Original Article

Risk of Incidence of Breast Cancer in Relationship to Age and BMI

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Abstract

Objective: To evaluate the association between different age groups and body mass index (BMI) and the incidence of breast cancer (BC) among clinically suspected women.

Methodology: A retrospective cross-sectional study was conducted at the Department of Radiology, Liaquat National Hospital, Karachi, based primarily on hospital records, with a few cases assessed cross-sectionally from May to October 2024. The study included all female patients aged 18 years or older who were clinically diagnosed with breast cancer and had histopathological confirmation, along with complete clinical records, including age, height, weight (for BMI calculation), menopausal status, and cancer stage. All patients and their medical records were assessed according to the inclusion criteria. Data were entered and analyzed using SPSS version 26.

Results: The overall mean age of the patients was 44.3 ± 14.8 years, and the mean BMI was 25.9 ± 4.7 kg/m². The most common breast condition was fibrocystic changes (30.0%), followed by breast cancer (25.6%), benign lumps (20.0%), mastitis (15.6%), and intraductal papilloma (8.9%). Analysis revealed a significant association between breast cancer and women aged >40 years, with an odds ratio (OR) of 0.26 (95% CI: 0.08–0.85; p = 0.019). Similarly, BMI showed a significant association, with an odds ratio of 0.12 for overweight/obese women (95% CI: 0.03–0.45; p = 0.001).

Conclusion: This study revealed that older age and higher BMI are significantly associated with an increased risk of breast cancer among women presenting with different breast conditions.

Keywords: Breast Cancer, Histopathology, Age, BMI.

Introduction

The breast carcinoma is the most frequently diagnosed malignancy among women throughout the world and remains the primary cause of cancer-associated mortality in this population. In 2020, around 2.3 million new cases were found, making up about 11.7% of all cancers.[1] Unfortunately, about 684,996 people died from breast cancer that same year.[1,2] The occurrence of this cancer is rising in all parts of the world, with the highest rates seen in industrialized nations, where nearly half of all cases occur, is largely linked to the Western lifestyle marked by inadequate diet, stress, smoking, and inadequate physical activity.[3,4]

Breast cancer is the most common and deadliest cancer in Pakistan, with 25,928 cases reported in 2020, making up 14% of all cancer diagnoses.[5] The risk of developing breast cancer has risen in Pakistan, where one in nine women is likely to face this disease in her lifetime. The country records the highest incidence and death rates among all Asian nations, with the occurrence rate being about 2.5 times higher than that of neighboring countries

like India and Iran.[5,6] Delayed detection often influenced by social and cultural factors significantly raises mortality, while additional risks such as age, reproductive history, and diet further worsen the problem. Additionally, about 70% of patients with advanced-stage breast cancer are likely to develop metastases.[7] Tumor cells that detach from the primary site promote the breakdown of the extracellular matrix by producing fibrinolytic enzymes and matrix metalloproteinases (MMPs), allowing them to spread to distant organs via the lymphatic and blood vessels.[7]

Age and obesity are major factors in breast cancer development, with studies showing that the risk increases as women advance in age.[8] The International Agency for Research on Cancer has also identified obesity as a key risk factor and in China, statistics show that more than half of the adult population is overweight or obese a number that has tripled over the last 20 years and about 41.6% of them are women.[8,9] Consequently, older women are generally believed to develop less aggressive tumors compared to younger women.

Although it remains uncertain whether aging itself directly causes these differences, various biological changes likely occur with age, influencing the clinical behavior of breast cancer.[10,11] However, obesity is an established risk factor for the development of hormone receptor–positive breast carcinoma, specifically among women with postmenopausal status.[12] Although the epidemiological relationship between obesity and breast carcinoma risk and outcomes is well recognized, the exact molecular mechanisms underlying how obesity contributes to breast cancer development and progression remain unclear.[13,14] However several explanations have been proposed, most of which highlight the roles of adipocytes, adipose tissue, and obesity-related chronic inflammation in promoting breast cancer.[13] Moreover, obesity has been linked to a poorer breast cancer prognosis, with an increased risk of disease recurrence and higher mortality rates. As a result, obese breast cancer patients face a greater likelihood of experiencing various treatment-related complications, including those from breast surgery, radiotherapy, and systemic therapy.[15] subsequently recently it has been concluded that the waist-to-hip ratio is linked with risk of metastasis, specifically among black women and those with high-risk tumors.[16] In Pakistan, the situation is particularly alarming, with high rates of late-stage presentation and advanced disease at diagnosis. Studies show that bone is the most frequent site of metastasis in Pakistani breast cancer patients,[17,18]

yet limited data exist on the contributing factors specifically for Age and BMI. However, the identification of risk factors is important for developing targeted screening and preventive strategies. Therefor this study has been done to evaluate the relationship between age groups and BMI among female breast cancer patients.

