Original Article

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Complications Associated with Loco-Regional Treatment of Breast Cancer and Their Impact on Quality-of-Life

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ABSTRACT

Objective: Aim of this prospective study was to determine the complications of different treatment modalities for breast cancer and assess their impact on patients' quality-of-life and psychological status.

Materials and Methods: Patients surgically treated for early-stage breast cancer were enrolled in the study. Complications after treatment and quality-of-life parameters were measured and recorded.

Results: 218 patients, all female with a median age of 48 (19-82) years, were included in the study. In early period, significant limitation of shoulder movements, increased pain and decreased in functional capacity were observed, whereas in mid-term, all shoulder movements, as well as pain and functional capacity returned normal. In both early period and mid-terms, anxiety scores were significantly decreased, whereas depression scores were significantly increased. In early period, there was a significant decrease in physical and mental area scores. Social area scores were significantly increased, whereas environmental, mental and physical area scores were significantly decreased in mid-term and late period.

Conclusion: Overall, patients' quality-of-life was found to be significantly deteriorated in both early period and mid-term and returned to pre-treatment period at long term follow up.

Keywords: Breast cancer, quality-of-life, chronic pain, axillary dissection, radiotherapy

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Introduction

In developed countries, one of every eight women suffers from breast cancer at some stage in life (1). Survival rate of women with breast cancer is similar to that of the same-age group in general population with early diagnosis and effective treatment. Therefore, the importance of the breast in a woman's body image as a symbol of her sexuality is a common concern.

Goal of modern breast cancer treatment is to provide local and systemic tumor control, minimize complications, achieve good functional results, and, if possible, to conserve the breast (2-9). Axillary dissection (AD) is associated with important complications such as upper extremity pain, loss of sensation, lymphedema (LE), weakness and limitation of shoulder movements. Upper extremity morbidity may cause difficulties in daily activities and corresponding stress and adaptation difficulties. Sentinel lymph node biopsy (SLNB) is accepted as an alternative to AD with less morbidity in patients with clinically negative axillary findings (5-9). Rates of shoulder movement limitation are lower in patients undergoing SLNB compared to those in patients undergoing AD.

Aim of this prospective study was to determine the early-period, mid-term and late-period complications of loco-regional treatment modalities (Surgery and Radiation Therapy (RT)) for breast cancer and to assess their impact on patients' Quality of Life (QoL) and psychological status.

Materials and Methods

This study was designed as a prospective observational cohort study targeting patients undergoing surgical treatment for early-stage breast cancer. Study population was selected from patients treated in the Breast Units of İstanbul University Istanbul Medical Faculty. Patients with

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early stage (I and II) unilateral breast cancer, were included in the study. All patients signed informed consent forms. Patients with locomotor or neurological diseases at ipsilateral arm, shoulder or axilla, who had recurrent breast cancer or died from breast cancer or other causes during the study, were also excluded from the study.

Study design

At pre-treatment period, patients with a histological diagnosis of breast cancer were informed of the study and their informed consent were received, arm-shoulder functions were assessed by Constant test and demographic data (age, gender, body mass index (BMI), smoking and alcohol consumption, education, marital status, etc.) were recorded. Quality-of-life scales, including ASES (American Shoulder and Elbow Surgeons) test, HAD (Hospital Anxiety and Depression) scale and World Health Organization Quality of Life Scale (WHOQOL-BREF scale), were applied to patients and results were recorded.

The type of loco-regional surgery, drainage methods and retention time, total number of lymph nodes extracted from the axilla, pathological findings, regional and systemic adjuvant therapy (type and time), and treatment-related complications were recorded.

All the patients were invited for clinical follow-up in early (1 week), intermediate (9 to 12 months) and late periods (once in a year after the first year) after surgery. In each follow-up, arm-shoulder functions were measured, presence of chronic pain and any other complaints were recorded. Loss of sensation at arm was objectively assessed by Pinprick test. In addition, patients were assessed by psychologists in the first 3 months after surgery and between 9-12 months. Psychometric measurement questionnaires (WHOQOL-BREF QoL scale and HAD scale) were recorded during face-to-face interviews.

