

## **The importance of an exercise program in breast cancer related lymphedema**

### **Rolul exercițiului fizic în limfedemul secundar cancerului de sân**

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#### **Abstract**

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females. In most cases of breast cancer, breast surgery is the first step in the complex and multidisciplinary treatment of the disease. After surgery, the most common postoperative complication is secondary lymphedema. Lymphedema following breast cancer treatment remains a long-term disabling complication which cannot be treated in a decisive and radical manner. The objective of the treatment is to limit complications, to try to preserve the remaining lymphatic system and to develop new anastomosis. Complete Decongestive Physiotherapy is currently recognized as the gold standard treatment for lymphedema following breast cancer treatment. It includes: exercises, meticulous skin hygiene, manual lymph drainage, bandaging and supportive garments.

**Keywords:** breast cancer, secondary lymphedema, physical activity, range of motion, fibrosis.

#### **Rezumat**

Cancerul de sân este cel mai frecvent tip de cancer diagnosticat și principala cauză de deces printre tipurile de cancer diagnosticate la femei. În majoritatea cazurilor de cancer de sân, chirurgia este primul pas în tratamentul complex și multidisciplinar al bolii. Cea mai frecventă complicație postoperatorie este limfedemul secundar. Limfedemul secundar postmastectomie este o complicație cronică, ce nu poate fi tratată într-un mod decisiv și radical. Obiectivul tratamentului este limitarea complicațiilor, conservarea sistemului limfatic restant și favorizarea noilor anastomoze. Fizioterapia decongestivă completă este recunoscută ca fiind tratamentul de elecție în cazul limfedemului secundar mastectomiei. Acesta include: exercițiu fizic, igiena tegumentară riguroasă, drenaj limfatic manual, bandajare cu feșe elastice și mănuși elastice.

**Cuvinte cheie:** cancer de sân, limfedem secundar, exercițiu fizic, amplitudinea mișcării, fibroza.

#### **Introduction**

Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females, accounting for 23% of all cancer cases and 14% of cancer deaths (Jemal et al., 2011). Only 5-10% of breast cancers occur in women with a clear genetic predisposition, whereas the rest are "sporadic", meaning that there is no direct relation with the family history. Breast cancer occurs more commonly in the left breast than in the right one (Sperry, 2010). In most cases of breast cancer, breast surgery is the first step in the complex and multidisciplinary treatment of the disease (Delpech & Barranger, 2013).

Both conservative breast surgery and radical mastectomy are accompanied by axillary lymph node excision, while radiotherapy often completes the treatment (Vignes, 2010).

Hormone therapy and chemotherapy are also adjuvant treatments which are recommended before or after surgery,

depending on the type and stage of cancer. Each of these therapies has an influence on shoulder mobility, the lymphatic system, well-being and the quality of life.

After surgery, the most common postoperative complications are: reduced range of motion in the shoulder, muscle weakness in the upper extremities, lymphedema, pain and numbness (Chan et al., 2010), fatigue, decreased physical functioning, psychological distress (Basen-Engquist et al., 2010), tension, web syndrome, tingling, itching, burning, partial dislocation of the shoulder (Liao et al., 2012), shoulder and chest wall pain (Nesvold et al., 2008). Radiotherapy may induce fibrosis of the tissues, affecting the muscles, organs and bones in the irradiated area, venous and lymphatic system dysfunction (Liao et al., 2012), skin diseases, pulmonary damage, pulmonary fibrosis (Păcurar et al., 2011). In patients with chemotherapy or/and hormone therapy, the following may occur: joint arthralgia, neuropathy, weight gain, cardiovascular effects, and osteoporosis (Stout et al., 2012).

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## The lymphatic system

The lymphatic system consists of lymphatic capillaries, lymphatic vessels, lymph nodes, lymphatic trunks, the thoracic duct and the right lymphatic duct, where the lymph passes into the venous system. Lymphatic vessels are divided into two types: initial lymphatics and collecting lymphatics. The valves and smooth muscle in their walls contract in a peristaltic way, propelling the lymph along the vessels. The normal 24 h lymph flow is 2 to 4 liters (Barrett, 2010).

## The role of lymphatic circulation

The lymphatic system is part of the circulatory system. Along with the vascular system, it mediates the systemic transportation of substances. The lymphatic system also has a drainage function, preventing excessive accumulation of the interstitial fluid (Barrett, 2010).

In the majority of capillary beds, filtration of fluid exceeds absorption by the capillaries and pericytic venules. If the excess fluid was not removed, it would accumulate in tissues, causing *edema* (Pocock & Richards, 1999).

