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Original Research Article

Detection of Carpal Tunnel Syndrome in Women Experiencing Lymphedema after Mastectomy

Loghman Ghaderi¹, Ali Reza, Naseri^{2*}

¹Department of chemistry, Science and Research Branch, Islamic Azad University, Tehran, Iran

¹ Assistant Professor of Thoracic Surgery, Department of Surgery, School of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran (ORCID: 0000-0002-0823-830X)

² Assistant Professor of Radiotherapy, Department of Radiology, Rahat Breath and Sleep Research Center, Tabriz University of Medical Sciences, Tabriz, Iran. (Orcid: 0000-0001-9714-2379)

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ABSTRACT

Lymphedema, an unpleasant postmastectomy complication, entails neuromuscular injuries. The most common complication is developing carpal tunnel syndrome (CTS), exacerbated by chemotherapy in cancer patients. As detecting this complication is effective in the therapeutic process of the patients, this study aimed to detect CTS in women experiencing postmastectomy lymphedema. This cross-sectional descriptive study was conducted on 320 patients suffering from postoperative lymphedema in the hospitals affiliated to Tabriz University of Medical Sciences in Iran from 2018 to 2020. The participants were selected using convenience sampling. The Boston Carpal Tunnel Questionnaire (BCTQ) was used to detect CTS in the participants, and the data were analyzed using chi-square test. According to the questionnaire, 20% of the participants had CTS symptoms. Study of the results suggested that radiotherapy, lymph node removal during surgery, and diabetes mellitus could be involved in the development of CTS. The results indicated that one of every five women who experienced postmastectomy lymphedema and had undergone chemotherapy exhibited symptoms of CTS.

Keywords: Lymphedema, Breast Cancer, Carpal Tunnel Syndrome, Radiotherapy

Introduction

In addition to their advantages (increased life expectancy, higher survival rate, improved public health, etc.) (1, 2), breast cancer treatments are accompanied by extensive and unwanted complications. Postoperative lymphedema, psychological problems (stress, depression, aggression, etc.), cosmetic problems, family problems, and neuroskeletal injuries caused by surgery and radiotherapy are among the most common complications of breast cancer treatments (3, 4). Lymphedema following surgery and/or chemotherapy and radiotherapy is the among most unwanted complications for patients and can lead to other disabilities and complications (5, 6). Upper limb neuroskeletal disorders are among the complications and disabilities caused by lymphedema. The effects of these disorders may remain long after the treatment of lymphedema. With 10 percent prevalence among healthy women, carpal tunnel syndrome (CTS) is most common focal mononeuropathy caused by pinched nerve (7, 8). However, according to Retrouvey et al. (2018), lymphedema caused by breast cancer treatment has the prevalence of 20% (9). The development of CTS is associated with a broad spectrum of complications including pain, numbness in hands and fingers, difficulty with driving and with performing daily activities, and inability to carry out personal activities (10). These complications in breast cancer survivors can emerge more frequently compared with people without cancer, and they strongly affect their quality of life after cancer development (11). Furthermore, CTS in breast cancer survivors can lead to patients refusing to follow treatment process and receive treatment for the current illness, increasing patient costs, decreasing life expectancy, and severely reducing quality of life (12). Therefore, its timely detection allows planning to take therapeutic and preventive measures. Due to the lack of information on the prevalence of CTS among Iranian women, specialists have not developed any programs to prevent and control it. This has imposed heavy treatment costs and has caused undesirable complications for breast cancer survivors. In this regard, this study aimed to study the frequency of CTS in treated breast cancer women patients with lymphedema who visited educational medical centers in Tabriz, Iran.

