# Physical Therapy Approach in Shoulder Impairment Along With Lymphedemea after Breast Cancer Surgery: A Case Study

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## Abstract

A 52-year-old woman with a history of breast cancer and mastectomy surgery and axillary lymph nodes dissection was referred to a physical therapy clinic. Lymphotherapist assessment revealed that there was a grade II upper limb lymph edema; pitting and palpable fibrotic tissue existed in volar side of forearm. Water displacement measurement to assess the limb volume in affected and unaffected side indicated an obvious difference. In physical examination, there was a significant limitation in shoulder range of motion (ROM) and tightness in shoulder girdle muscles. A multimodal physical approach based on manual therapy, electrotherapy and exercise therapy was conducted to eliminate shoulder impairment along with Manual Lymph Drainage (MLD) and lymphological compression bandage to eliminate lymphedema. The results of final re- assessment indicated that combination of lymphatic massage and compression bandage can lower the lymph edema following the mastectomy. Also, physical therapy approach can reduce the symptoms of shoulder disability caused by mastectomy and lymph nod dissection surgery. It should be taken into account that in patients who are suffering from lymph edema, recovering the shoulder movements and early return to normal function are very effective in improving lymph flow and reducing edema. Therefore, by restoring shoulder movement, in addition to reducing shoulder pain and increasing performance, can improve lymph flow as well among these patients.

**Key words**: Breast Cancer, Lymph Edema, Physiotherapy, Shoulder

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## Introduction

Breast cancer is the most common type of cancer in women in the developed world. Breast cancer-related lymph edema of the upper limbs is a common complication following breast cancer surgery. The incidence of lymph edema after breast surgery is approximately 30% especially in patients who underwent tumor resection with auxiliary lymph node dissection (1). Most of these patients, suffer from serious complaints in their arm and shoulder including decreased joint mobility and muscle strength, pain, impairment in functions and structures (2, 3) disability in gross and fine motor skills, psychosocial disorders and cosmetic deformity mostly related to lymph edema leading to limitations in activities of daily living and participation in work, sports and social activities (4). Also, cancer surgery and related factors cause tissue fibrosis. Fibrosis impairs the proliferation of lymphatic endothelial cells and makes difficulty in the lymphatic regeneration. In addition, radiotherapy and hormonal therapy are the main risk factors for formation of fibrosis (5)

Early physical therapy intervention can reduce the complications related to breast surgery and reduce the need for intensive rehabilitation and the associated costs. (6) Manual Lymph Drainage, lymphological compression bandage, massage of fibrotic tissue, progressive active assisted shoulder exercises and educational strategy are some of the physical therapy approaches (7). Previous studies reported that exercise therapy can be beneficial in reducing lymph edema along with

improvement in the shoulder movements (8). Moreover, it has been revealed that application of transcutaneous electrical nerve stimulation (TENS) is effective in reducing edema and pain (9). Assessment of these patients is performed in several stages:

1) Evaluation of shoulder function, the strength of muscles around the shoulder, range of motion and functional performance.
2) Assessment of scapular function, strength of scapular stabilizer muscles and scapulothoracic rhythm.
3) Assessment of the upper extremity lymph edema: stiffness , fibrotic tissue, pitting , the limb volume, the diameter of the upper extremity in certain landmarks
4) Evaluation of pain and heaviness(10)

The purpose of this case report is to describe the evaluation and treatment of patient with lymph edema related to breast cancer in a middle-aged woman who was suffering from the complications of surgery, shoulder pain and movement limitations.

## Case History:

A 52-year-old woman with a history of breast cancer and mastectomy surgery and axillary lymph nodes dissection was referred to physical therapy clinic. Chief complaint of patient was pain and lymphatic edema in left upper limb. Mastectomy surgery was operated 6 months ago and the patient has undergone 8 sessions of chemotherapy and 30 sessions of radiotherapy. According to the medical records that had been filled by the surgeon and oncologist, the cancer stage was grade III. 10 lymph nodes were excised and only one of them was affected.

***Assessment:***

Initial assessment was carried out by the Lymphotherapist. Lymphotherapist. The assessment revealed that there was a grade II upper limb lymph edema; pitting and palpable fibrotic tissue existed in volar side of forearm. There was no skin lesion, no skin color change, no stemmer sign, no lymhangitis and sensation was normal. Patients suffered from heaviness in her upper extremity and there was a report of mild parastesia in history taking. The results of paraclinical examinations like bone scan, blood marker, sonography of abdomen and Doppler sonography of patient were normal.

