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Case Report

Breast Carcinoma in a Nulliparous Woman: A Case Report

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Abstract:
Breast carcinoma is a heterogeneous malignancy with multifactorial etiology involving genetic, hormonal, environmental, and reproductive factors. Nulliparity is a recognized risk factor due to prolonged exposure to unopposed endogenous estrogens. This case report presents a 42-year-old nulliparous female diagnosed with right-sided breast carcinoma, who presented with a palpable breast mass and ipsilateral axillary lymphadenopathy. Clinical examination and imaging revealed a well-defined, mobile lesion in the upper inner quadrant of the right breast, classified as BIRADS III. Given the tumor size and nodal involvement, a Modified Radical Mastectomy (MRM) was performed under general anesthesia. Histopathological and receptor status evaluation will guide further management, including adjuvant therapies. This case underscores the importance of recognizing nulliparity as a significant risk factor and highlights the need for individualized, multidisciplinary management strategies in breast cancer.
Keywords: Nulliparity, Breast cancer, Mastectomy, Hormone exposure, Lymphadenopathy

Introduction

Breast carcinoma is the most frequently diagnosed cancer and the leading cause of cancer-related mortality among women globally, accounting for approximately 2.3 million new cases and over 680,000 deaths in 2020 alone [1]. It is a biologically heterogeneous disease with complex pathogenesis involving interactions between genetic predisposition, hormonal influences, environmental exposures, and reproductive factors. The increasing burden of breast cancer, particularly in low- and middle-income countries, underscores the need for improved understanding of its etiopathogenesis, early detection strategies, and personalized treatment approaches.

Etiology and Risk Factors

The etiology of breast cancer is multifactorial. Established non-modifiable risk factors include advancing age, female sex, family history of breast or ovarian cancer, and genetic mutations (notably BRCA1 and BRCA2) [2]. Modifiable risk factors comprise obesity, sedentary lifestyle, alcohol consumption, prolonged use of hormonal replacement therapy, and nulliparity [3]. Reproductive history, particularly age at menarche, age at first full-term pregnancy, breastfeeding, and menopause, plays a pivotal role in modulating risk through cumulative exposure to estrogen.

Nulliparity is associated with a prolonged window of uninterrupted estrogen exposure due

to the absence of pregnancy-induced hormonal changes. During pregnancy, high levels of progesterone and other pregnancy-associated hormones induce differentiation of breast epithelial cells, reducing their vulnerability to malignant transformation. The absence of this protective effect in nulliparous women increases their lifetime risk of hormone receptor-positive breast carcinoma [4].

Basic Pathology

Histologically, breast carcinoma arises from the epithelial cells lining the terminal ductal lobular units. The most common type is **invasive ductal carcinoma**, accounting for 70–80% of cases, followed by **invasive lobular carcinoma** [5]. Carcinogenesis involves a series of molecular changes starting from hyperplasia, progressing to atypical hyperplasia, ductal carcinoma in situ (DCIS), and finally invasive carcinoma. Tumor grading (Nottingham system), staging (TNM classification), and receptor status (ER, PR, HER2) are vital for prognostication and therapeutic planning.

Role of Genetic and Molecular Factors

Genetic alterations play a central role in breast carcinogenesis. **BRCA1** and **BRCA2** mutations confer a lifetime breast cancer risk of up to 72% and 69%, respectively [6]. These tumor suppressor genes are involved in homologous recombination-mediated DNA repair. Their loss leads to genomic instability and oncogenesis. Other high-penetrance genes include TP53 (Li-Fraumeni syndrome), PTEN (Cowden syndrome), and PALB2. Additionally, epigenetic mechanisms, such as DNA methylation and histone modification, contribute to silencing of tumor suppressor genes.

On the molecular level, breast cancer is classified into subtypes based on receptor expression: **luminal A (ER+/PR+/HER2−), luminal B (ER+/PR+/HER2+), HER2-enriched (ER−/PR−/HER2+)** and **basal-like/triple-negative breast cancer (TNBC)** [7]. These subtypes not only guide treatment but also provide prognostic information. For instance, luminal tumors generally have the best prognosis and respond well to endocrine therapy, whereas TNBCs are more aggressive and lack targeted treatment options.

Clinical Presentation and Diagnosis

Breast carcinoma typically presents as a painless, palpable mass, commonly in the upper outer quadrant. Associated signs may include nipple retraction, skin dimpling, or axillary lymphadenopathy. Diagnostic work-up includes **clinical breast examination, mammography, ultrasound**, and **core needle biopsy** for histopathologic confirmation. MRI is used in selected cases, especially in dense breast tissue or suspected multifocal disease. The **BIRADS** (Breast Imaging-Reporting and Data System) scoring aids in risk stratification based on imaging.

Treatment Modalities

The management of breast cancer is multidisciplinary and stage-dependent. **Surgical intervention** remains the cornerstone of treatment for localized disease, ranging from **breast-conserving surgery (lumpectomy)** to **modified radical mastectomy (MRM)** depending on tumor size, location, and nodal involvement [8].

Adjuvant therapies include:

- **Radiotherapy**: Recommended post-lumpectomy and in selected post-mastectomy cases to reduce locoregional recurrence.
- **Systemic therapies**:
  - **Endocrine therapy** (e.g., tamoxifen, aromatase inhibitors) for hormone receptor-positive tumors.
  - **Chemotherapy**: Typically reserved for high-grade, node-positive, triple-negative, or HER2-positive tumors.
  - **Targeted therapy**: Trastuzumab and pertuzumab have revolutionized the treatment of HER2-positive disease [9].