Methodology

This cross-sectional descriptive study was carried out in Imam Reza, Shahid Madani, Ghazi Tabatabaei, and Alzahra Hospitals affiliated to Tabriz University of Medical Sciences from 2018 to 2020. Convenience sampling was used and the established inclusion and exclusion criteria were applied to select the participants. The sample size was determined after consulting the statistician

cooperating in the research project, taking into account the results of a similar study (9), setting the alpha at 0.05 and least significant difference level of 0.01, and using equal ratio estimation formula ($n=160$). The inclusion criteria included completion of breast cancer treatment at least six months before beginning research, development of lymphedema after breast surgery or chemotherapy and radiotherapy, and 30–70 age range. The exclusion criteria were history of CTS, shoulder and shoulder nerve surgery and shoulder and wrist trauma, use of corticosteroids in the last six months, metastatic cancers, and nervous system and cervical disc problems. The number of participants in each hospital in Tabriz was determined based on the total population of patients. Using convenience sampling, 122, 58, 102, and 38 participants were selected in Imam Reza, Shahid Madani, Ghazi Tabatabaei and Alzahra Hospitals, respectively. The participants entered the study after informed consent was obtained and the objectives of the study were explained in simple language. The research instrument consisted of two parts. The first part contained items on demographic information such as age, breast cancer side, and history of chemotherapy, radiotherapy, breast surgery, diabetes mellitus, and smoking. The second part was the Boston Carpal Tunnel Questionnaire (BCTQ) designed by Levine in 1993 to determine CTS symptom severity and functional status. It consists of 19 items in two parts (a symptom severity scale with 11 questions and a functional status scale with eight questions). Each item has five options and the score for ranges from 1 (asymptomatic) to 5 (very severe symptoms). The participants are divided into five groups based on symptom severity: score of 1–11 (asymptomatic), 12–22 (mild symptoms), 23–33 (moderate symptoms), 34–44 (severe symptoms), and 45 and higher (very severe symptoms). Moreover, based on the functional status, the patients are divided into five categories: score of 1–8 (asymptomatic), 9–16 (mild symptoms), 17–24 (moderate symptoms), 25–32 (severe symptoms), and 33 and higher (very severe symptoms) (13). The validity of the BCTQ in Iranian population is 92.75 and its reliability is 0.86 according to Cronbach's alpha (14). The reliability of this questionnaire was studied in this research using the test-retest method, and 15 questionnaires were completed in two stages, at a two-week interval, by 15 participants. Its reliability was 0.83 according to Cronbach's alpha. All of the participants in the moderate, severe, and very severe groups for both symptom severity and functional status were examined by an orthopedic specialist and, if necessary, were referred to a center for electromyography (EMG) for accurate examination. As in similar research, ethical considerations for human research were observed in this study. The study ethics code was obtained from the Regional Ethics Committee (IR.TBZMED.REC.1397.598). further considerations were obtaining the permission of the authorities of the hospitals and informed consent of the

participants, explaining the objectives of the research to the participants in clear and simple language, and clarifying that participating in the study was free.

The data were analyzed using SPSS 20 with the help of regression testing and Spearman's correlation at 0.05 significance level.

Results

All of the participants (n=320) remained in the research until its end (there was no participant attrition) and completely filled in the questionnaires. Their mean and standard deviation for age was 42.18 ± 6.39 , most of them (142 or 44.38%) had cancer in the right breast, history of chemotherapy (102 or 63.13%), radiotherapy (222 or 69.37%), surgery (142 or **75.62%**), and lymph node removal (82 or **56.87%**). Table 1 lists the personal-social and medical information of the participants.

Table 1. Demographic information and medical history of the participants

Variable		M±SD	N
Age Year		42.18±6.39	
Cancer side	Right	118	
	Left	142	
	bilateral	60	
Chemotherapy	Yes	102	
	NO	118	
Radiotherapy	Yes	222	
	NO	98	
Removal of lymph nodes	Yes	182	
	NO	138	
Smoking	Yes	24	
	NO	296	
Diabetes mellitus	Yes	78	
	NO	142	

Frequency distribution of CTS obtained from the BCTQs indicated that 76 participants (23.75%) showed severe and very severe symptoms based on the symptom severity scale and 66 participants

(20.62%) exhibited severe and very severe symptoms based on the functional status scale. Table 2 demonstrates the results of symptom severity and functional status according to the BCTQ.