Scales

Constant test: It consists of three phases including arm pain, functional capacity and objective measurements of shoulder movements (10). The normal scores of Constant test are 15 in arm pain, 20 in functional capacity and 40 in shoulder movements. The pain score is inversely correlated with the pain experienced by the patient. Shoulder movements were objectively evaluated by examining four shoulder movements (abduction, flexion, internal rotation and external rotation) and by measuring angles with goniometer.

ASES test: It consists of 20 questions (about washing the back, combing hair, sleeping on the operated side, etc.), subjectively assessing patients' QoL. Patients are questioned about their daily activities and are asked to score every action subjectively (10).

HAD scale: It is a self-assessment scale applied to patients with physical diseases and referred to primary care services to determine the risk of anxiety and depression and to measure the level and change of their intensities. It provides a four-point Likert-type measurement. Test contains 14 questions in total, 7 of which (uneven numbers) measure anxiety, whereas other 7 questions (even numbers) measure depression. Subscale scores range from 0 to 21. Cut-off scores for the anxiety subscale (HAD-A) and depression subscale (HADS-D) are 10/11 and 7/8, respectively. Therefore, patients with scores above these values are considered at risk. Validity and reliability of its Turkish version was confirmed previously (11, 12).

WHOQOL-BREF quality-of-life scale: It consists of 26 questions, including two questions about generally perceived QoL and perceived health status. It evaluates patient's physical (daily-task performance, drug and treatment dependency, vitality, exhaustion, physical mobility, pain and discomfort, sleep and rest and work ability), psychological (physical image and appearance, negative emotions, memory and concentration), social (relationship with other people, social support, and sexual life) and environmental status (financial resources, physical security, health service accessibility, home environment, recreation and leisure opportunities, physical environment and transportation) during past 15 days. Validity and reliability of its Turkish version were confirmed previously (13). Higher scores count as better QoL. Scale is for self-evaluation.

Study outcomes

Primary outcomes:

1. Arm and shoulder function measurements in early period (1 week), mid-term (9 to 12 months) periods,
2. Quality-of-life measurements in early period, mid-term periods.

Secondary outcomes:

1. Determination of significant factors adversely affecting mid-term QoL level (age, BMI, smoking and alcohol consumption, surgery type, axillary intervention type, presence of drainage, drainage retention time, tumor type, number of removed axillary lymph nodes, cancer stage, presence or absence of RT and chemotherapy [CT] administration, lymphedema, loss of sensation, arm pain, measurements of arm and shoulder movements and functional capacity and ASES score),
2. Loss of sensation at ipsilateral arm in early period and mid-term periods,
3. Determination of significant factors leading to mid-term loss of sensation (age, BMI, smoking and alcohol consumption, surgical procedure, type of axillary surgery, presence of drainage, drainage removal time, tumor type, number of removed axillary lymph nodes, cancer stage, and presence or absence of RT and CT),
4. Arm and shoulder function measurements in late period.

Statistics Analysis

All information was collected in a data base created using the Statistical Package for the Social Sciences (SPSS) version 16.0 (SPSS Inc., Chicago, IL, USA) program. The comparison between different time points was performed by repeated measures variance analysis and to reduce the statistical significance level (p-value) Bonferroni correction was used (After Bonferroni correction value of $p \leq 0.01$ was considered as a significant). One-way ANOVA, Tukey test, Chi-square test, Man Withney U test, Mc Nemar tests and logistic regression analysis were used where appropriate. Friedman and Wilcoxon tests were used to detect the differences and changes in scores of QoL scale and HAD scale. Value of $p \leq 0.05$ was considered as a significant. All values were expressed as mean±SD.

Results

A total of 221 patients were enrolled in this prospective study, of which 177 were treated at İstanbul University İstanbul School of Medicine Department of Surgery and 44 were treated at Marmara University School of Medicine Department of General Surgery. Three patients were died during study period therefore they were excluded from the study. Data of remaining 218 patients were assessed in early period, mid-term and late periods. Median follow-up time of this group was 64 (24-82) months.