## Factors that influence the interstitial fluid volume

The amount of fluid in the interstitial spaces depends on capillary pressure, interstitial fluid pressure, oncotic pressure, the capillary filtration coefficient, the number of active capillaries, the lymph flow and the total extracellular fluid volume. Changes in any of these variables lead to changes in the volume of interstitial fluid to an abnormally large amount. Another cause of edema is inadequate lymphatic drainage. Edema caused by lymphatic obstruction is called *lymphedema* (Barrett, 2010).

## Secondary lymphedema after breast surgery

Secondary lymphedema is one of the most common problems after breast surgery in breast cancer treatment (Lacomba et al., 2010). It is a major concern for physiotherapists and for the whole team involved in the treatment of breast cancer patients.

Acquired interruption or damage to the axillary lymphatic system after surgery or radiotherapy for breast cancer can lead to regional or generalized accumulation of lymph fluid in the interstitial space, known as secondary lymphedema. This condition is the most important chronic complication after dissection of the axillary lymph nodes and if untreated, it has a tendency to progress. Secondary lymphedema can cause disfigurement, physical discomfort, and functional impairment. The condition may also precipitate cellulite, erysipelas, lymphangitis, and occasionally lymphangiosarcoma (Lacomba et al., 2010).

There are several possible risk factors identified for breast edema: an increased irradiated breast volume, an increased boost volume, an increased breast separation, a higher density of the breast tissue, a large tumor, a higher specimen weight, postoperative infection, acute postoperative toxicity, and diabetes mellitus (Verbelen et al., 2014). After axillary lymph node dissection, the incidence of secondary lymphedema is about 23-38% if the criterion used to identify it has a greater than 2 cm increase in upper arm circumference measured at two adjacent points compared with the circumferences in the other arm

(Lacomba et al., 2010).

Most women (71%) develop secondary lymphedema within 12 months after breast surgery for cancer (Tambour, 2014).

Problems associated with lymphedema include: pain, altered sensations such as discomfort and heaviness, difficulties with physical mobility, physiological distress, recurrent infections and social isolation. Lymphedema has been shown to significantly negatively affect the quality of life, and it is a traumatic condition because in addition to inconveniences and functional impairment that starts at the arm level, the aesthetic factor plays a determinant role in the loss of self-esteem, which causes psychological sequelae in many patients (Martin et al., 2011).

## Prevention and treatment

Preventing lymphedema implies correct information of the patient about this complication, risk factors, and the role of physiotherapy, consisting of a regular exercise program and manual lymphatic drainage in preventing lymphedema. A supervised and personalized program of exercises is safe, has no risks and may improve physical functions (Anderson et al., 2012). Also, a structured program of exercises is recommended, because it has a greater potential of improving the range of motion than an unstructured program, containing only general directions.

A containment elastic orthosis and manual lymphatic drainage significantly improve the quality of life by decreasing the volume of extracellular water, the volume of the limb on the mastectomized side, and by improving the upper limb's function (Castro-Sanchez et al., 2011).

Lymphedema following breast cancer treatment remains a long-term disabling complication which cannot be treated in a decisive and radical manner. The objective of the treatment is to limit complications, to try to preserve the remaining lymphatic system and to develop new anastomosis (Marcos et al., 2012).

Lymphedema treatment remains a problem even with modern treatment modalities, since there are no clear therapeutic protocols. Several methods have been used with varying results. Among them, the physical treatment introduced by Winiwarter (1892), improved by Vodder (1932-1960) and later termed Complex Physical Therapy (CPT) by Foldie has been recommended by several groups of experts (Martin et al., 2011).

No cure for lymphedema currently exists, and incidence rates in breast cancer patients post treatment remain high. While Complete Decongestive Physiotherapy is currently recognized as the gold standard treatment for lymphedema after breast cancer treatment, its efficacy as a means of preventing the development and/or progression of lymphedema following treatment has yet to be firmly established. Current literature has identified Complex Decongestive Physiotherapy (CDP) as a possible effective prevention mechanism against the development of lymphedema in breast cancer patients if implemented immediately after surgery, instead of being implemented post-diagnosis of lymphedema (Ecclestone et al., 2014).

## Complete decongestive physiotherapy

Complex Physical Therapy, also called Complex Decongestive Physiotherapy, is a treatment regimen that

includes exercises, meticulous skin hygiene, manual lymph drainage, bandaging and supportive garments. This therapy is carried out in two phases; in the first phase (treatment), the aim is to mobilize the accumulated lymph, reduce the fibrous tissue and improve the health of the skin using mainly daily Manual Lymph Drainage (MLD) during a variable period of time. In addition, patients receive instructions regarding skin care, prophylactic measures and the use of multilayer bandages. In the second phase (maintenance), compression bandaging, regular physical exercise and weight control are used (Martin et al., 2011).

