The association between Breast cancer and body mass index (BMI)

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Abstract

Background: Breast cancer is strongly impacted by obesity for a number of reasons. Furthermore, a high body mass index is linked to an increased risk of many cancers and a higher cancer-specific death rate. Although it has been demonstrated to be a risk factor, obesity is generally acknowledged as a poor prognostic factor for breast cancer. Obese women had higher rates of malignancies discovered during screening and at a later stage, even though the false-negative rate was comparable across a broad range of BMIs

Aim of study: To identify the association between Breast cancer and body mass index.

Patients and methods: Cross sectional study on the breast cancer patients in Baquba teaching hospital in the period from July 2023 to February 2024. We obtained the data from the patients attending Baquba teaching hospital's outpatient clinics. We collected date about age, type of tumor, tumor grade and body mass index (BMI). We collected a sample of 50 patients randomly.

Results: 50 patients were enrolled in this study. The majority of the patients were obese (46%), 44% of them were overweight, and only 6% of them were normal weight.

Conclusion: We concluded that there is strong association between the incidence of breast cancer and the value of the body mass index especially in older people.

Introduction

Breast cancer is the most frequent cancer to harm women worldwide. UK records show that 49,936 new cases of breast cancer were reported in 2011. and the frequency of occurrences is rising. Even though death rates from this illness are dropping, over 11,000 British women still die from it each year. After their initial tumor is surgically removed, thousands of long-term survivors have intensive and prolonged adjuvant therapy. Environmental factors, which may combine with polygenic factors, are the primary cause of most adult malignancies; inherited mutations in high susceptibility genes account for only a small part of these cases. (1).

Mainly because it is a systemic illness that often spreads to distant organs like the liver, brain, lung, and bone, breast cancer is incurable. Early diagnosis of the condition can lead to a good prognosis and a high likelihood of survival. Patients with breast cancer have a 5-year relative survival rate of over 80% due to the disease's early discovery in North America. It has been demonstrated that mammography, a commonly used screening technique for breast cancer detection, effectively reduces death rates. Other screening methods, like Magnetic Resonance Imaging (MRI), which is more sensitive than mammography on screening tests, have also been employed and studied within the previous ten years. There're numerous risk factors such as sex, aging, estrogen, family history, gene mutations and unhealthy lifestyle, which can increase the possibility of developing breast cancer (2).

Breast tumors usually start as hyperproliferation of the ducts and develop into benign tumors or even metastatic carcinomas when repeatedly provoked by various carcinogenic factors. Tumor microenvironments, which include stromal effects and macrophages, have a major impact on the development and progression of breast

cancer. Rats' mammary glands were able to develop neoplasms when carcinogens were only exposed to the stroma, not the extracellular matrix or the epithelium (3). Macrophages have the capacity to induce an inflammatory and mutagenic environment, which can promote angiogenesis and aid in the immune system evasion of cancer cells. DNA methylation patterns in the normal and tumor-associated microenvironments differ, indicating that epigenetic modifications in the tumor microenvironment may promote the growth of cancer (4).

In the current era of widespread screening mammography, palpable breast masses account for around one-third of all breast cancer diagnoses in the United States, and over half are detected by screening mammograms. Palpable axillary lump, nipple discharge, nipple inversion, breast asymmetry, breast skin erythema, and thickening of the breast skin (peau d'orange) are less common indications of breast cancer. In the US, 31% of instances of breast cancer had spread to neighboring lymph nodes at the time of diagnosis, leaving 62% of cases confined to the breast. Measuring more than just the breast and its surrounding lymph nodes, only 6% of breast cancers are metastatic at the time of diagnosis (5).

A histologic diagnosis of breast cancer is determined using established pathologic criteria. Invasive ductal carcinoma accounts for 50%-75% of cases of breast cancer, while invasive lobular carcinoma accounts for 5%-15% of cases. The remaining patients have a mixture of ductal/lobular carcinomas and other less prevalent histologies (6).