Patients characteristics

Median age and mean BMI of 218 patients were 48 (19-82) years and 27.2 (17.7-41.7), respectively. Among these patients, 166 (76.1%) had a history of smoking, 118 (54.1%) underwent mastectomy, 100 (45.9%) underwent breast conserving surgery (BCS), 131 (60.1%) underwent standard level I-II AD due to positive sentinel lymph node(s), 87 (39.9%) underwent SLNB only. Closed drainage system was applied to 160 patients (73.0%) and their average retention time was 11.8 (1-60) days. Invasive ductal cancer was most frequently encountered malignant tumor (n=175, 80.3%). Half of patients were in stage II. Median number of lymph nodes removed from patients who underwent AD was 15 (7-42). A total of 169 patients (77.5%) received adjuvant RT: 81 (37.1%) to the breast after BCS, 52 (23.9%) to the chest wall and regional lymphatics after mastectomy and 36 (16.5%) to both breast and regional lymphatics after BCS. In addition, 38 patients (17.4%) received adjuvant CT (Table 1).

Table 1. Patients' characteristics

Age; median (range)	48 (19-82)
Body Mass Index; median (SD)	27.2 (4.99)
Smoking history; n (%)	
Non-smoker	52 (23.9)
Smoker	166 (76.1)
Surgery type; n (%)	
Mastectomy	118 (54.1)
Breast conserving surgery	100 (45.9)
Type of axillary intervention; n (%)	
Only SLNB*	87 (39.9)
SLNB+AD**	131 (60.1)
Drainage; n (%)	
Yes	160 (73.0)
No	58 (27.0)
Drainage retention time; mean day (SD)	11.75 (9.38)
Tumor histology; n (%)	
Ductal carcinoma in situ	9 (4.2)
Invasive ductal cancer	175 (80.3)
Invasive lobular cancer	15 (6.9)
Other	19 (8.6)
Pathologic stage; n (%)	
0	9 (4.2)
1	68 (31.1)
2	109 (50.0)
3	32 (14.7)
Number of removed lymph nodes*; median (range)	15 (7-42)
Radiotherapy; n (%)	
No	49 (22.5)
Yes	
Breast only	81 (37.1)
Breast and/or regional lymphatics	88 (40.4)
Chemotherapy; n (%)	
No	180 (82.6)
Yes	38 (17.4)

*SLNB: sentinel lymph node biopsy

**AD: axillary dissection

Early period

Constant test demonstrated that arm pain at ipsilateral operated side in early postoperative period (19.87±6.31) significantly decreased compared to that in preoperative period (23.76±5.31; p<0.001) (Table 2). Arm functional capacity in early postoperative period significantly decreased (7.99±2.56) compared to that in preoperative period (9.44±1.72; p<0.001) (Table 3). Statistically significant limitations were observed in shoulder movements, including flexion (8.14±2.66) (Table 4), abduction (7.76±2.77) (Table 5), internal rotation (7.87±3.07) (Table 6) and external rotation (7.80±3.04) (Table 7) in early postoperative period compared to those in preoperative period (flexion (9.63±1.15), abduction (9.55±1.17), internal rotation (9.53±1.32) and external rotation (9.42±1.60); p<0.001). AD was identified as only significant factor for deterioration of functional capacity of the arm and flexion, abduction, internal and external rotation movements in early postoperative period (p=0.008, p=0.019, p=0.020, p=0.002 and p=0.001, respectively).

American Shoulder and Elbow Surgeons test scores in early postoperative period (51.32±10.61) were significantly lower than those in preoperative period (56.33±11.54; p<0.007) (Table 8). AD was identified as the only significant factor responsible for lower ASES scores in this period (p=0.037).

Anxiety scores of patients in early postoperative period (7.38±5.38) were significantly decreased compared to those in preoperative period (7.78±4.98, p=0.002). Only smoking was found to be statistically significant among factors related with anxiety, (p=0.037).

Depression scores in early postoperative period (5.59±4.58) were significantly increased compared to those in preoperative period (6.30±5.07, p=0.005). Smoking (p=0.008) and AD (p=0.045) were found as significant factors related with depression.

