Evaluation of shoulder girdle strength more than 12 month after modified radical mastectomy and axillary nodes dissection

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INTRODUCTION

Muscle strength is an essential element of normal function of body muscle. Atrophy and progressive reduction in muscle volume can be seen in patients with breast cancer (BC) operation and adjuvant therapy.¹,² In the modified radical mastectomy (MRM), the breast tissue, some of axillary lymph nodes and pectoral muscle fascia are completely removed which can cause severe breast deformity and upper arm disability.³,⁴ However, muscle strength was not changed postoperatively in some studies.⁵,⁶

The aim of this study is to evaluate shoulder girdle strength in women with BC postoperatively and compared the results with healthy matched group of women.

MATERIALS AND METHODS

This study was a randomized control trial (IRCT2013052213432N1) with two groups of BC survivors (BCS) and healthy controls (control group [CON]). The study samples were included postmenopausal women (Stage 0-III), who had spent surgical

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treatment, chemotherapy, and radiotherapy. By reviewing patient records, referring physicians and nurses, eligible subjects (800 patients) were selected to participate in the study. To select healthy individuals, records of patients referred to the prevention and screening centers studied and 700 healthy controls without a history of BC disease were also investigated.

Based our inclusion criteria, 33 postmenopausal women 45–65 years were selected, who had been diagnosed with stage 0–III BC and all initial treatment (surgery, chemotherapy and/or radiation) had completed at least 12 months before MRM and lymph node dissection. Subjects of this study were under hormone therapy (tamoxifen, 20 mg/day). Other inclusion criteria were no specific disease (diabetes, cardiovascular disease, MS, and thyroid disease), lack of menstrual periods in the past 6 months, no participation in regular exercise or physical activity program, no rehabilitation history of the upper thoracic spine and neck in the past 6 months. Among 700 healthy controls, 30 healthy postmenopausal women with the same age range as the CON (without cancer) were selected.

The research ethics committee approval was received from the Department of Sport Medicine, Kish International Campus, University of Tehran. Before registering and patient consent, the group confirmed the study. Medical consent was required from each participant’s physician before beginning this study. In addition, all participants completed the consent form and demographic information.

**Shoulder girdle strength measurement with a handheld dynamometer**

Peak muscle force as kilogram was measured by means of a maximal voluntary isometric contraction using a handheld dynamometer (Lafayette Instrument®, Lafayette, IN). Concurrent validity of Digital Handheld Dynamometer with isokinetic dynamometer has been proved.[6] The dynamometer reliability with (intraclass correlation coefficient = 0.82–0.97) has been reported in several studies for the strength test.[9] Strength was assessed for shoulder flexor muscles, internal and external rotators muscles, pectoral muscles, back muscles, and scapula stabilizer muscles. The participants were asked to push with maximum effort without moving their arm, for a 5 s count. Thirty seconds rest occurred between each trial. A 1 min rest period occurred between each testing position. Scapula abduction and upward rotation and scapula depression and adduction were performed according to Kendall[10] and the test positions of humeral flexion, scaption, and adduction were performed according to Hislop and Montgomery.[11] All assessments were done with same staff, at A.M.

**Data analysis**

Mean and standard deviation was used to describe the data, and multivariate analysis of variance was used to examine differences between the two healthy and patient groups ($P < 0.05$). Data analysis was performed using the software SPSS 21 (IBM SPSS Statistics software, version 21).

**RESULTS**

Subjects demographics characteristics are shown in Table 1. Study participants were postmenopausal and had similar demographic characteristics (sex, age, and body mass index). BC patients according to the type of previous surgery, chemotherapy, and radiotherapy, metastasis or recurrence of the disease were similar.

Significant differences were found between the groups on the dependent measures, Wilks’s $= 0.73 (F_{1,61} = 3.40, P = 0.006)$ indicate decreased upper extremity strength in the BCS group when compared to the control (CON) group.

All six of the shoulder strength measures were different between groups and are displayed in Table 2; flexion ($F_{1,61} = 9.25, P = 0.003$), abduction ($F_{1,61} = 11.51, P = 0.001$), internal rotation ($F_{1,61} = 13.49, P = 0.001$), external rotation ($F_{1,61} = 4.41, P = 0.040$), horizontal adduction ($F_{1,61} = 17.56, P = 0.000$), and depression ($F_{1,61} = 5.27, P = 0.025$). The findings indicate that the shoulder girdle strength in patients with BC is significantly lower than in healthy controls.

