RESEARCH ARTICLE

Effectiveness of preoperative stretchings on postoperative shoulder function in patients undergoing mastectomy

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Abstract

Objective: To analyse the effects of pre-operative stretchings of shoulder muscles on post-operative shoulder function in patients undergoing mastectomy.

Method: The comparative study was conducted from January to May 2019 at Allied Hospital, Madinah Teaching Hospital and the District Headquarter Hospital, Faisalabad, Pakistan, and comprised mastectomy patients. The subjects were randomised to treatment and control groups. The treatment group received static stretching with range of motion, while the control group received routine post-operative care. Data was collected using Numeric Pain Rating Scale, Universal goniometer and Groningen Activity Restriction Scale at post-op day 1 and day 3. Data was analysed using SPSS 20.

Results: Of the 30- patients, there were 15(50%) in each of the two groups. The overall mean age was 46±10.75 years. The treatment group showed significant difference ($p<0.05$) in pain, range of motion and Groningen Activity Restriction Scale scores for activities of daily living compared to the control group. The treatment group also showed better results in terms of shoulder flexion and abduction range of motion ($p<0.05$), but showed non-significant difference ($p>0.05$) in external rotation and Groningen Activity Restriction Scale scores.

Conclusion: Pre-operative stretching of shoulder muscles proved to be safe and effective in reducing post-operative pain and functional restriction in patients undergoing mastectomy.

Keywords: Pre-operative stretching, Stretching of shoulder muscles, Post-op shoulder function, Mastectomy.
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Introduction

Breast cancer is the second most common cause of death in the developed world. It ranks as the fifth leading cause of death and the most common cause of cancer-related death in women. In many countries it has become the number one malignancy in females.[1] Incidence rate of breast cancer among females in Pakistan is higher compared to the other countries of Asia, except among the Jews in Israel. It is accounted for 23% of all cancer cases globally.[2] Every year in Pakistan, at least 90,000 females suffer from breast cancer. One in every nine Pakistani female suffers from breast cancer which is the highest incidence rate in Asia.[3] The main factors that play a vital role in breast cancer development comprise genetics and the living environment, the reproductive cycle, effects of exogenous and endogenous hormones as well as immunity and host vulnerability. Pakistani women have factors that increase the risk and that include age at menarche, oral contraceptive usage, polycystic ovaries (PCOs), first pregnancy at late age and lack of breastfeeding. Other factors which increase the risk are increasing age, family or previous history of breast cancer, obesity, radiation exposure, alcohol consumption and post-menopausal hormone replacement therapy (HRT).[4]

Pre-operative shoulder flexion, abduction range of motion (ROM) and grip strength are reliable predictors of post-operative flexion and abduction ROM as well as of grip strength recovery. Individuals with limited ROM pre-surgery have a more significant ROM decline post-surgery and do not return to the prior level even after 1 year. Preoperative activity level depicts the post-operative recovery in patients undergoing mastectomy.[5] In breast cancer treatment, upper limb dysfunction is a common side effect which includes decreased shoulder ROM, strength, pain and lymphoedema.[6] Upper limb arm morbidities are common side effects of breast cancer, and affect activities of daily livings (ADLs) and instrumental ADLs (IADLs). Physical, social and emotional functioning is also affected, and quality of life (QOL) remains disturbed sometimes for longer period following treatment.[7] Pre-operative exercises may prove to be advantageous for cancerous patients through positive effects on power and physical functioning. Oncologists consider pre-operative exercise interventions as an important additional therapy to improve patient's post-operative functional outcomes.[8] Scapula plays very important role in stability and strength of shoulder. It has strong relation with all the