In early postoperative period, overall QoL (QoL; 3.31±0.78), environmental area (EA; 15.00±1.93) were deteriorated significantly than in preoperative period (3.43±0.80, 14.91±2.06; p=0.026, p=0.048, respectively) and social area (SA; 16.19±2.48) scores were not significantly different than those in preoperative period (15.56±2.65; p=0.068). Therefore, there was a significant deterioration in the early postoperative physical area score (PA; 13.50±2.87) when compared to that in preoperative period (15.33±2.71, p<0.001). Also, mental area score (MA, 13.72±2.83) in early postoperative period was also significantly impaired compared to that in preoperative period (14.84±2.61, p=0.039) (Table 9). In the early postoperative period, presence of drainage was identified as the only significant factor affecting PA score (p=0.044).

In early postoperative period, 22 patients (10.1%) experienced loss of sensation. Among factors affecting loss of sensation in postoperative period, AD (p=0.004) and presence of drainage (p=0.012) were found to be statistically significant factors. In multivariate analysis, presence of drainage (p=0.033) was identified as the only independent factor affecting loss of sensation.

Table 2. Comparison of Constant arm pain scores at different time points

Arm pain	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	23.76	5.31	20.85	≤0.001	**1-2=≤0.001**	**2-3=≤0.001**
Early period (2)	19.87	6.31			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	23.35	4.17			1-4=0.610	**3-4=0.007**
Late period (4)	24.64	1.75				

*: repeated measures variance analysis

**: after bonferroni correction, α=0.05/4=0.01

Table 3. Comparison of Constant functional capacity scores at different time points

Functional capacity	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	9.44	1.72	19.877	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	7.99	2.56			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	9.47	1.64			1-4=0.022	3-4=0.013
Late period (4)	9.94	0.45				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

Table 4. Comparison of Constant flexion movement of arm at different time points

Flexion	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	9.63	1.15	33.394	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	8.14	2.66			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	9.58	1.19			1-4=1.000	3-4=1.000
Late period (4)	9.52	1.18				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

Table 5. Comparison of Constant abduction movement of arm at different time points

Abduction	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	9. 55	1.17	42.262	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	7.76	2.77			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	9.47	1.33			1-4=1.000	3-4=1.000
Late period (4)	9.45	1.87				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

Mid-term

Arm pain on the operated side in the mid-term postoperative period (23.35±4.17) was similar to that of the preoperative period (23.76±5.31) (Table 2). Functional capacity of the operated arm in mid-term postoperative period (9.47±1.64) decreased compared to that in preoperative period (9.44±1.72), however, the difference was not statistically signifi-

Table 6. Comparison of Constant internal rotation movement of arm at different time points

Internal rotation	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	9.53	1.32	28.159	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	7.87	3.07			1-3=0.033	**2-4=≤0.001**
Mid-term (3)	9.17	1.96			1-4=0.031	3-4=1.000
Late period (4)	9.16	1.95				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

Table 7. Comparison of Constant external rotation movement of arm at different time points

External rotation	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	9.42	1.60	34.890	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	7.80	3.04			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	9.45	1.53			1-4=1.000	3-4=1.000
Late period (4)	9.50	1.43				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

Table 8. Comparison of ASES scores at different time points

ASES	Mean	SD	F*	p	P values after Bonferroni correction**	
Pre-treatment (1)	56.33	11.54	23.189	≤0.001	**1-2= ≤0.001**	**2-3=≤0.001**
Early period (2)	51.32	10.61			1-3=1.000	**2-4=≤0.001**
Mid-term (3)	57.89	5.81			1-4=0.074	3-4=0.003
Late period (4)	59.34	4.01				

*: repeated measures variance analysis

**: after Bonferroni correction, α=0.05/4=0.01

cant either (p=1.000) (Table 3). There was no difference between shoulder movements of flexion (9.58±1.19) (Table 4), abduction (9.47±1.33) (Table 5), internal rotation (9.17±1.96) (Table 6) and external rotation (9.45±1.53) (Table 7) in mid-term postoperative period and those in preoperative period (flexion (9.63±1.15), abduction (9.55±1.17), internal rotation (9.53±1.32) and external rotation (9.42±1.60); p=1.000, 1.000, 0.033 and 1.000, respectively). AD comparing with SLNB at mid-term period, there was no statistical significance detected between arm pain, functional capacity and shoulder motions.

For ASES test, no difference was observed between mid-term postoperative (57.89±5.81) and preoperative period scores (56.33±11.54) (p=1.000) (Table 8).

