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Original Research Article

Correlation between Body Mass Index and Post-Mastectomy Chronic Pain

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ABSTRACT

Post-mastectomy chronic pain (PMCP) refers to any pain that lasts longer than six months. Many risk factors contribute to chronic pain, and it seems that body mass index (BMI) is one of them, but more research is required to confirm it. This study aimed to investigate the relationship between BMI and PMCP. This correlational study was conducted during 2018-2020 on 340 patients who had undergone mastectomy. They were selected using convenience sampling of patients visiting hospitals affiliated to Tabriz University of Medical Sciences. The risk of chronic pain was measured using the visual analog scale (VAS), and its correlation with BMI was determined using descriptive and inferential statistics. High BMI can be a risk factor exacerbating PMCP ($P<0.001$). In this study, the negative impact of high BMI on exacerbation of PNCP was investigated. The results may prepare the ground for developing preventive interventions for chronic pain.

Keywords: Body Mass Index, Mastectomy, Chronic Pain

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Introduction

Breast cancer has many negative impacts on women with this disease and pain is among the most common ones [1, 2]. Pain caused by disease is an unpleasant feeling that most patients are afraid of, but there are many methods for controlling it [3]. However, PMCP (which is treatment resistant) is considered a significant clinical concern due to its effect on quality of life [4] and general resistance to treatment [5]. The prevalence of PMCP has been reported to range from 20% to 30% [6, 7]. Recent advances in breast cancer management protocol, which includes chemotherapy, radiation therapy, lymph node removal and lumpectomy and mastectomy, seem to have reduced the prevalence and severity of chronic pain following breast cancer treatment [8-11].Although moderate to severe chronic pain still affects 15% of women [12], there seem to be many pathogenic mechanisms contributing to chronic pain after breast cancer treatment that have prevented reducing its incidence to zero [13]. Patient-related risk factors include age [14], genetic predisposition [15] and mental disorders such as anxiety and depression [15] whereas major axillary (armpit) surgeries and radiotherapy are among the treatment-related risk factors [16]. Obesity has recently been identified as a potential risk factor for chronic pain [9, 17], but no accurate information has been provided in this relation yet. It is therefore essential to determine the prevalence of PMCP and the possible factors influencing persistence of PMCP in order to prevent it and develop treatment strategies for improving quality of life of patients with breast cancer. Therefore, this study aimed to determine the correlation between high BMI and PMCP in patients with breast cancer.

Materials and Methods

This descriptive-correlational study was conducted during 2017-20 in Imam Reza, Shahid Madani and Ghazi Tabatabaei Teaching Hospitals affiliated to Tabriz University of Medical Sciences. Participants were selected using convenience sampling based on the research objective. The sample size (n = 340) was determined based on the statistical formula, a review of similar studies [10, 18] and a possible attrition rate of 10%. Patients who met the inclusion criteria (were of the minimum age of 18 years, had developed non-metastatic unilateral breast cancer, and had undergone a lumpectomy or mastectomy) entered the study. Exclusion criteria included patients with known pain disorders and those addicted to opium derivatives. There was no rule in participant selection and they entered the research based on the dates they had entered the medical centers mentioned above. It is worth mentioning that the number of patients selected in each of the hospitals, as in similar studies, depended on the total population of patients visiting it [19-21]. Consequently, 120, 90 and 130 patients visiting Imam Reza, Shahid Madani and Ghazi Tabatabaei hospitals entered the study, respectively. The research instrument consisted of two parts. The first part was a self-report completed by patients who were asked to complete the VAS checklists once a month up until 6 months after surgery. The patients were divided into four groups based on their pain intensity: the no-pain group (VAS score of 0), the mild-pain group (VAS scores <3), the moderate-pain group (VAS scores 3-6) and the severe-pain group (VAS scores>6). Any patient with a pain lasting longer than three months was allocated to the chronic pain group. This checklist has been used in various studies to determine pain intensity [18]. The classification system was

based on that used in the study by Meretoja who divided the patients into the three groups of no-pain, moderate-pain and severe-pain [9]. The second part of the research instrument dealt with factors affecting postoperative pain. All risk factors influencing PMCP mentioned in the study by Anderson et al. (10) were included in the researcher-made checklist, which was used only in this study and has not been registered anywhere. These factors included age, smoking, diabetes, BMI, the histopathological status of the disease, type of surgery (mastectomy or lumpectomy), axillary lymph node removal, reoperation, chemotherapy, radiation therapy and hormone therapy. Demographic data of the patients and their medical records, interventions and pathology reports were collected. Height (in cm with a precision of 0.1 cm) and weight (in kg with a precision of 0.1 kg) were measured using a Seca digital scale to calculate BMI. The data were analyzed using descriptive statistics (mean ± standard deviation and frequency-percentage), the independent samples t-test, and ANOVA and logistic regression was used to determine the correlation between them. Normality of data distribution was confirmed by the Kolmogorov-Smirnov test and qualitative data were assessed using chi-squared and Fisher's exact tests. The data were analyzed using SPSS 22. A p-value of 0.05 was considered statistically significant. The study was conducted following the approval of the Regional Ethics Committee Research. The objectives of the research were explained to the patients and they were assured that the information would be available only to the researcher. They were allowed to withdraw from the study at any time during the study and could get the results of the research. Informed consent was obtained from all patients.