Methodology

This retrospective cross-sectional study was carried out at radiology department of Liaquat National Hospital, Karachi from May to October 2024. Study was specifically done based on Hospital records with a few cases assessed cross-sectionally, Ethical approval was obtained from Liaquat National Hospital, Karachi Re no IRB/M-000065/37. included all female patients aged 18 years or older who were clinically diagnosed with breast cancer and had histopathological confirmation, with complete clinical records, including age, height and weight or overall BMI calculation, menopausal status, and stage of cancer were included in the study. All patients with another primary malignancy, pregnant or lactating women, patients who had recently undergone radionuclide therapy or related procedures, and those unwilling to participate in the study were excluded. After taking institutional permission, information for patient was assessed for demographic information including age and body mass index (BMI), which was calculated using the formula: weight in kilograms divided by the square of height in meters (kg/m²). All the data were entered and analyzed using SPSS 26. The correlation between age and BMI were assessed using odds ratios (ORs) with 95% confidence intervals through univariate and multivariate logistic regression. The Chi-square test was applied for categorical comparisons taking p-values <0.05 as statistically significant.

Results

In this study 90 participants were included with mean age of 44.3±14.8 years ranging from 21 to 70 years and mean BMI was 25.9±4.7 kg/m², with values ranging from 18 to 35 kg/m². Majority of patients were in younger age group of 18-30 years, while 33.3% were in age range 31-40 years, and those in the age range >40 years were 20.0%. Moreover, healthy weight patients with BMI <18.0 kg/m² and overweight patients with BMI 18-24.9kg/m2 equally comprised the greater part of patients, 40% each, however obese patients were 20% (BMI >25kg/m²). The most common breast condition was fibrocystic changes (30.0%), followed by breast cancer (25.6%), and benign lumps (20.0%). Mastitis was

reported in 15.6% of cases, while intraductal papilloma was 8.9%. (Table I)

Demographic Variables	Frequency	Percentage
Age groups		
18-30 years	42	46.7%
31-40years	30	33.3%
>40 years	18	20.0%
Total	90	100.0%
Mean age	44.3±14.8 years	
BMI		
<18.0 kg/m^2	36	40.0%
18-24.9kg/m^2	36	40.0%
>25kg/m^2	18	20.0%
Total	90	100.0%
Mean BMI	25.9±4.7 kg/m²	
Breast Conditions		
Fibrocystic changes	27	30.0%
Breast cancer	23	25.6%
Benign lump	18	20.0%
Mastitis	14	15.6%
Intraductal papilloma	8	8.9%

There was an insignificant association of different breast conditions with age groups and BMI categories (p=>0.05) as shown in table II.

Analysis of the study revealed a significant association between age and breast cancer risk as; among women aged <40 years, 4 (4.4%) had breast cancer compared to 19 (21.1%) in the >40 years group, indicating that the women older than 40 years had a higher likelihood of breast cancer, with an odds ratio (OR) of 0.26 (95% CI: 0.08–0.85, p = 0.019). Additionally, BMI was significantly associated with breast cancer risk, with odds ratio for overweight/obese women was 0.12 (95% CI: 0.03–0.45, p = 0.001), as shown in table III.

Discussion

Breast cancer represents a leading malignant condition among women, with a million of freshly diagnosed cases each year around the world, and contributing to significant cancer-related annual mortality among the women during their 4th and 5th decade of life.[19,20] Despite its significant burden of mortality among those with growing age, obesity, classified in terms of BMI, is also significantly associated with breast cancer.[20,21] In this study 90 breast cancer patients were included to evaluate the risk of incidence. The mean age of

Table II: Breast diseases and their association with age groups and BMI.

	BREAST DISEASES					Total	p-value
	Benign lump	Breast cancer	Fibrocystic changes	Intraductal papilloma	Mastitis		
Age groups							
18-30 years	9	9	16	1	7	42	
	10.0%	10.0%	17.8%	1.1%	7.8%	46.7%	
31-40years	4	10	7	5	4	30	
	4.4%	11.1%	7.8%	5.6%	4.4%	33.3%	
>40 years	5	4	4	2	3	18	0.402
	5.6%	4.4%	4.4%	2.2%	3.3%	20.0%	
Total	18	23	27	8	14	90	
	20.0%	25.6%	30.0%	8.9%	15.6%	100.0%	
BMI							
<18.0 kg/m^2	7	11	11	2	5	36	
	7.8%	12.2%	12.2%	2.2%	5.6%	40.0%	
18-24.9kg/m^2	8	7	11	5	5	36	
	8.9%	7.8%	12.2%	5.6%	5.6%	40.0%	
>25kg/m^2	3	5	5	1	4	18	0.901
	3.3%	5.6%	5.6%	1.1%	4.4%	20.0%	
Total	18	23	27	8	14	90	
	20.0%	25.6%	30.0%	8.9%	15.6%	100.0%	