### **Exercise program**

An exercise program is very important in recovery after breast surgery and in preventing or treating lymphedema. Physical activity increases the lymph volume which is drained from the thoracic duct into the venous system from 2 liters/24 h to over 3 liters/24 h. Accelerating lymphatic circulation prevents lymph stasis and lymphedema.

The introduction of aerobic training caused a slowdown in negative changes in bones, and body fat was reduced in patients with hormone therapy. The introduction of resistance therapy reverses an adverse tendency for bone strength and sarcopenia. Mixed type physical activity (aerobic training and resistance training) during breast cancer associated with endocrine therapy can prevent negative changes of hormone therapy in the body build in premenopausal women (Hojan et al., 2013).

Most common symptoms after radiotherapy or chemotherapy are: tissue fibrosis, muscle mass loss, fatigue and poorer physical health. Exercise and physical activity can improve many of the symptoms and health problems experienced by breast cancer survivors (Basen-Engquist et al., 2008).

Increased energy expenditure was associated with better physical functioning and general health, less pain and depression. High energy expenditure is significantly related to an optimal general health, lack of depression, good physical functioning and less pain (Basen-Engquist et al., 2008).

Regarding physical activity frequency, as the frequency of activity increases, physical functioning improves, the pain is less, and general health is improved. Depression scores decreased as the frequency of physical activity increased (Basen-Engquist et al., 2008).

Physical activity duration has also an importance in improving physical functioning, general health and reducing pain. Most of the physiotherapists prescribe moderate to vigorous exercise 3 to 5 days per week, with sessions lasting 20 to 30 min.

It is recommended to initiate the physiotherapy program immediately after breast surgery, in the first postoperative 24-48 h, to prevent muscle contracture and tightening of the arm muscles, chest and upper back muscles (Dell, 2001).

Early recommendations emphasized vigorous exercise for at least 20 min. Current recommendations also endorse moderate activity done for at least 30 min on most days of the week, allowing people to accumulate this activity in short bouts throughout the day. The latter regimen decreases the risk of cardiovascular disease and mortality (Basen-Engquist et al., 2008). Many studies conclude that

90-120 minutes/week of moderate exercises are much more effective than a high-dose exercise program (Carayol, 2013).

A complete program of exercise contains specific exercises for the shoulder (Seung et al., 2010): flexions, extensions, rotations, abductions, adductions; it is recommended to perform the exercises alternatively with both upper limbs, then simultaneously to regain or improve the upper limb, anterior and posterior thorax muscle strength. This way, a correct posture is regained or improved.

Meanwhile, it is recommended to perform general aerobic exercises that involve the entire body (Cho et al., 2012), exercises inspired from the Pilates program, stretching elements inspired from Yoga, walking, hiking, gymnastics, folk dance, chi kung, tai chi. When planning patient education after breast cancer surgery, healthcare professionals should consider not only the role of exercise in breast cancer recovery, but also the new trends in exercise behavior among breast cancer survivors (Hsu et al., 2012).

Aquatic exercise in chest-high pools obtains a good adherence (almost 90%) to the physiotherapy program in breast cancer patients with hormone therapy induced arthralgia. Participants experience a decrease in pressure pain threshold in the neck, hand, shoulder and leg measured by algometry, as well as in waist circumference (Cantarero-Villanueva et al., 2013), increased muscle strength, an improved range of motion of the shoulder (especially flexion), improved exercise resistance, improved blood flow and muscle relaxation (Bordinic & Irsay, 2014). The initial exercise program can be replaced by hydrotherapy only when wound healing has occurred and the drain tubes have been removed.

The physiotherapy recovery program should establish progressive doses of exercise and encourage performing the exercises until full range of motion is restored. Exercise should be performed only to the point of discomfort, not pain (Dell, 2010).

Lifting heavier objects than 5 pounds (2.3 kg) is contraindicated (Dell, 2010). Thermotherapy, sauna (Bordinic & Irsay, 2014) are also contraindicated, because heat causes vasodilatation, low lymphatic pressure, determining lymphatic stasis and, implicitly, lymphedema.

There was no evidence of increased risk of lymphedema from exercise at any time point (McNeely et al., 2011). Yet, overstrain and over-workout should be avoided.

### **Conclusions**

1. An exercise program is very important in recovery after breast surgery and in preventing or treating lymphedema. It is recommended to initiate the physiotherapy program immediately after breast surgery. Current recommendations endorse moderate activity performed for at least 30 min on most days of the week, allowing people to accumulate this activity in short bouts throughout the day. A complete program of exercise contains specific exercises for the shoulder and general aerobic exercises that involve the entire body.