Limb volume measurements indicated there was an obvious volume difference between affected and unaffected side. To measure the limb volume, performed circumferential tape at specific distances in anatomic landmarks was used water displacement in specific container was filled completely with water. Circumferential tape was placed in a standardized position which extended the limb while measurement point was marked over muscle and bony prominences. The measurement tape, which was calibrated in metric units (0.1 cm divisions), was placed around the limb at 7 intervals from wrist to axilla: around knuckles, heel of hand, wrist, midline of forearm, the fold of elbow, midline of arm and around axillary fold. Both limbs were measured for comparison of circumferences at similar anatomic locations to compare differences in volume (11).

Water displacement volumetry is based on a simple physical principle. Upper extremity was immersed into a container filled completely with water; the volume of overflowing water represented the volume of the limb, as far as it was immersed. The overflow water was measured in a calibrated container. To get accurate measurement, the arm was kept straight and was immersed slowly into the water, and the fingers were sliding straight down inside wall of the volumeter (12, 13).

These methods are reliable and valid to accurately quantify and monitor the extremity volume (11, 14). Water displacement measurement on affected and unaffected side was 8.1 ml and 6.9 ml respectively and circumferential tape indicated that there was 0.5cm volume difference around knuckle, 0.5cm differences around heel of hand, 1cm differences around the wrist, 4 cm around forearm, 2.7 cm around elbow, 4.2 cm around arm and 2 cm around fold of axilla compared with unaffected side. Table 1 shows the results of volumetery by circumferential tape.

Manual inspection revealed that, there was palpable and significant stiffness in anterior part of the deltoid, superior part of the trapezius, inferior part of the triceps, also the tendon of the pectoral muscle was painful with palpation. There was a significant fibrotic tissue on the volar surface of forearm. Also, an axillary cord was found in observation of axillary area in full abduction of shoulder. Axillary cord (web) is thick line or cord structure that usually appears after axillary lymph nodes dissection and can develop after surgical manipulation can causing pain and limited range of motion in the upper extremity. It is thought that formation of cord may be related to abnormalities in either the axillary veins or the lymphatic vasculature. Ii is also suggested that thrombosis in lymphatics and superficial veins causes the cord formation (15).

Physical examination of shoulder demonstrated a significant decrease in shoulder range of motion and disturbance in scapulotorasic rhythm. Goniometer modeled EA8161 made in Belgium was used to measure the shoulder ROM. Reliability of goniometer for measuring the ROM was revealed in previous studies (ICC=0.88-0.94) (16). The measurements of shoulder

***Table 1.*** The results of volumetry by circumferential tape

| landmarks | Un affected side (right side) | Affected side ( left side) |
|---|---|---|
| **Around knuckles** | 16 | 16.5 |
| **Around heel of hand** | 17 | 17.5 |
| **Around wrist** | 15.5 | 16.5 |
| **Around forearm** | 21 | 25 |
| **Around fold of elbow** | 25.2 | 27.9 |
| **Around arm** | 28 | 32.2 |
| **Around fold of axilla** | 30 | 32 |

**All measurements are based on the milliliter (ml) unit*

***Table 2***. The result of shoulder range of motion assessment

| MOVMENTS | ACTIVE | PASSIVE |
|---|---|---|
| **Ext** | 15 | 25 |
| **Flex** | 100 | 130 |
| **Abd** | 80 | 100 |
| **Add** | 10 | 15 |
| **Med. Rot** | 20 | 20 |
| **Lat. Rot** | Painful* | painful |

**movement was painful and patient was unable to do it*

***Table 3.*** Manual muscle test results

| Muscle | | MMT Grade | Muscle | | *MMT Grade* |
|---|---|---|---|---|---|
| **Seratus anterior** | | 3+ | Pectpralis major | | *4* |
| **Trapezius** | Upper fiber | 4+ | Deltoid | Anterior fibers | 3+ |
| | Middle fiber | 4- | | Middle fibers | 4- |
| | Lower fiber | 4- | | Posterior fibers | 3+ |
| **Biceps** | | 4 | Medial rotators | | 3+ |
| **Triceps** | | 4 | Lateral rotators | | painful |
| **Latismus dorsi** | | 4 | Pectoralis minor | | 4 |

***Table 4.*** The results of muscle length test

| Muscle | shortness |
|---|---|
| **Pectoralis minor** | + |
| **Pectoralis major** | + |
| **Upper trapeziuse** | _ |
| **Latismus dorsi** | + |
| **Levator scapula** | + |
| **Medial rotators** | + |
| **Lateral rotators** | painful |