Table III: Association of age and BMI with risk of breast cancer

Variables		Breast Cancer Risk		Total	95% CL	Odd ratio	p-value
		Yes	No				
Age groups	<40 years	4	30	34			
		4.4%	33.3%	37.8%	0.080 - 0.846	0.260	0.019
	> 40 years	19	37	56			
		21.1%	41.1%	62.2%			
BMI kg/m^2	18-25 kg/m^2	3	37	40			
		3.3%	41.1%	44.4%	0.033 - 0.449	0.122	0.001
	25.1-39.9 kg/m^2	20	30	50			
		22.2%	33.3%	55.6%			

participants was 44.3±14.8 years, with mean BMI was 25.9±4.7 kg/m². Additionally, the overweight patients were (40%) and 20% were obese. Similar age and BMI trends were noted in the study of Wada K et al[20] who documented that at baseline, mean age was 43.7 years and mean BMI was 23.0 kg/m² among premenopausal women, while postmenopausal women of mean age 60.6 years showed BMI of 23.5 kg/m². In another study by Dodelzon K et al[22] comparable trends were of mean age (34 years) and mean BMI (24.6 kg/m²) were noted. Similarly, in a recent study of Seely JM et al[23] the trends of age-specific diagnosis among women aged below 40 years revealed concerns regarding fresh incidences in young age population.

In this study cohort, the most common breast condition was fibrocystic changes (30.0%), followed by breast cancer (25.6%), and benign lumps (20.0%). Mastitis was reported in 15.6% of cases, while intraductal papilloma was 8.9%. Comparably, mixed trend of condition was documented in the study carried out by Kotepui M et al[24] wherein the most common breast condition was Fibroadenoma in 35.6% cases, followed by Breast cancer in 27.1%, and fibrocystic change were present in 22.6% cases, while other condition was less frequent, among those Fibroadenoma/fibrocystic change were present in 1.7% cases, Lipoma in 0.7%, Inflammation in 0.5%, Mastitis in 0.4%, and Intraductal papilloma in 0.2% of cases.

According to the current study, there was a significant association between age and breast cancer risk. The prevalence of breast cancer was significantly lower among women aged below 40 years compared to those aged above 40 years (4.4% vs. 21.1%, respectively), indicating that women older than 40 years had a higher likelihood of developing breast cancer. The odds ratio (OR) was 0.26 (95% CI: 0.08–0.85; p = 0.019).

In agreement with our findings, the study conducted by Jadoon NA et al.[25] reported a significantly elevated risk of breast cancer among women aged above 40 years, with an odds ratio of 1.84. Similarly, a recently published study by Hu Y et al.[26] reported that the risk of breast cancer was significantly higher among older women aged 40 years or more. They further stated that when the 18–39-year age group was taken as the reference category, the risk of breast cancer was 6.52-fold higher among women aged 40–49 years (OR = 6.52; 95% CI: 4.60–9.25; p < 0.001), approximately 7.37-fold higher among those aged 50–59 years (OR = 7.37; 95% CI: 5.18–10.47; p < 0.001), and 8.81-fold higher among women aged 60 years or more (OR = 8.81; 95% CI: 6.11–12.72; p < 0.001). All reported p-values were highly statistically significant.

In present study, BMI was significantly associated with breast cancer risk as only 3 women (3.3%) with normal BMI (18–25 kg/m²) developed breast cancer, compared to 20 women (22.2%) in the overweight/obese group (25.1–39.9 kg/m²), with odds ratio for overweight/obese women was 0.12 (95% CI: 0.03–0.45, p = 0.001), suggesting that women with higher BMI were at greater risk of developing breast cancer compared to those with normal BMI. Aligning with these findings, in the study of Zha JM et al[27] significant association was confirmed between breast cancer development and higher BMI (p<0.001), with significantly higher number of overweight patients in cancer group (57.9%) compared to cancer-free group (42.1%). Similarly, another more recent study published by Hu Y et al[26] reported significantly increased risk of developing breast cancer among those with higher BMI, exhibiting that compared to those with BMI range 18.5-23.9 kg/m² (normal weight), the risk of breast cancer was 1.89-fold higher among those with BMI range 24 - 27.9 kg/ m²(overweight), and 2.46-fold higher risk among patients with BMI ≥ 28 kg/m², with Odd ratios of 2.46. These results were statistically significant (p < 0.001). However, association between BMI below 18.5 kg/m² (underweight) and cancer risk was statistically not significant (p = 0.68).

Generally, several studies including this study suggests that advanced age and higher BMI may on high risk of breast carcinoma, underscoring the potential importance of targeted screening and preventive strategies for obese and advanced age women. Although this study has several important limitations specifically the all suspected women were initially included, and only 23 women were further analyzed for risk stratification, which could influence the strength and reliability of the findings.

Hence further larger-scale prospective studies with more comprehensive data are recommended to validate the findings of this study to provide more robust guidance for clinical practice in this population.

Conclusion

Present study revealed that the advancing age of women and raised BMI were noted to be the important factors related to the breast cancer risk, as specifically advanced aged women and those who are overweight or obese were more likely to develop breast cancer compared to younger or normal-weight patients.

Though, as the risk stratification was based on very limited number of specified breast cancer patients, these findings cannot be considered conclusive. Hence, further large-scale studies with a sufficiently large sample of breast cancer patients are recommended to validate the findings.

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