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muscles of the shoulder because majority of shoulder muscles are attached to the scapula. This is the reason scapulo-humeral rhythm get disturbed at first in breast cancer, and that is why scapula-oriented exercise is very effective in dealing with shoulder pain, QOL and muscle strength.[9] Pre-operative shoulder exercise can reduce post-operative pain without increasing risk of developing seroma.[10] Pre-operative exercises and education are very beneficial in reducing the incidence of breast cancer-related upper limb dysfunction. Pre-operative exercises reduce the rehabilitation period because shoulder ROMs regain strength earlier which reduces the chance of secondary complications. The time invested pre-surgery helps to maintain and improve shoulder ROMs and strength.[11] A study confirmed that stretching is very effective in increasing flexibility and muscle extensibility. Static stretching is particularly more effective at increasing range. The greatest change in ROM with a static stretch occurs between 15 and 30 seconds, and most studies suggest 10-30 seconds is sufficient time for increasing flexibility.[12]

The current study was planned to analyse the effects of pre-operative stretching of shoulder muscles on post-operative shoulder function, and to find the impact of stretching on ADLs of females undergoing mastectomy.

Patients and Methods

The comparative study was conducted from January to May 2019 at Allied Hospital, Madinah Teaching Hospital and the District Headquarter (DHQ) Hospital, Faisalabad, Pakistan, and comprised mastectomy patients. Sample size of 30 patients were included by using following formula:[13]

$$\frac{n = 2[(a + b)^2\sigma^2]}{(\mu^1-\mu^2)^2}$$

The sample was raised using convenience sampling technique. Those included were patients aged 35-65 years with unilateral modified radical mastectomy and axillary clearance. Those excluded were patients with local breast cancer recurrence, previous cancer history, distant metastasis, diagnosed pre-existing shoulder joint disorders, like rheumatoid arthritis, diabetics, previous surgeries within the preceding 2 years involving chest wall, neck shoulder and arm, and patients with diagnosed psychiatric problems. All patients who were undergoing modified radical mastectomy were screened and those who met the inclusion criteria were included. After getting permission from Ethical Review Committee and taking informed consent from patients, and then subjects were randomly allocated into cases and controls through lottery method in which each participant was requested to draw

Annexure: Groningen Activity Restriction Scale.[16]

TABLE 1—Items and Response Categories of the Groningen Activity Restriction Scale (GARS)

Response categories for each item
1. Yes, I can do it fully independently without any difficulty.
2. Yes, I can do it fully independently but with some difficulty.
3. Yes, I can do it fully independently but with great difficulty.
4. No, I cannot do it fully independently, I can only do it with someone's help.
5. No, I cannot do it at all, I need complete help.

Activities of daily living (ADL)
1. Can you, fully independently, dress yourself?
2. Can you, fully independently, get in and out of bed?
3. Can you, fully independently, stand up from sitting in a chair?
4. Can you, fully independently, wash your face and hands?
5. Can you, fully independently, wash and dry your whole body?
6. Can you, fully independently, get on and off the toilet?
7. Can you, fully independently, feed yourself?
8. Can you, fully independently, get around in the house (if necessary, with a cane)?
9. Can you, fully independently, go up and down the stairs?
10. Can you, fully independently, walk outdoors (if necessary, with a cane)?
11. Can you, fully independently, take care of your feet and toenails?

Instrumental activities of daily living (IADL)
12. Can you, fully independently, prepare breakfast or lunch?
13. Can you, fully independently, prepare dinner?
14. Can you, fully independently, do "light" household activities (for example, dusting and tidying up)?
15. Can you, fully independently, do "heavy" household activities (for example, mopping, cleaning the windows, and vacuuming)?
16. Can you, fully independently, wash and iron your clothes?
17. Can you, fully independently, make the beds?
18. Can you, fully independently, do the shopping?

TABLE 2—Correlations of the GARS and ADL and IADL Scales with the Physical Mobility Subscale from the Nottingham Health Profile (NHP-PM), the Karnofsky Physical Status Scale (KPSS), the Overall Evaluation of Health (OEH), and the Somatic Symptoms Subscale from the General Health Questionnaire (GHQ-SS)

	NHP-PM	KPSS	OEH	GHQ-SS
GARS	.78	.68	−.40	.25
ADL	.77	.64	−.39	.26
IADL	.71	.66	−.37	.21

Note. GARS = Groningen Activity Restriction Scale; ADL = activities of daily living; IADL = instrumental activities of daily living.