***Table 5.*** The results of special test for shoulder, acromioclavicular and scapulothoracic joints

| Special tests | results | Possible causes |
|---|---|---|
| **Drop Arm Test** | - | Tear of the rotator cuff |
| **Empty can** | + | Supraspinatus tendon involvement |
| **Yergason test** | + | Inflammation in biceps tendon in bicipital groove |
| **Speed test** | + | Inflammation in biceps tendon |
| **Lateral scapular slide test** | + | Weakness in Scapular stabilizer muscle |
| **Cross over impingement test** | - | Acromioclavicular joint disorder |
| **Hawkins-kennedy impingment test** | + | Supraspinatus tendon impairment |
| **Acromioclavicular compration test** | _ | Strain in acromioclavicular ligament |

***Table 6.*** The results of re assessment of volume by circumferential tape

| landmarks | Un affected side (right side) | Affected side ( left side) |
|---|---|---|
| **Around knuckles** | 16 | 16.2 |
| **Around heel of hand** | 17 | 17.3 |
| **Around wrist** | 15.5 | 15.5 |
| **Around forearm** | 21 | 24 |
| **Around fold of elbow** | 25 | 26 |
| **Around arm** | 28 | 28.5 |
| **Around fold of axilla** | 30 | 31 |

**All measurements are based on the milliliter (ml) unit*

ROM determined that the main limited motion was shoulder abduction. Assessment of shoulder's passive movements showed that pain appeared in the end range of most of movements. Table 2 shows the result of shoulder range of motion assessment.

Physical examination showed that there was a significant weakness in shoulder girdle muscles. Manual muscle testing (MMT) was performed for patient's shoulder, upper body and scapulathorasic muscles (17). The results are presented in table 3. Also, Muscle length testing (MLT) was operated for the shoulder girdle and upper body muscles (18). Table 4 shows the result of MLT tests. Significant decrease in muscle strength and tightness in shoulder and upper body muscles indicated an importance of comprehensive training program in this patient.

In the following, for further detailed information and detect associated lesions, specific test was applied. Table 5 shows the results of special test for shoulder, acromioclavicular and scapulothoracic joints. The results of the specific tests indicated that, there was impairment in suprascapular tendon and rotator cuff. Also there was weakness in scapular stabilizer muscles which conforms the results of MMT test.

Finally, the patient was asked to report her pain by marking a line on the visual analogue scale (VAS). The VAS was a 10-cm horizontal line divided into 10 equal parts from0 = no pain to 10=maximum pain ever felt (19). The reliability of VAS was reported to be high (ICC=0.96-0.98) (20) in the previous research. Patient reported that the most severe pain was felt in shoulder during overhead movements and about 8 in VAS. Additionally, she reported that there was a dull pain in upper extremity which got worst during lifting and working with involved hand. She reported this pain about 4 in VAS.

***Treatment:***

The patient was treated through 20 sessions, 5 days in each week and for 4 weeks. Treatment protocol was planned according to the goals of treatment: improve pain, decrease tightness, increase shoulder range of motion, eliminate muscles shortness and improve patient's ADL. Physical therapy approach was conducted in 4 manners:

1) electrotherapy modalities
2) manual therapy
3) exercise therapy
4) And complex decongestive treatment.

Treatment sessions started with electrotherapy. Conventional TENS was used for 20 minutes with frequency of 150 Hz, pulse width of 20 μs and the intensity exclusively set at the subject's sensorial threshold in shoulder area. Self-adhesive electrodes were used to prevent transmission of infection. Also, 8 min Ultrasound (frequency of 1MHz, wave length of 1.5 mm and pulsed mode) was conducted on the auxiliary region particularly aimed at auxiliary cord (9).

In the following, manual techniques including soft tissue manual techniques and joint mobilization were operated. Soft tissue manual technique included:

1) Trigger point treatment was performed on upper trapezius trigger points.
2) Soft tissue massage was performed to pectoralis minor, levator scapulae, upper trapeziuse, anterior part of the deltoid and long head of biceps.
3) Transverse friction massage was conducted on involved tendons and axillary cord.
4) Contract/Relax was performed to external rotators, internal rotators, shoulder flexors and extensors.

All of these techniques were operated in every treatment sessions.

Also, various mobilization techniques were employed in order to decrees tissue resistance and increased range of motion in shoulder flexion, extension, abduction, and rotation.

Distraction technique for glenohumeral joint was used to increase accessory motions, decrease pain and improve periarticular muscle performance. This technique was employed in oscillatory manner and in grade I and II of mobilization in the following method. The patient was supine; glenohumeral joint was placed on the resting position. The therapist was standing at the patient's side, facing the glenohumeral joint and with both hands griped the proximal of humerus close to the axillary. Distraction technique was used by rocking the body far from the patient (21).