Results

The mean ± standard deviation of the age of the patients was 58±12.12 years and of their BMI was 31±03.18. About 20% (n=70) of them had diabetes and 60% (n=202) had undergone lumpectomy. The demographic data and the information on the received treatments are presented in Table 1.

Table 1: Demographic data and treatments received by the patients

Variable	Amount
Age (Year)	**58±12.12**
Smoking	**42**
Diabetes	**70**
Mastectomy	**138**
Lumpectomy	**202**
Removal of lymph nodes	**178**
reoperation	**76**
Chemotherapy	**222**
Radiotherapy	**230**
BMI (kg/m^2)	
18.5-25	**62**
25-30	**98**
30-35	**58**
35-40	**62**
>40	**60**

No chronic pain was reported in 200 patients; 78 patients (22.94%) reported severe pain and 40 patients (11.76%) reported moderate pain. The statistical analysis revealed the correlation of chronic pain with age, type of surgery, reoperation, chemotherapy, radiation therapy, lymph node removal and BMI. A comparison of factors affecting chronic pain and their correlation with the influential indicators is shown in Table 2 based on the results of the Wilcoxon signed-rank test on various groups with respect to pain intensity.

Table 2: Comparison of factors affecting chronic pain and their correlation with influential indicators between the various groups based on pain intensity

Variable	P Value	CI95%	Severe chronic pain(n=78)	Moderate chronic pain(N=40)	No chronic pain(N=222)
Age (Year)	**<0.01**	**0.65 (0.60-1.03)**	**13.25 ±63**	**12.52 ±61**	**10.51 ±55**
Smoking	**0.92**	**0.85 (0.80-0.99)**	**16**	**6**	**20**
Diabetes	**0.71**	**1.03 (0.99-1.51)**	**42**	**18**	**10**
Mastectomy	**0.07**	**1.14 (1.11-1.28)**	**22**	**38**	**78**
Lumpectomy			**18**	**42**	**162**
Removal of lymph nodes	**<0.01**	**1.42 (1.22-2.14)**	**38**	**50**	**90**
reoperation	**0.01**	**1.55 (1.45-2.01)**	**28**	**30**	**18**
Chemotherapy	**<0.01**	**1.91 (1.55-2.42)**	**72**	**60**	**90**
Radiotherapy	**0.03**	**1.66 (1.50-2.66)**	**78**	**82**	**70**
BMI (kg/m^2)					
18.5-25			**8**	**12**	**42**
25-30		**1.02 (0.95-1.15)**	**12**	**28**	**58**
30-35	**0.05**		**18**	**26**	**14**
35-40			**20**	**30**	**12**
>40			**20**	**30**	**12**

Analysis of the data identified 8 potential risk factors associated with pain in patients with PMCP including age, BMI, type of surgery, lymph node removal, reoperation, chemotherapy, and radiation therapy. Chronic pain risk factors are shown in Table 3 based on the results of logistic regression.

Table 3: Chronic pain risk factors in the patients with chronic pain

Risk Factor	P Value	OR
Age	**0.001**	**0.32**
BMI	**0.001**	**0.42**
Surgery Type	**0.25**	**0.03**
Removal of lymph nodes	**0.03**	**0.40**
Reoperation	**0.001**	**0.21**
Chemotherapy	**0.001**	**0.48**
Radiotherapy	**0.001**	**0.22**

The results suggested that risk factors such as age, mastectomy, lumpectomy, lymph node removal, chemotherapy (P=0.001), radiation therapy, and reoperation were among the risk factors associated with high BMI that were involved in the development of chronic pain. The results are presented in Table 4.