TABLE 3—Mokken Scale Analysis for Polychotomous Items on the Groningen Activity Restriction Scale (GARS), for the Combined European Data Set (n = 623)

Ordered GARS Items		Item Mean Scores	Scalability Coefficient for the Individual Items (H_i)
1. Wash face/hands	(ADL)	1.22	.49
2. Feed yourself	(ADL)	1.24	.40
3. Get around inside house	(ADL)	1.26	.50
4. Get on/off toilet	(ADL)	1.32	.48
5. Prepare breakfast/lunch	(IADL)	1.35	.47
6. Get in/out of bed	(ADL)	1.43	.47
7. Stand up from chair	(ADL)	1.45	.49
8. Do light cleaning	(IADL)	1.54	.46
9. Dress yourself	(ADL)	1.59	.53
10. Walk outdoors	(ADL)	1.60	.50
11. Wash/dry body	(ADL)	1.76	.51
12. Prepare dinner	(IADL)	1.79	.47
13. Go up/down stairs	(ADL)	1.81	.48
14. Wash/iron clothes	(IADL)	2.07	.47
15. Take care of feet/toenails	(ADL)	2.10	.42
16. Make beds	(IADL)	2.35	.47
17. Do shopping	(IADL)	2.49	.43
18. Do heavy cleaning	(IADL)	2.79	.49
Scalability coefficient H of the GARS			.47
Reliability coefficient rho			.94
Scalability coefficient H of the ADL items			.52
Reliability coefficient rho			.90
Scalability coefficient H of the IADL items			.51
Reliability coefficient rho			.89

a card from a box filled with 30 cards, with equal number of cards marked No. 1 and No. 2. Participant who picked up card No 1 were placed in the treatment group and the others were in the control group. Outcomes were measured using the Numeric Pain Rating Scale (NPRS)[14] for pain assessment, the Universal Goniometer (UG)[15] for shoulder ROM and the Groningen Activity Restriction Scale (GARS)[16] for ADLs and IADs. Pain and ROM were used as primary outcome measures, while ADLs were used as secondary outcome. Post-operative analgesia was same in both groups and it was done in coordination with the head of the department (HOD) of surgery and coordinator of research academics in the study hospitals. Pre-operative treatment was performed to check post-operative pain and range of shoulder movement. The doctors in hospitals were blind to randomisation and the same post-operative medications were given in both groups.

The subjects in the treatment group performed active ROMs as warm-up for 5min. Shoulder ROM 10-12 reps and 2-3 sets per day and then passive static stretching with 15-30sec hold, 8-10 reps and 2-3 sets per day. There were 2-5 sessions given per week. Stretches of pectorals, shoulder extensor, rotators and adductors to improve shoulder flexion, abduction and external rotation in supine position, and sitting when patient's ROM was <90 degrees.6 Firstly, active ROM (AROM) was performed following passive ROM (PROM) for once to guide the patients about how to perform AROM of shoulder flexion, abduction, internal and external rotation when the patient was in sitting position. Then the patient was asked to perform supervised AROM as warm-up for 10-12 reps with 2-3 sets and then static stretching was performed. Codeman's exercise was used as a cool-down session following static stretching. Cool-down for 5-10min was given. This protocol was followed in pre-operative patients and after post-op day 1 and day 3. In the post-op period, patients followed routine care only. In the control group, routine care was followed in both pre-operative and post-operative phases involving shoulder ROM for 10-12reps, 2-3 sets per day. Patient was in supine position. Patient was guided first through passively performing ROM and then asked to perform actively.

Pain, ROM and GARS scores were measured after post-op day 1 and day 3 in both groups.

Data was analysed using SPSS 20. Post-test design was applied in which independent t test was used at post-op days 1 and 3 between the groups with 95% confidence interval (CI). P<0.05 was taken as statistically significant.