Another technique was inferior glide of humerus. This technique was practiced to increase the abduction range of motion. The patient lay supine, the glenohumeral joint was placed in the resting position. The therapist was standing at the patient's head, facing the glenohumeral joint. The mobilizing hand was positioned with the web space over the superior surface of the proximal humerus while the guiding hand was supporting the upper limb from the medial side of the distal humerus. The therapist applied a grade I traction to the joint while mobilizing hand glides the humerus in an inferior direction (22).

Posterior glide of humerus was conducted to increase the internal rotation of shoulder. The patient was supine with the humerus positioned off the edge of the treatment table. The glenohumeral joint was placed in the resting position. The therapist was standing at the patient's side, facing the patient. Mobilizing hand was positioned over the anterior surface of the proximal humerus and the guiding hand supported the upper limb from the posterior side of the distal humerus. Therapist applied a grade I traction to the joint then glided the humeruse in posterior direction with mobilizing hand (22).

***Figure 1***. Lymphological compression bandaging

Anterior glide of humerus was operated in order to increase external rotation of shoulder. The patient was prone with the humerus positioned off the edge of the treatment table .The glenohumeral joint was placed in the resting position. The therapist was standing at the patient's side, facing the glenohumeral joint. The mobilizing hand was positioned over the posterior surface of the proximal humerus and the guiding hand supports the upper limb from the anterior side of the distal humerus. The therapist applied a grade I traction to the joint then glided the humerus in anterior direction by mobilizing hand (22).

Scapulothoracic joint mobilization was conducted also in order to increase scapular motion and release the shortened and spastic muscles. Scapulothoracic joint mobilization included: distraction of scapula (lifting the scapula away from the ribs), superior glide of scapula (applying a grade I traction and gliding the scapula in a superior direction simultaneously), Inferior glide of scapula (applying a grade I traction and gliding the acromion in an inferior direction), medial glide of scapula (hands positioned over the lateral surface of the scapula, and scapula glided in medial direction ) and lateral glide of scapula (hands positioned with the fingertips over the vertebral border of the scapula and scapula glided in lateral direction)(21).

In the following, complex decongestive treatment, including manual lymphatic drainage (MLD) and specialized compression bandage was operated by trained therapist. In MLD, specialized rhythmic massage techniques was used to massage the affected area and enhance the circulation lymph flow, increase the anastomosis and soften the fibrotic tissues. Gentle skin massage is thought to cause superficial lymphatic contraction, thereby increasing lymph drainage. MLD was conducted in 4 manners (23):

1) stationary circle
2) Rotator technique
3) Pumping technique
4) Scoop technique

Lymphological compression bandaging after MLD was performed in every sessions. Patients did not allow opening the bandage during the day. Opening the bandage was done only for a short time in the clinic to treat patient. Bandaging the lymphatic extremity is specialized and just operated by trained therapist. The bandage included 5 layers of different materials and each layer was used for a specific purpose (24). All bandages used were produced by Lohmann & Rauscher Company (Germany). Bandaging started with applying lotion to moisturize the skin. First layer consisted of tubular gauze known as stockinette. Stockinette protects the skin and provides a comfortable, breathable basis and protects the skin from rubbing against the other layers. The stockinette that was used had 5 cm width. The stockinette extended from the base of the fingers upward to fold of axilla. Second layer had two or three rolls of flexible gauze. 2cm wide gauze was used for the fingers up to the wrist. The third layer consisted of a soft cotton padding that facilitates pressure distribution of compression bandages and aids in the prevention from excessive pressure. This protective layer covers prominences such as the elbow and help shape the limb. Next layer was thin foam that was used to add excessive padding that equally distributes the compression of the outer bandages and adds more pressure as well. In some sessions to increase the pressure, in area that the edema was more dominant, spongy foam was used. Its outermost layer consisted of short-stretch bandages. These bandages were in 3 different widths. Smaller width short-stretch bandages were used for hand and wrist. Short-stretch bandages did not cover the fingers and started from base of fingers. The greatest compression was performed in the distal of the limb and the least compression near the axilla (23).