For advanced and metastatic disease, the treatment is palliative, aimed at prolonging

survival and improving quality of life. Novel agents such as **CDK4/6 inhibitors, PARP inhibitors** (especially in BRCA-mutant tumors), and **immunotherapy** for TNBC are expanding the therapeutic landscape [10].

Case Report

A 42-year-old female patient, a known case of right-sided breast carcinoma, presented for further evaluation and management. On general inspection, both breasts appeared symmetrical in size and at the same level. The nipples were also aligned bilaterally, with no evidence of retraction or skin tethering. When the patient raised her arms above her head, both breasts moved freely away from the chest wall, indicating no fixation to the underlying structures.

On palpation of the right breast, a solitary, well-defined, firm to hard mass was identified in the upper inner quadrant. The lesion measured approximately 5 × 4 cm, was oval in shape, and demonstrated mobility within the breast tissue. It was not adherent to the chest wall. Axillary examination revealed multiple palpable, enlarged lymph nodes in the right axilla, suggestive of regional lymphatic involvement.

Bilateral breast ultrasonography revealed a BIRADS III lesion in the right breast, along with mildly prominent ducts on the same side. The left breast appeared unremarkable on imaging, with no suspicious findings noted.

The patient is nulliparous, which is considered a significant risk factor for the development of breast malignancy due to prolonged exposure to endogenous estrogens without the hormonal modulation of pregnancy.

Given the clinical findings, imaging results, and lymph node involvement, the managing physician has recommended a Modified Radical Mastectomy (MRM) on the right side, including lumpectomy, under general anesthesia. This surgical approach is intended to excise the primary tumor along with the involved axillary lymph nodes while preserving the pectoralis major muscle.

Discussion

Breast carcinoma remains one of the most common malignancies affecting women worldwide, with risk factors including age, family history, genetic predisposition, hormonal influences, and reproductive history. In this case, the patient is a 42-year-old nulliparous woman, which places her at increased risk due to the absence of pregnancy-related hormonal modulation. Nulliparity is associated with a prolonged estrogenic state, which can lead to increased epithelial proliferation in breast tissue, a known precursor to malignant transformation.

Clinically, the presentation of a solitary, hard, and mobile mass in the upper inner quadrant of the right breast aligns with a typical manifestation of a localized breast carcinoma. The absence of nipple retraction, or fixation to the chest wall initially suggests a lesion confined to the breast tissue without overt invasion of the skin or underlying musculature. However, the presence of right axillary lymphadenopathy is concerning and indicative of possible lymphatic spread, which plays a critical role in staging and prognosis.

The ultrasonographic findings, particularly the BIRADS III classification, suggest a lesion that is probably benign but warrants close follow-up or biopsy to exclude malignancy. However, in the context of a known breast carcinoma and palpable axillary nodes, the imaging must be interpreted with caution, and histopathological confirmation is essential. The mildly prominent ducts could indicate associated ductal involvement or an early ductal carcinoma in situ (DCIS) component, which requires further evaluation during surgery and subsequent pathology.

From a surgical standpoint, the decision to proceed with a Modified Radical Mastectomy (MRM) is well-justified. MRM involves removal of the entire breast tissue along with axillary lymph node dissection, while preserving the pectoralis major muscle. This approach is indicated in cases where there is significant tumor burden or nodal involvement, especially

when breast-conserving surgery is not feasible or contraindicated. Given the tumor size (approximately 5 × 4 cm), the risk of local recurrence, and the presence of axillary lymphadenopathy, MRM is the most appropriate therapeutic intervention in this context.

Furthermore, performing the surgery under general anesthesia ensures patient comfort, proper surgical access, and thorough exploration of both the primary lesion and regional lymphatic basins. The findings during surgery, combined with histopathological assessment, will determine the need for adjuvant therapies such as chemotherapy, radiotherapy, and hormone therapy, depending on receptor status (ER, PR, HER2) and tumor grading.

This case highlights the importance of a multidisciplinary approach in breast cancer management. It underscores the need for early detection, accurate staging, and appropriate surgical planning. While imaging provides valuable guidance, definitive diagnosis and staging rely heavily on tissue diagnosis. Moreover, the patient’s reproductive history serves as a reminder of the nuanced risk factors involved in breast carcinogenesis, emphasizing the role of individualized care in oncology

Conclusion

This case highlights the clinical and pathological presentation of breast carcinoma in a 42-year-old nulliparous female, emphasizing the relevance of reproductive history as a significant risk factor. The presence of a well-defined, mobile breast mass with axillary lymphadenopathy, in conjunction with imaging findings, warranted prompt surgical intervention. The decision to perform a Modified Radical Mastectomy was appropriate, considering the tumor size and regional lymph node involvement.

Nulliparity, through prolonged estrogenic stimulation without the regulatory effects of pregnancy-induced hormonal changes, underscores a biologically plausible pathway contributing to breast tumorigenesis. This case reinforces the importance of individualized risk assessment and a multidisciplinary approach in managing breast cancer. Comprehensive evaluation including histopathological analysis and receptor profiling remains essential for guiding post-surgical adjuvant therapy and improving clinical outcomes.

Early detection, patient education about risk factors, and personalized treatment strategies continue to be the cornerstone of effective breast cancer management, especially in women without classic protective reproductive factors.

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