



ORIGINAL RESEARCH PAPER

General Surgery

ASSOCIATION OF PREOPERATIVE SERUM LEVELS OF CARCINOEMBRYONIC ANTIGEN, CANCER ANTIGEN 125 AND CANCER ANTIGEN 15-3 WITH TUMOR FEATURES IN BREAST CANCER PATIENTS.

KEY WORDS: Breast cancer, Tumor markers, CEA, CA 125, CA 15-3, Tumor characteristics

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ABSTRACT

Breast cancer is a major contributor to illness and death among women globally. It represents one in every four cancer cases diagnosed in women. The present study was conducted to investigate the association between serum tumor markers and specific tumor characteristics in breast cancer. The study evaluated the association between serum tumor markers and key tumor features, including age distribution, menopausal status, laterality, tumor size, grade, lymph node involvement, and histopathological subtypes. The majority of breast cancer cases occur in the 51-60 years age group (26.7%), followed closely by 41-50 years (23.3%) and 61-70 years (21.7%). The mean age of the patients was 52.02 ± 11.53 years. The majority of cases (58.3%) are seen in post-menopausal women. The breast cancer is more frequently observed in the left breast (58.3%) compared to the right breast (41.7%). The upper outer quadrant is the most common site for breast cancer, accounting for 46.7% of cases. Among breast cancer patients, 38.3% have a history of hypertension. The majority of breast cancer cases (71.7%) fall within the 2-5 cm tumor size group. The majority of breast cancer cases (58.3%) are Grade III. Lymph node involvement was observed in 58.3% of breast cancer patients. The most common type of breast cancer in this study is Invasive Ductal Carcinoma (IDC), accounting for 78.3% of cases. The analysis of CEA levels in relation to tumor size in breast cancer patients showed a statistically significant association ($p = 0.008$).

INTRODUCTION

Breast cancer is the most frequently diagnosed cancer in women and the second leading cause of cancer-related mortality worldwide. Each year, more than 250,000 women in the United States are diagnosed with invasive breast cancer. Although overall mortality for breast cancer patients has declined due to advancements in early detection and treatment, it remains the second most common cause of cancer death among women. In India, the age-standardized incidence rate of breast cancer ranges from 9 to 32 per 100,000 women, with over a million new cases reported annually. High mortality rates persist due to delays in early detection and suboptimal treatment outcomes. Breast cancer is a leading cause of cancer-related morbidity and mortality among females worldwide, accounting for 25% of all cancer cases and 15% of all cancer-related deaths in women. Despite advancements in early detection and treatment, breast cancer remains a significant public health concern, emphasizing the need for continued research into effective prognostic markers, targeted therapies, and personalized treatment approaches to improve patient outcomes and reduce mortality rates. According to the GLOBOCAN 2020 report by the International Agency for Research on Cancer (IARC), breast cancer has become the most commonly diagnosed cancer globally, with an estimated 2.3 million new cases in 2020, accounting for 11.7% of all cancer cases. It is also the fifth leading cause of cancer mortality worldwide, responsible for approximately 685,000 deaths in the same year. Among women, breast cancer represents one in four cancer cases and one in six cancer deaths, ranking first in incidence in 159 out of 185 countries and in mortality in 110 countries. Notably, while incidence rates are higher in transitioned countries, mortality rates are higher in transitioning countries, reflecting disparities in access to early detection and treatment services. The present study was conducted to investigate the association between tumor markers and specific tumor characteristics in breast cancer.

This study evaluated the association between serum tumor markers and key tumor features, including age distribution, menopausal status, laterality, tumor size, grade, lymph node involvement, and histopathological subtypes. For each patient, 5 mL of venous blood was collected before treatment. The serum samples were obtained through centrifugation, stored in freezing tubes, and immediately preserved at -80°C . The serum levels of CEA, CA 125, and CA 15-3 were measured using an automatic electrochemiluminescence immunoassay system. The cutoff values were set as follows: CEA (≤ 5.0 ng/mL), CA 125 (≤ 35 U/mL), and CA 15-3 (≤ 30 U/mL). The results were classified as positive or negative based on these cutoff values. Data were collected using a structured proforma and compiled at the end of the study. Descriptive statistics such as mean and standard deviation were calculated for continuous variables, while frequencies and percentages were used for categorical variables. The level of statistical significance was also assessed.