Preventing a metastatic recurrence and removing the tumor from the breast and surrounding lymph nodes are the main goals of treatment for nonmetastatic breast cancer. Local therapy for nonmetastatic breast cancer involves surgical resection, removal or biopsy of axillary lymph nodes, and postoperative radiation therapy considerations. Systemic therapy can be administered either preoperatively

(neoadjuvant), postoperatively (adjuvant), or both. The recommended systemic therapy is determined by the specific subtype of breast cancer (7).

The goals of treatment for metastatic breast cancer include symptom alleviation and prolongation of life. At this point, metastatic breast cancer is still incurable for nearly all affected individuals. The same basic categories of systemic therapy are used when applying the neoadjuvant/adjuvant techniques outlined here to metastatic breast cancer. Palliative care with local therapeutic approaches (radiation and surgery) is typically reserved for metastatic illnesses (8).

A body mass index of 30 or higher is considered obese. Obesity is a chronic illness that is becoming more common worldwide and is a major cause of health issues in the majority of nations. The World Health Organization estimates that 15% of women worldwide are obese (BMI of 30 kg/m2) and 40% of overweight (BMI of 25 kg/m2). These figures are still rising (9).

Obesity has a significant influence on breast cancer for several reasons. Moreover, a high BMI is associated with a greater death rate from cancer-specific causes as well as an elevated risk of numerous malignancies. Obesity is largely considered a poor prognostic indicator for breast cancer, despite being proven to be a risk factor. While HR-negative breast cancer stayed stable, the incidence of HR-positive breast cancer rose as BMI increased. Despite a similar false-negative rate over a wide range of BMIs, obese women had greater incidences of malignancies found during screening and at a later stage (10).

Aim of study

To identify the association between Breast cancer and body mass index in patients attending Baquba teaching hospital in Diyala governorate, Iraq.

Patients and methods

Cross sectional study on the breast cancer patients in Baquba teaching hospital in the period from July 2023 to February 2024. We obtained the data from the patients attending Baquba teaching hospital's outpatient clinics. We collected date about age, type of tumor, tumor grade and body mass index (BMI). We collected a sample of 50 patients randomly. We expressed the values of BMI as the following:

- Underweight (less than 18.5)
- Normal weight (18.6-24.9)
- Overweight (25-29.9)
- Obese (more than 30)

We calculated the BMI through this formula:

BMI= weight in Kilograms ÷ (length in meters)$_2$

We included the patients who are newly diagnosed with breast cancer and excluded the mastectomized patients.

Statistical analysis: All data were statistically analyzed using frequencies and percentages.

Results

50 patients were enrolled in this study, their age groups are demonstrated in table 1.

Table 1. distribution of patients according to age groups

| Age groups	Frequency	Percent
20-29 Years	2	4.0
30-49 Years	16	32.0
50-70 Years	29	58.0
More than 70 Years	3	6.0
Total	50	100.0

Their body mass index (BMI) is demonstrated in table 2.

Table 2. BMI status of the patients

BMI status	Frequency	Percent
Underweight	2	4.0
Normal weight	3	6.0
Overweight	22	44.0
Obese	23	46.0
Total	50	100.0

As shown in table 2, The majority of the patients were obese (46%), 44% of them were overweight, and only 6% of them were normal weight.
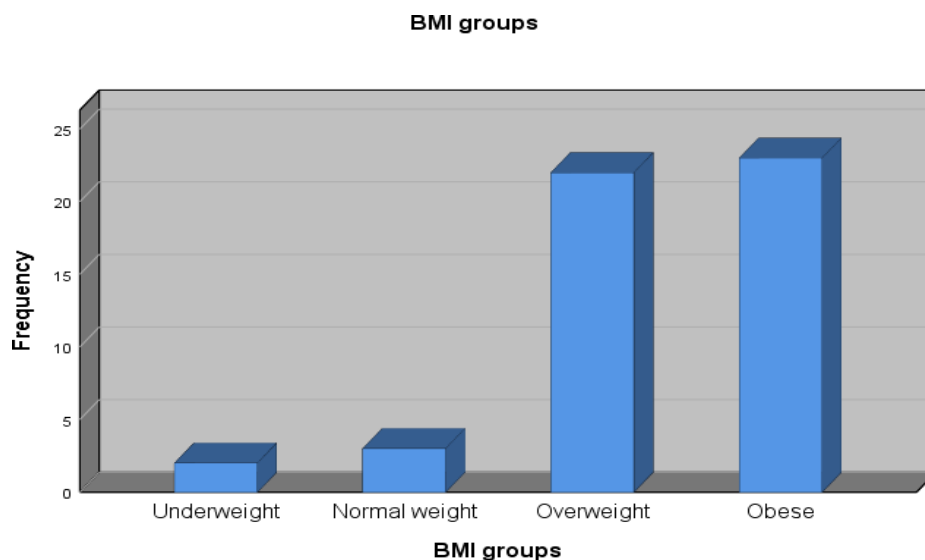
BMI groups