Results

Of the 36 patients screened, 30(83.3%) were included; 15(50%) in each of the two groups. The overall mean age was 46±10.75 years. There was significant difference in pain, ROM and ADLs between the groups (p<0.05). At post-op day 1 and 3, there was significant difference between the groups for pain, flexion and abduction ROM (p<0.05). At post-op day 1, there was no difference in external rotation and ADLs on GARS score (p>0.05), but the difference was significant at post-op day 3. At post-op day 1, mean value of pain on NPRS in the treatment group was 3.40±1.639 and it was 4.73±1.580 in the control group. At post-op day 3, the mean value in the treatment group was 1.40±1.056 and it was 2.87±1.642 in the control group. At post-op day 1, mean GARS score for ADL restriction in the treatment group was 53.27±3.474 and in the control group it was 55.73±4.559. At post-op day 3, mean value in the treatment group was 34.93±3.807 and

Table-1: Pain assessed at post-operative days 1 and 3 on NPRS.

Outcome	Group	N	Mean±SD	P value
Pain at post op day 1	Treatment	15	3.40±1.639	0.031
	Control	15	4.73±1.580	
Pain at post op day 3	Treatment	15	1.40±1.056	0.007
	Control	15	2.87±1.642	

NPRS: Numeric Pain Rating Scale, N: No of patients in each group, SD: Standard deviation, P: level of significance.

Table-2: Raneg of Motion (ROM) assessed at post-op days 1 and 3 through Goniometer.

Outcome	Group	N	Mean±SD	P value
Flexion ROM at post Op day 1	Treatment	15	129.67±23.181	0.044
	Control	15	110.67±26.040	
Flexion ROM at post Op day 3	Treatment	15	135.67±17.915	0.038
	Control	15	120.00±21.297	
Abduction ROM at post Op day 1	Treatment	15	127.00±20.857	0.021
	Control	15	108.67±20.219	
Abduction ROM at post Op day 3	Treatment	15	136.00±17.444	0.012
	Control	15	119.00±17.029	
External rotation at post Op day 1	Treatment	15	59.67±9.904	0.090
	Control	15	52.00±13.601	
External rotation at post Op day 3	Treatment	15	67.00±10.316	0.040
	Control	15	57.33±13.998	

N: No of patients in each group; SD: Standard deviation; P: Level of significance.

Table-3: GARS score at post-op days 1 and 3.

Outcome	Group	N	Mean±SD	P value
GARS at post Op day 1	Treatment	15	53.27±3.474	0.107
	Control	15	55.73±4.559	
GARS at post Op day 3	Treatment	15	34.93±3.807	0.001
	Control	15	39.67±2.920	

GARS: Groningen Activity Restriction Scale; N: No of patients in each group; SD: Standard deviation, P: Level of significance.

in the control group it was 39.67± 2.920 (Tables-1-3).

Discussion

The current study had subjects aged 35-60 years. Another study[11] supported that breast cancer is very common in women aged 35-65 years, and another study[16] showed that breast cancer was most common in young and middle-age females.

In the current study, there was significant difference in pain level ($p<0.05$) at post-op days 1 and 3 between the groups, which was a finding in line with other studies.[8,11]

There is no significant difference in shoulder functioning between the groups on post-op day 1 ($p>0.05$), but on day 3 there was a marked difference ($p<0.05$). The finding is supported by an earlier study.[17]

The current study has limitations as the sample size was too small and the study focussed only on pain, ROM and functional activities. As such, generalisability of the findings are limited, especially in view of its short-term follow-up. Further studies need to be performed focussing on evaluating lymphoedema and on comparing different surgical treatments of breast cancer.

Conclusion

Those treated with pre-operative physical therapy showed significant results in improving shoulder ROM, ADLs and in reducing post-operative shoulder and breast pain.

Disclaimer: The text is based on an academic dissertation.

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