RESULTS

The age distribution of breast cancer patients in this study indicates that the majority of cases fall within the 51-60 years age group (26.7%), followed closely by 41-50 years (23.3%) and 61-70 years (21.7%). A considerable proportion of cases (21.7%) also occur in younger individuals aged 31-40 years. The mean age of the patients was 52.02 ± 11.53 years. The majority of cases (58.3%) are seen in post-menopausal women, indicating that age-related hormonal changes may contribute to increased breast cancer risk. However, a significant proportion (41.7%) occurs in pre-menopausal women. The breast cancer is more frequently observed in the left breast (58.3%) compared to the right breast (41.7%). This finding aligns with some studies suggesting a higher prevalence of left-sided breast cancer. The upper outer quadrant is the most common site for breast cancer, accounting for 46.7% of cases. The upper inner quadrant (20.0%), lower inner quadrant (13.3%), and lower outer quadrant (13.3%) also show significant involvement. The retroareolar region (6.7%) has the lowest frequency of

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tumors. Among breast cancer patients, 38.3% have a history of hypertension, making it the most common comorbidity. Diabetes is present in 18.3% of patients. The majority of breast cancer cases (71.7%) fall within the 2-5 cm tumor size group. Only 10.0% of tumors are <2 cm. Meanwhile, 18.3% of cases present with tumors >5 cm. The mean size of the tumour is 4.01 ± 2.76 . The majority of breast cancer cases (58.3%) are Grade III, indicating a predominance of high-grade, poorly differentiated tumors that are more aggressive and associated with a worse prognosis. Grade II tumors account for 31.7%, representing moderately differentiated cancers. Grade I tumors, which are well-differentiated and typically have a better prognosis, make up only 10.0% of cases. Lymph node involvement was observed in 58.3% of breast cancer patients. The most common type of breast cancer in this study is Invasive Ductal Carcinoma (IDC), accounting for 78.3% of cases. The analysis of CEA levels in relation to tumor size in breast cancer patients showed a statistically significant association ($p = 0.008$). Among the 38 patients with elevated CEA levels, the majority (71.05%) had 2-5 cm tumors, while 26.32% had tumors >5 cm, and only 2.63% had tumors <2 cm.

DISCUSSION

The present study indicates that the majority of breast cancer cases occur in the 51-60 years age group (26.7%), followed closely by 41-50 years (23.3%) and 61-70 years (21.7%). The mean age of patients was 52.02 ± 11.53 years. This finding is consistent with studies published in PubMed, which report a peak incidence of breast cancer in women aged 50-60 years, coinciding with postmenopausal status and hormonal changes that contribute to increased susceptibility. In this study, 58.3% of patients were postmenopausal, while 41.7% were premenopausal. The left breast was affected more frequently (58.3%) than the right (41.7%). The upper outer quadrant (46.7%) was the most commonly affected site, followed by the upper inner quadrant (20%). Hypertension was the most common comorbidity (38.3%), followed by diabetes (18.3%). The majority of breast cancer cases (71.7%) fell within the 2-5 cm tumor size group. The majority of breast cancer cases (58.3%) are Grade III, indicating a predominance of high-grade, poorly differentiated tumors that are more aggressive and associated with a worse prognosis. Lymph node involvement was observed in 58.3% of breast cancer patients. The most common type of breast cancer in this study is Invasive Ductal Carcinoma (IDC), accounting for 78.3% of cases.

CONCLUSION

This study highlights the association of preoperative serum levels of CEA, CA 15-3, and CA-125 with tumor characteristics in breast cancer patients. The findings indicate that CA 15-3 and CEA levels correlate significantly with tumor size, suggesting their potential as markers for tumor burden. Additionally, CA 15-3 levels were significantly associated with tumor grade, reinforcing its role as a prognostic biomarker for aggressive breast cancer. However, CA-125 did not show a statistically significant association with tumor grade or size, limiting its utility in breast cancer prognosis. The predominance of postmenopausal women, left-sided breast cancer, and invasive ductal carcinoma aligns with existing literature. The high proportion of Grade III tumors and lymph node involvement underscores the need for early detection and improved screening strategies. While CA 15-3 and CEA can aid in disease monitoring and prognosis, further large-scale studies are necessary to refine their clinical application and explore their role in guiding treatment decisions.