In mid-term postoperative period, anxiety scores (7.46±4.53) were statistically significantly lower than those in preoperative period (7.78±4.98, p=0.001). Among the factors affecting anxiety, only smoking was found to be statistically significant (p=0.006).

Depression scores in mid-term postoperative period (7.46±4.53) were significantly increased compared to those in preoperative values (6.30±5.07, p=0.038). AD (p=0.021), mastectomy (p=0.036), drainage (p=0.028) and loss of sensation (p=0.027) were found to be significant factors for depression in mid-term postoperative period. Multivariate analysis revealed that only AD (p=0.030) and drainage (p=0.016) were independent factors.

In QoL (3.58±12.50) and MA (14.32±2.76) scores there were no statistically significant difference detected when compared with preoperative period (3.43±0.80, 14.84±2.61; p=0.077 and p=0.080). Significant difference was observed in EA (14.16±2.21) and SA (15.72±2.73) scores in mid-term postoperative period when compared

Table 9. Comparisons of quality of life scales at different time-points and the relevant p-values

Tests	Pre-treatment	Early period (p^1)	Mid-term (p^2)	Late period (p^3)
HAD Scale				
Anxiety	7.78±4.98	7.38±5.38 (0.002)	7.46±4.53 (0.001)	**Could not be performed**
Depression	6.30±5.07	5.59±4.58 (0.005)	7.46±4.53 (0.021)	
WHOQOL-BREF Scale				**Could not be performed**
*EA				
**SA	14.91±2.06	15.00±1.93 (0.048)	14.16±2.21 (0.014)	
*** PA	15.56±2.65	16.19±2.48 NS	15.72±2.73 (0.006)	
****MA	15.33±2.71	13.50±2.87 (<0.001)	14.04±2.91 (0.001)	
	14.84±2.61	13.72±2.83 (0.039)	14.32±2.76 NS	

*EA: environmental area

**SA: social area

***PA: physical area

****MA: mental area

p^1: Between pretreatment and early period

p^2: Between pretreatment and mid term

p^3: Between pretreatment and late period

NS: Non-significant

to those in preoperative period (14.91±2.06 and 15.56±2.65; p=0.014 and p=0.006, respectively). PA score in mid-term postoperative period (14.04 ± 2.91) showed a significant deterioration when compared to that in preoperative period (15.33 ± 2.71, p=0.001) (Table 9). In mid-term postoperative period, no factor was found to affect to QOL or MA, whereas increased BMI (p=0.04) and ALND (p=0.038) were identified as significant factors affecting PA score. In multivariate analysis, both increased BMI (p=0.01) and AD (p=0.02) were identified as the independent factors affecting PA score. Also, significant factors affecting SA score in mid-term postoperative period included increased BMI (p=0.029), lymphedema (p=0.001), shoulder movement restriction (p<0.001) and mastectomy (p=0.044). Among those, increased BMI (p=0.012) was the only independent factor. Lymphedema (p=0.014) and shoulder movement restriction (p=0.009) were found as significant factors affecting EA score of which only lymphedema was the independent factor (p=0.008).

Loss of sensation was seen in 25 patients (11.5%) in the mid-term postoperative period. When factors affecting the loss of sensation in the mid-term postoperative period were examined; no statistically significant factors were identified.

Late period

No statistically significant decrease was observed in pain at the operated arm in late postoperative period (24.64±1.75) compared to that in preoperative period (23.76±5.31) (p=0.610) (Table 2). Increase in functional capacity at the operated arm in postoperative late period (9.94±0.45) was compared to that in preoperative period (9.44±1.72), and the difference was not significant, p=0.022 (Table 3). Shoulder movements including flexion (9.52±1.18) (Table 4), abduction (9.45±1.87) (Table 5), internal rotation (9.16±1.95) (Table 6) and external rotation (9.50±1.43) (Table 7) in postoperative mid-term period did not differ from those in preoperative period (flexion (9.63±1.15), abduction (9.55±1.17), internal rotation (9.53±1.32) and external rotation (9.42±1.60); p=1.000, 1.000, 0.031 and 1.000, respectively) (Table 2-7). AD comparing with SLNB at late period, there was no statistical significance detected between arm pain, functional capacity and shoulder motions.

For ASES test, no difference was observed between late period (59.34±4.01) and preoperative period scores (56.33±11.54) (p=0.074) (Table 8).

