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Breast Cancer and Associated Risk Factors: A Comprehensive Review

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ABSTRACT

Breast cancer is the most common malignancy affecting women worldwide, with a rising incidence in both developed and developing countries. This review explores the associated risk factors for breast cancer, including genetic predisposition, lifestyle habits, hormonal influences, and environmental exposures. Understanding these risk factors is crucial for prevention, early detection, and targeted interventions. Recent studies have emphasized the role of modifiable risk factors such as diet, physical activity, and obesity alongside non-modifiable factors like age, family history, and genetic mutations.

Introduction

Breast cancer remains a significant public health challenge and the leading cause of cancer-related mortality among women global (1). It accounts for approximately 2.3 million new cases and over 680,000 deaths annually(2). While survival rates have improved due to advancements in screening and treatment, understanding the associated risk factors is essential for prevention and better outcomes. This review aims to comprehensively evaluate the risk factors for breast cancer, categorizing them into modifiable and non-modifiable factors.

Non-Modifiable Risk Factors

Non-modifiable risk factors are inherent and cannot be altered but play a substantial role in breast cancer development.

- **Age**:

The risk of breast cancer increases with age. Women over 50 are at the highest risk(3).

A study showed that the median age of diagnosis is 61 years, with postmenopausal women at greater risk (4).

- **Family History and Genetics**:

Family history of breast cancer significantly increases risk, particularly if a first-degree relative (mother, sister) has been diagnosed.

- Mutations in the **BRCA1** and **BRCA2** genes are the most notable genetic risk factors (5).
- Women with a BRCA1 mutation have a 55%-65% lifetime risk of breast cancer, while those with BRCA2 mutations have a 45% risk (6).

2. **Hormonal and Reproductive Factors**:

- **Early Menarche and Late Menopause**: Early onset of menstruation (<12 years) and late menopause (>55 years) increase the cumulative exposure to estrogen, thereby raising breast cancer risk (7).
- **Nulliparity and Late Age at First Birth**: Women who have never given birth or have their first child after age 30 are at an elevated risk (8).

3. **Breast Density**:

Women with dense breast tissue have a higher risk, as dense tissue can mask tumors on mammograms(9)

Modifiable Risk Factors

Addressing modifiable risk factors can help reduce the risk of breast cancer and improve overall health outcomes.

- **Obesity and Physical Inactivity**:
  - Postmenopausal obesity is a well-documented risk factor for breast cancer. Adipose tissue increases estrogen levels, contributing to tumor development(10).
  - A meta-analysis demonstrated that women with a BMI ≥30 had a 20%-40% higher risk of breast cancer compared to women with normal weight(11).
  - Physical inactivity exacerbates the obesity risk and reduces immune system efficiency(12).
- **Diet and Alcohol Consumption**:
  - High-fat diets, processed foods, and excessive alcohol consumption increase breast cancer risk.
  - Alcohol consumption, even in moderate amounts, has been associated with an increased risk of hormone receptor-positive breast cancer(13).
    Women consuming >2 drinks per day have a 20% higher risk(14).
- **Hormone Replacement Therapy (HRT)**: Postmenopausal women receiving combined estrogen and progestin therapy for extended durations face an increased risk of breast cancer.
  - The Women's Health Initiative reported a 26% increased risk of breast cancer among HRT nged users(15).
- **Radiation Exposure**:
  Proloexposure to ionizing radiation, especially during childhood (e.g., radiation therapy for Hodgkin's lymphoma), raises the risk of breast cancer later in life (16).
- **Smoking**:
  Smoking has been linked to an increased risk of breast cancer, particularly in premenopausal women(17).

Emerging Risk Factors

Recent studies have identified emerging risk factors that require further investigation:

- **Environmental Pollutants**:

Exposure to endocrine disruptors, such as pesticides and plastics (e.g., BPA), has been associated with breast cancer (17)

- **Night Shift Work**:

Circadian rhythm disruption among night shift workers may increase breast cancer risk due to melatonin suppression and hormonal imbalance (18).

- **Stress and Mental Health**:

Chronic stress may indirectly contribute to cancer risk through lifestyle factors such as poor diet, smoking, and alcohol use.

Prevention Strategies

Understanding modifiable risk factors enables the development of preventive strategies, including:

- **Lifestyle Modifications**:
  - Promoting regular physical activity (≥150 minutes/week) and maintaining a healthy weight.
  - Limiting alcohol intake and smoking cessation.
- **Dietary Recommendations**:

Encouraging a Mediterranean diet rich in fruits, vegetables, whole grains, and omega-3 fatty acids(19).

- **Screening Programs**:

Regular mammography screening facilitates early detection and improves survival rates.

- **Genetic Counseling**:

Women with a family history of breast cancer should undergo genetic testing for BRCA mutations to assess their risk and consider preventive measures, such as prophylactic surgery.

Conclusion

Breast cancer is influenced by a combination of genetic, hormonal, lifestyle, and environmental factors. While non-modifiable risk factors such as age, genetics, and hormonal changes play a crucial role, addressing modifiable factors like obesity, physical inactivity, alcohol use, and smoking is essential for prevention. A multidisciplinary approach that emphasizes education, screening, and lifestyle interventions can significantly reduce breast cancer incidence and mortality. Further research is needed to explore emerging risk factors, including environmental exposures and circadian rhythm disruptions, to develop comprehensive preventive strategies.

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