Table 2. Symptom severity and functional status according to the BCTQ

Functional status	N (%)	Severity of symptoms	N (%)
no sign	(36.78) 118	no symptoms	(28.12) 90
Mild sign	(23.75) 76	Mild symptoms	(31.25) 100
Medium sign	(18.75) 60	Medium symptoms	(16.78) 54
Severe sign	(11.25) 36	Severe symptoms	(12.5) 40
Very Severe sign	(9.37) 30	Very Severe symptoms	(11.25) 36

Among all of the examined participants, 120 patients were grouped in higher than moderate severity of symptoms and functional status, and EMG tests revealed that 66 of them (20.62%) had CTS. The results of chi-square test suggested that there was a statistically significant relationship between CTS and the variables of age ($P = 0.003$), lymphedema ($P = 0.002$), history of radiotherapy ($P = 0.002$), lymph node removal ($P = 0.041$), and diabetes mellitus ($P = 0.038$). The relationships between the qualitative variables (based on test results) are shown in Table 3.

Table 3. The relationship between the variables related to varicose veins in pregnancy in the participants

Variable	P-Value
Age	0.003
lymphedema	0.002
Radiotherapy	0.002
Removal of lymph nodes	0.041
Diabetes mellitus	0.038

Discussion

This study aimed to examine the frequency ratio of CTS in women with treated breast cancer who visited educational medical centers in Tabriz. The results showed that the prevalence of this syndrome among the breast cancer survivors, all of whom had lymphedema, was 20.62%. CTS following lymphedema caused by breast cancer treatment is one of the most common problems during recovery from breast cancer that has undesirable effects on various

aspects of life in these patients (15). Congruent with this study, previous studies that have investigated the neuromuscular problems following breast cancer treatment, such as Pereira et al. (2015) (16) and Menzies et al. (2014) (17) reported prevalence rates of approximately 20%. Research has shown that history of lymphedema has a significant relationship with development of CTS and lymphedema is a risk factor for CTS. In this regard, the results of this study were similar to the findings of Retrouvey et al. (2018) (9). It seems that, in patients with lymphedema, inflammation in the hands and in the lymphatic vessels of the hands occurs due to edema compressing the nerves in the hands, which leads to developing CTS in the patients. The results of this study were in congruence with the results reported by Baltzer et al. (2017) (18). The results also indicated that history of radiotherapy, surgery, and lymph node removal were risk factors for the development of CTS. In this regard, the results of this research were congruent with the findings of Leppäpuska et al. (2019) (19) and Stubblefield et al. (2015) (20). Moreover, Stubblefield et al. (2015) stated that during breast surgery (with or without lymph node removal) the probability of nerve inflammation increases in the area due to the damage inflicted by the surgeon on the nerves in the breast, making the patient susceptible to neuroskeletal problems including CTS. Additionally, Leppäpuska et al. (19) suggested that radiotherapy weakens the axillary nerve of the nervous system and hence, the slightest pressure applied on the nerves in that area is accompanied by complications. They concluded that radiotherapy is one of the main reasons for the development of CTS in women with breast cancer. It seems that the high prevalence of this syndrome in breast cancer survivors with a history of lymphedema is closely related to the risk factors for cancer including radiotherapy, lymphedema, lymph node removal, and breast surgery and this problem in these patients can jeopardize achieving positive results by breast cancer treatment. Therefore, making interventions and taking preventive measures is necessary for researchers and specialists in this area. As the limitations of this study, the speed of transmission of nerve messages in EMG and the occupation of the patients and how they used their dominant hand were not examined. Further studies are recommended to accurately determine the prevalence of CTS and prevent its development through preventive interventions during breast cancer treatment.

Conclusion

Prevalence of CTS in this study was 20.62% in treated breast cancer patients who developed lymphedema. Identification of the risk factors for the development of this syndrome can prepare the ground for taking measures to prevent and control CTS in these patients.

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