At last, gentle exercises were introduced in the first days and progressed to strengthening exercises, coordination and agility activities in the last sessions. Most of educated exercises at the beginning of treatment sessions were aimed at increasing shoulder range of motion. Proprioceptive Neuromuscular Facilitation (PNF) pattern movements were taught to the patient to re-educate the motion pattern. Flexion, extension, adduction, Internal and external rotation movements were re-educated in PNF pattern (25). Training included following exercises:

Range of motion exercise: Initiating with active-assisted ROM, Codman's exercise (pendular), rope and overhead pulley exercises, wall climbing, shoulder wheel exercises and towel exercises

***Figure 2.*** A calibrated container was used to Water displacement volumetry

Stretching exercise for shortened muscles: including pectoral corner (wall corner stretch) in 30° and 90°, 90-90 supine exercise, shoulder abduction L-bar stretch in 90-90 position and wall slides (26).

Strengthening exercise for weak muscles: containing isometric shoulder extension, flexion, lateral and medial rotation with wall, Initiate light bench press (with 0.5 kg weight), Wall push up, bent over rows, shoulder shrug, rowing exercise, and pull-down exercise (27, 28)

Coordination and agility activities: including Ball circumduction, plyometric exercise (throwing the ball on tilt board), balance, and coordination training on a gym ball, maintain balance on a foam roll while the extremities moved in various directions (26)

All of these exercises were done with bandaged upper extremity.

***Re-assessment:***

In the last session, all of assessments which were carried out in first session were repeated. The most considerable improvement was developed in shoulder range of motion. However, an increase in muscle length and strength was significant, due to the limitations of treatment sessions, to increase muscle strength and restore the normal length, 4 weeks for treatment duration was not enough, so the results did not show a full recovery. In manual examination, fibrotic tissue and stiffness in the muscles were also fully improved. Shoulder pain during overhead movements was completely improved and dull pain in upper extremity was removed totally. The heaviness in upper extremity was fully recovered. Water displacement measurement on affected and unaffected side was changed to 6.7 ml and 6.4 ml respectively. Circumferential tape indicated that volume difference around knuckle had become 0.2 cm, 0.3 differences around heel of hand, without differences around wrist, 1 cm around forearm, 1 cm around elbow , 0.5 cm around arm and 1cm differences around fold of axilla in comparison with un affected side. Table 6 the results of re assessment of volume by circumferential tape.

## Discussion

Cancer patients are often referred to physical therapy to treat postoperative impairments. It was claimed that in these patients early physiotherapy and shoulder functional educations can significantly lower 20%–25% lymph edema involvement rates (29). Physiotherapy approaches are performed for the purpose of decreasing the limb and shoulder pain, heaviness, tightness, increasing range of motion, muscle strength, and facilitating tissue healing while avoiding possible malignant tumor growth(1). So physiotherapy can be helpful in improving the quality of life, increasing the functional abilities and decreasing the psychological distress for these patients.

It should be noted that the physical therapy of patients suffering from cancer is almost different from common patients. Some of the physical agents are contraindicated in the treatment of these patients because of potential concerns that they may raise the rate of growth of malignant tumors (30). For example, it isbetter to avoid using thermal modalities. In some texts it was emphasized that heat could increase cell metabolism, so it can cause accelerating in cellular divisions. However the effects of heat on accelerating the growth of cancer cells are unknown.

Skin care is very important in patients suffering from lymph edema. Any scratch may lead to uncontrolled infection. Arm infection, inflammation, or injury can increase the lymph edema. So, during the use of the modalities, manual techniques and massage the skin of the patient should be protected.

In addition to the decrease in pain and improvement in the function of shoulder, exercise therapy can be effective in enhancing lymph flow as well as improving protein resorption in patients with breast cancer operation (31). All exercise regimens require individualization in these patients. Proper assessment of flexibility, strength, and aerobic capacity should be performed prior to training. Gradual progression of exercises, combinations of stretching, aerobic training and strengthening

should be considered. All of the exercises should be done with bandaged arm. Also, pain and amount of edema should be controlled during and after the exercises (32).

It should also be noted that exercises which are suggested to these patients should be without the weight bearing on involved limb. In people with lymph edema, applying weight on the hands, leads to an increase in i edema or the creation of it. Patients should be instructed to absolutely avoid lifting weights heavier than 2 kg during their daily activities and exercises (33).

## Conclusion

Shoulder dysfunction following surgery in patients with breast cancer is common. Physiotherapy treatment in these patients is almost different from common cases. Application of Some modalities such as thermal modalities is contraindicated since they would speed up the growth of cancer cells. It should be taken into account that in patients suffering from lymph edema, recovering the shoulder movements and early return to normal function is very effective in improving lymph flow and reducing edema. Therefore,, restoring shoulder movement in these patients improves lymph flow in addition to reducing shoulder pain and increasing its performance..

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None

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