At late period, HAD scale and WHOQOL-BREF Quality-of-Life Scale could not be performed.

In late postoperative period, 10 patients (5.8%) exhibited loss of sensation. Lymphedema was identified as the only significant factor affecting the loss of sensation in late postoperative period (p=0.049).

Discussion and Conclusion

Most common complications after breast cancer treatment include limitation of arm and shoulder movements, arm pain, decreased functional capacity, loss of sensation, lymphedema, and therefore, deterioration of QoL. Most common complaint after breast cancer treatment is pain (7-9). No relationship has been reported between intensity of the pain and surgery involving axilla or RT (14, 15). Pain persists in 12% to 51% of patients even one year after surgery (16). In this study, only in early period after surgery there was an increment in pain score detected, but this was not continued after that and there was no factor detected to explain this increment.

Shoulder movement limitation in breast patients varies between 2% and 51% (17, 18), and arm strength loss is between 16% and 40%

(19). Shoulder movement limitation on flexion, abduction and external rotation are more frequently seen (20). This limitation rate orderly increases in presence of following conditions: comprehensive surgical treatment (21, 22), nerve damage (long thoracic and thoracodorsal nerve) (23) and RT (21). Ernst et al. (23) have reported limitation in shoulder abduction after AD. However, there was no significant difference between postoperative short (6 to 12 months) and long-term (>5 years) periods in means of abduction limitation. The present study revealed that surgical methods (mastectomy and BCS) have no effect on shoulder movements. Our study showed that all shoulder movements (flexion, abduction, internal rotation and external rotation) showed limitation in early postoperative period but after that all limitations were completely disappeared.

Axillary dissection has a negative effect on both functional shoulder capacity and shoulder movements. Schijven et al. (24) concluded that 15% of patients undergoing AD have difficulties in performing daily activities, and this rate was 7.8% in patients who underwent SLNB only. In a multi-center prospective study in Sweden, a statistically significant difference was observed in the AD group regarding arm pain, limitation of shoulder movements and lymphedema compared to those in SLNB group (25). In the present study, AD was the only factor affecting the decrease in functional capacity and arm movements in early period.

One of the most important problems after breast cancer treatment is development of psychological disorders. These disorders impair patients' QoL, leading to decreased patient compliance to treatment and shorter survival (26). In the present study, AD, mastectomy and presence of drainage, loss of sensation and lymphedema were determined as significant factors causing depression. However multivariate analysis revealed that AD and presence of drainage were independent factors. In addition, high BMI, shoulder movement limitation and lymphedema resulted in problems in social, environmental and physical areas. These problems were significantly worse in mid-term period. Body image loss in young patients leads to problems such as difficulties in establishing physical contact with people (embracing people, prurience, etc.), feeling excluded from social life, growing worries and disease recurrence fears, and depression especially in the absence of adequate family support (27).

Simple screening questionnaires, such as HAD, help clinicians to refer patients to expert psychologist, and increase patients' compliance rate to treatment which are considered significant improvements in patients' QoL (28).

There are several strengths of the present study. It is designed as a prospective observational study and most patients were followed more than 24 months. All patients were monitored on a regular basis and assessed by constant physician and psychologist throughout the study. At each evaluation, physical measurements were performed, QoL and psychological assessment tests were applied. This study, conducted at two major centers in Turkey, is the first Turkish multicenter collaborative study for loco-regional breast cancer treatment and its consequences.

The limitations of this study were that, measuring quality of life was performed by using general scales, not used much specific tests. Follow up period was so long and late period quality of life scales (HAD scale and WHOQOL-BREF Quality-of-Life Scale) could not be performed.

As a conclusion, following loco-regional breast cancer treatment, significant limitation of shoulder movements and functional capacity were observed in early follow-up. But almost all limitations returned normal within one year. Overall, patients' quality-of-life was found to be significantly deteriorated in both early and mid-term. Patients undergoing SLNB but not receiving RT to regional lymphatics had better QoL after treatment.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Zahedan University of Medical Sciences (IR.ZAUMS.REC.1394.153).

Informed Consent: Written informed consent was obtained from patient who participated in this study.

Peer-review: Externally peer-reviewed.

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