Figure 1. BMI

Table 3 shows the association between age and BMI groups.

Table 3. association between age groups and weight

Age groups		Underweight	Normal weight	Overweight	Obese	**Total**
			BMI groups			
20-29 years	Number	1	0	1	0	2
	% within BMI groups	50.0%	0.0%	4.5%	0.0%	4.0%
	% of Total	2.0%	0.0%	2.0%	0.0%	4.0%
30-49 years	Number	0	0	5	9	14
	% within BMI groups	0.0%	0.0%	22.7%	39.1%	28.0%
	% of Total	0.0%	0.0%	10.0%	18.0%	28.0%
50-70 years	Number	1	3	14	13	31
	% within BMI groups	50.0%	100.0%	63.6%	56.5%	62.0%
	% of Total	2.0%	6.0%	28.0%	26.0%	62.0%
More than 70 years	Number	0	0	2	1	3
	% within BMI groups	0.0%	0.0%	9.1%	4.3%	6.0%
	% of Total	0.0%	0.0%	4.0%	2.0%	6.0%
Total	Number	2	3	22	23	50
	% within BMI groups	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	4.0%	6.0%	44.0%	46.0%	100.0%

Discussion

Adult obesity and overweight have been linked to an increased incidence of breast cancer; however, research examining the impact of obesity and overweight on the prognosis of breast cancer has shown conflicting results. To fill this knowledge vacuum, we carried out a retrospective investigation to clarify the connection between obesity and the prevalence of breast cancer (11).

While the impact of BMI on the prognosis of breast cancer remains debatable, the following potential mechanisms have been revealed. Higher BMI women may not fully benefit from aromatase inhibitors in postmenopausal women because increased synthesis of peripheral estrogen in adipose tissue and reduced sex hormone binding globulin may be to blame for the poor prognosis of breast cancer in these patients. Moreover, enhanced aromatase activity may induce and stimulate the growth of abnormal mammary cells (12).

Moreover, due to concerns over toxicity, women with greater BMIs and older ages may tolerate comorbidities and lower chemotherapy doses. Additionally, women with higher BMIs may exhibit elevated levels of insulin, insulin-like growth factor, and hormones with strong mitogenic activity. Furthermore, the creation of a pro-inflammatory microenvironment and the paracrine release of interleukin-6 and tumor necrosis factor-alpha may encourage the growth and metastasis of tumors. Obese adipose tissue produces a number of cytokines that may accelerate the development of breast cancer by increasing the angiogenesis of breast tumors, suppressing antitumor immunity, and upregulating breast cancer stem cells. Therefore, a greater BMI may contribute to the development of breast cancer (13).

In contrast, the relationship between a higher BMI and a better prognosis is less evident when the tumor biology is aggressive, as in triple-negative cancer. One

could argue that, since most women with aggressive BC biological subtypes receive treatment with cytotoxic CT and can potentially mitigate the negative effects of a higher BMI with effective systemic therapy, the relationship between a higher BMI and an unfavorable outcome is less significant in these cases (14).

Conclusion

We concluded that there is strong association between the incidence of breast cancer and the value of the body mass index especially in older people. We recommend performing educational campaigns about this fact and about weight reduction to decrease the incidence of cancer in women.