Table 4: Risk factors associated with high BMI that were involved in the development of chronic pain in the female patients

Risk Factor	BMI > 30 N=180	BMI 25 – 30 N=94	BMI < 25 N=62	P Value
Age	**10.25 ±54**	**9.25 ±51**	**14.26 ±63**	**0.001**
BMI	**100**	**22**	**16**	**0.03**
Surgery Type	**112**	**42**	**28**	**0.036**
Removal of lymph nodes	**84**	**72**	**22**	**0.004**
Reoperation	**38**	**22**	**16**	**0.04**
Chemotherapy	**158**	**42**	**22**	**0.001**
Radiotherapy	**160**	**50**	**40**	**0.039**

Discussion

The results indicated that 41% (n=70) of the patients experienced various degrees of pain 6 months after breast cancer treatment and BMI was an independent risk factor for PMCP. Similar to this research, two other recent studies reported that BMI was a risk factor for chronic pain. In a meta-analysis on 860 patients receiving breast cancer treatment, Meretoja et al. (2014) reported that BMI was potentially associated with chronic pain 12 months after surgery [9]. In addition, Miaskowski et al. (2014) investigated 398 patients with persistent pain that lasted for 6 months. Pain intensity was classified as mild, moderate and severe. The patients with severe pain had higher BMI compared to those who experienced less severe pain [19]. In a retrospective study, Fecho et al. (2012) investigated 196 women who had undergone mastectomy and studied acute pain within one month and 6-12 months following surgery. According to their results, obese patients reported higher pain intensity one month after surgery and their BMI was reported as a factor contributing to high pain intensity 6-12 months after surgery [20]. This study is the first one conducted in Iran on the relationship between BMI and PMCP. There is a bilateral relationship between pain and BMI. For instance, pain contributes to reduced physical activity and depression is followed by obesity. In addition, chronic pain may increase stress and cortisol secretion which induces obesity. On the other hand, obesity-induced metabolic disorders can prepare the ground for the development of pain. Obesity may lead to mental illnesses [21] which are a major risk factor for PMCP [4]. These relationships are recommended to be fully investigated in future multivariate studies. Younger age is usually a predictive factor for PMCP. According to this study, younger age was shown to be associated with the development of PMCP as well as more severe pain [14]. As in this research, Anderson et al. (2015) reported a positive correlation between younger age and chronic pain. According to their report, chronic and severe pain were more common among

women younger than 50 compared to older patients. They stated that younger women experienced more severe pain because they received combination therapies such as chemotherapy, radiation therapy and surgery and had lower pain thresholds [6]. It is not clear whether this is due to the difference in physiological perception of pain, individual expression, or in daily physical activities of younger patients compared to older ones and requires further research. In addition to age and BMI, other risk factors for the development of chronic pain include the type of surgery, radiation therapy, lymph node removal, chemotherapy, reoperation and cancer grade. This finding conforms to the results of the present study and those of previous ones [14, 22-24]. In relation to type of surgery, Wang et al. (2016) reported in their meta-analysis that chronic pain was more common among women undergoing mastectomy compared to those undergoing lumpectomy. They believe that due to the larger incisions in mastectomy compared to lumpectomy, more nerves are incised which cause patients to experience more chronic pain. Their results agree with those of this research [7]. In this study, reoperation was also identified as a risk factor for the development of PMCP. In this regard, Ilhan et al. [2017] reported reoperation was a risk factor for the development of PMCP. In their review study, they investigated the results of 3792 patients and reported that the number of operations were associated with increased risk of chronic pain: those women who underwent several operations for breast cancer treatment were more likely to experience chronic pain [25]. In this study, lymph node removal was also identified as a risk factor for the development of chronic pain. In this regard, Spivey et al. (2018) investigated PMCP and reported that the simpler the operation was the less severe the postoperative chronic pain would be. However, the greater the scope of surgery was (and if it was accompanied by lymph node dissection) the more severe the chronic pain would become [26]. In their study, as in this research, chronic pain was more prevalent in patients undergoing lymph node removal. The results of this research also suggested that radiation therapy and chemotherapy were among the risk factors for PMCP. In their study, Na et al. (2016) reported that radiation therapy debilitated women with breast cancer and was one of the main factors increasing pain in the area of the body that was targeted in radiation therapy. They also stated that radiation therapy increased pain in the chest and disability in the women caused by weakness [27]. Boa et al. (2018) stated in their study that chemotherapy made the women more vulnerable to chronic pain by weakening their immune system and increasing their general weakness. They also reported that chronic pain was more prevalent in women undergoing chemotherapy [28]. Their results are in agreement with those of this research. One of the limitations of this study was that the daily activities the patients engaged in and whether they did their exercises were not taken into account. According to the results of this study, there was a direct correlation between BMI and PMCP in the patients with breast cancer.

Conclusion

High BMI may be a risk factor for the development of PMCP. In general, BMI control can be a goal for preventing postoperative chronic pain. The authors suggest that future research be conducted with an emphasis on overcoming the limitations of this study and also intervention studies be carried out to investigate the effects of weight reduction and low-calorie diets on PMCP in obese women.

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