**DISCUSSION**

In the present study, differences between BCS and healthy age, matched, and gender controls were studied for upper extremity strength. The results show the impact of BC and its treatment on the shoulder girdle strength in patients with BC. The findings show that, there is significant difference in strength between BCS and healthy group.

Approximately, one-third of BCS have persistent losses in strength more than 1 year after treatment.[12] Several studies found decreased upper body strength in BCS. Subjectively, it has been reported that BCS have decreased muscle strength on the affected extremity, however, very few studies have quantified these actual deficits.[13] Shamley et al. found decreased activity in upper trapezius, rhomboid and serratus anterior muscle, in compared to affected limb.

<table>
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<th>Table 1: Participant (patients and healthy women) demographic data</th>
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<td><strong>Age</strong> (year)</td>
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<td><strong>Height</strong> (cm)</td>
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NS=Not significant; BMI = Body mass index; SD = Standard deviation; BC = Breast cancer; CON=Control group
Some researchers have found 40% of BCS 2.7 years after surgery[18], and 76% of patients had undergone breast conservative surgery[17]. In these studies, 66.7% and all test subjects, respectively, had undergone mastectomy. In studied women who had undergone surgery, during radiation therapy to the chest and breast, with the exception of the armpit, normal strength of arm was maintained during 6 weeks of radiation and the flexion, abduction, and external rotation strength at elevation 90° was decreased.[22] The difference between our results and the other's findings can be due to the type of surgery and the time of surgery.

Reduction in flexion, abduction and internal rotation strength[1,17,20,21] are understandable because the main muscles responsible for these movements, the pectorals and latissimus dorsi, are innervated by nerves that could be damaged during the surgery.[5] Serratus anterior muscles are also responsible for scapula protraction and upward rotation and arm elevation make possible. The weakness of abduction and upward rotation strength can occur due to long thoracic nerve injury.[11] With respect to variation in the treatment of BC patients, different effects are expected. Harrington[1] and Fisher,[21] in the same studies, were observed a significant reduction in strength of people with cancer. In these studies, 66.7% and all test subjects, respectively, had undergone mastectomy. In studied patients with BC, it appears the more invasive the BC surgery, the greater the impact on upper extremity disability, although further research is needed to explore this topic.[1]

The group that had axillary radiation treatment, compared with nonirradiated group, had a greater loss of shoulder strength in flexion, external rotation, and abduction.[17] In another study, irradiated patients reported significantly reduction in flexion and abduction except external rotation,
whereas, nonirradiated patients exhibited a significant reduction only in shoulder strength for flexion. Blomqvist et al. believe radiotherapy is the major cause for the reduction of shoulder strength in patients who underwent mastectomy surgery and axillary dissection. Strength was decreased in the BC patients in the recent study, all of whom had completed radiation therapy, is in agreement with the finding of the current study. On the other hand, according to Lee et al., radiation therapy, which is not in the armpit area, may be does not impair shoulder function. However, because of the lack of complete information about the exact position of radiotherapy in our study and some studies, it is not possible to compare the results. There is some recommendation that shoulder disability following radiotherapy may be latent, with reports of impairment starting at 3.9 years after radiotherapy. Perhaps for this reason, Lee et al. found no significant differences in strength following radiotherapy. It seems that our findings about BC complications and lower strength in patients confirmed Sugden’s study, because of 3 years (mean) distance than BC treatment.

The current study had some strengths and limitations; strengths are (1) comparison between healthy and BCS, (2) use of Hand Held Dynamometer as a reliable and valid strength measurements tools, (3) use of patients with same surgery type (MRM) and limitations are (1) small sample size, (2) wide age range, (3) no control of daily fatigue.

CONCLUSION

The results indicate the shoulder girdle strength in women with BC decreased compared with healthy women without cancer. Therefore, during the treatment of patients with BC, designing of training programs and rehabilitation programs need to be performed on special shoulder girdle strength factors in patients undergoing mastectomy with axillary surgery and radiation therapy.

Acknowledgments

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Nil.

Conflicts of interest

There are no conflicts of interest.

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