertainty: the management of B3 lesions or lesions of uncertain malignant potential. The reported upgrade rates varied across atypical subgroups, supporting risk-sensitive rather than automatic decision-making [6]. The importance of this work is not that one threshold can be applied everywhere, but that management pathways should be based on a clearly described risk, with enough detail to identify which patients might reasonably avoid surgery and which require further assessment.

Second, the papers on clinical and pathological stratification show how established markers and newer scores can refine prognosis, while also reminding us that prognostic information must be connected to action. A twelve-year retrospective cohort study of more than 2000 women found better overall survival among hormone-receptor-positive than hormone-receptor-negative patients and reported that HER2 status further differentiated outcomes within receptor groups [3]. In patients with HER2-positive disease treated with neoadjuvant therapy, residual cancer burden was associated with survival, while the clinical–pathological CPS+EG score was associated with outcomes and tracked with higher pathological complete response [5]. A separate study of clinically node-negative luminal T1–T2 tumors examined progesterone-receptor level in relation to axillary metastasis and raised the possibility that selected patients could be considered for de-escalated axillary surgery [11]. These findings support more tailored assessment, but their retrospective or setting-specific character makes careful replication essential before they are used to narrow treatment.

Third, the contributions concerning therapeutic mechanisms and drug discovery point to the breadth of current attempts to address resistance. A review of endocrine therapy links treatment choices to tumor biology and discusses mechanisms that can reduce sensitivity to therapy [7]. Computational work combined transcriptomic data with drug-repositioning pipelines to identify candidates for further investigation [12]. Such approaches can help prioritize hypotheses, especially when the number of possible molecular targets is large. They cannot, however, establish therapeutic efficacy on their own. Experimental confirmation, attention to toxicity, and ultimately clinically meaningful comparative studies remain necessary steps between computational prediction and patient care.

A fourth strand widens the biological frame. A Romanian cohort study reported an association between greater abundance of *Fusobacterium* and breast cancer, while the observed difference was not explained by basic demographic factors. The authors also discussed possible links with BRCA mutation status and oral–gut–breast pathways [13]. This is an intriguing line of inquiry, not evidence that a microbiome signal is ready to serve as a diagnostic or prognostic marker. Diet, antibiotic exposure, sampling site, tumor subtype, and other sources of confounding need to be addressed before causal or clinical claims can be made.

Finally, two contributions bring the lived consequences of care into sharper focus. A study of patients receiving chemotherapy in Greece assessed health-related quality of life and found moderate overall scores, with preserved physical and social functioning alongside measurable effects of marital status, residence, and time since diagnosis [8]. A review of toxicity in advanced breast cancer described the interaction of treatment burden with psychological vulnerability and health-system demands [14]. Read together, these papers make a necessary point: treatment effectiveness cannot be fully understood if the costs borne by patients remain outside the framework.

4. Future Research Directions: Priorities for the Next Phase of Research

The next step is not simply to produce more biomarkers, scores, or algorithms. It is to design studies that determine when these tools change care for the better. Six priorities follow from the themes of this Special Issue.

1. Imaging models that are tested against a clinical action. AI mammography and BI-RADS–immunophenotype correlations need multicenter external validation, calibration in dense breasts, and endpoints that include avoided biopsies and missed cancers, not accuracy alone [4,9,10].
2. Risk-adapted management of B3 lesions and the axilla. Upgrade rates and progesterone-receptor-linked nodal risk should be confirmed in prospective pathways that prespecify who can avoid excision or axillary dissection [6,11].
3. Liquid biopsy and minimal residual disease. Circulating tumor DNA and circulating tumor cells remain outside the evidence assembled here and are a priority for surveillance after neoadjuvant therapy, particularly in HER2-positive disease stratified by CPS+EG [5].
4. Resistance and repositioning with a clinical filter. Endocrine-resistance mechanisms and computational candidates need orthogonal experimental confirmation before any claim of therapeutic readiness [7,12].
5. Microbiome signals that survive confounding. The Fusobacterium association should be retested with diet, antibiotic exposure, and tumor subtype as covariates, and with oral as well as fecal sampling [13].
6. Survivorship endpoints decided in advance. Quality of life and time toxicity should be co-primary or key secondary outcomes in studies of treatment intensity, not post hoc descriptions [8,14].

5. Conclusions

The field of breast cancer diagnosis and management has moved toward more biologically informed care, but precision must mean more than finer classification. It should help patients and clinicians make better decisions, reduce avoidable harm, and preserve outcomes that matter to the person receiving treatment. The studies in this Special Issue offer a varied view of that work: they examine imaging and biopsy decisions, clinical and pathological risk, treatment resistance, emerging biological hypotheses, and the effects of care on quality of life.

Taken together, these studies show that progress will depend not only on technological innovation, but also on the patience to test it rigorously and the willingness to ask whether it makes care better in ways patients can feel.

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