2. The physiotherapy recovery program should establish progressive doses of exercise and encourage

performing the exercises until full range of motion is restored. Exercise should be performed only to the point of discomfort, not pain. There is no evidence of increased risk of lymphedema from exercise at any time point. Yet, overstrain and over-workout should be avoided.

### Conflicts of interest

This paper uses partial results from the ongoing thesis of the first author. There are no conflicts of interest to declare.

### References

- Anderson RT, Kimmick GG, McCoy TP, Hopkins J, Levine E, Miller G, Ribisl P, Mihalko SL. A randomized trial of exercise on well-being and function following breast cancer surgery: the RESTORE trial. *J Cancer Surviv*, 2012;6(2):172-181. doi: 10.1007/s11764-011-0208-4.
- Barrett KE, Barman SM, Boitano S, Brooks HL. Ganong's Review of Medical Physiology 23<sup>rd</sup> Edition, McGraw Hill Lange, International Edition, 2010, 550
- Basen-Engquist K, Hughes D, Perkins H, Shinn E, Taylor CC. Dimensions of physical activity and their relationship to physical and emotional symptoms in breast cancer survivors. *J Cancer Surviv*, 2008;2(4):253-261. DOI: 10.1007/s11764-008-0067-9.
- Bordinc E, Irsay L. Indications and contraindications of physiotherapy in breast cancer patients. *Balneo Res J*, 2014;5(3):99-107.
- Cantarero-Villanueva I, Fernandez-Lao C, Caro-Moran E, Morillas-Ruiz J, Galiano-Castillo N, Diaz-Rodriguez L, Arroyo-Morales M. Aquatic exercise in a chest-high pool for hormone therapy-induced arthralgia in breast cancer survivors: a pragmatic controlled trial. *Clin Rehabil*, 2013; 27(2):123-132. doi: 10.1177/0269215512448256.
- Carayol M, Bernard P, Boiché J, Riou F, Mercier B, Cousson-gélie F, Romain AJ, Delpierre C, Ninot G. Psychological effect of exercise in women with breast cancer receiving adjuvant therapy: What is the optimal dose needed?, *Ann Oncol*, 2013;24(2):291-300. doi: 10.1093/annonc/mds342.
- Castro-Sanchez AM, Moreno-Lorenzo C, Mataran-Penarrocha GA, Aguilar-Ferrandiz ME, Almagro-Cespedes I, Anaya-Ojeda J. Preventing lymphoedema after breast cancer surgery by elastic restraint orthotic and manual lymphatic drainage: a randomized clinical trial. *Med Clin.*, 2011;137(5):204-207. doi: 10.1016/j.medcli.2010.09.020.
- Chan DNS, Lui LYY, So WKW. Effectiveness of exercise programmes on shoulder mobility and lymphoedema after axillary lymph node dissection for breast cancer: systematic review: Effectiveness of exercise programmes on shoulder mobility and lymphoedema. *J Adv Nurs*, 2010;66(9):1902-1914. DOI: 10.1111/j.1365-2648.2010.05374.x.
- Comparisons of exercise dose and symptom severity between exercisers and nonexercisers in women during and after cancer treatment. *J Pain Symptom Manag*, 2012; 43(5):842-854. doi: 10.1016/j.jpainsymman.2011.05.016.
- Dell D. Regaining range of motion after breast surgery, *Nursing, Lippincott Williams & Wilkins, Inc* 2001;31(10):50-52.
- Delpech Y, Barranger. Chirurgie du cancer du sein. *Rev. Praticien*, 2013;63(10):1395-1399.
- Ecclestone C, Bedard G, Popovic M, Thavarajah N, Lam H, Verma S, Leahey A, McDonald R, Wong E, Chow EC. Prevention of lymphedema following complete decongestive physiotherapy in breast cancer patients: A literature review. *J Pain Manag*, 2014;7(2):107.
- Hojan K, Milecki P, Molińska-Glura M, Roszak A, Leszczyński P. Effect of physical activity on bone strength and body composition in breast cancer premenopausal women during endocrine therapy. *Eur J Phys Rehab Med*, 2013;49(3):331-339.
- Hsu HT, Huang CS, Liu Y, Dodd MJ, Juan CH, Lai YH, Guo SE. Exercise behaviors in breast cancer survivors in Taiwan. *Cancer Nurs*, 2012, 35(6):E48-E56. doi: 10.1097/NCC.0b013e3182479984.
- Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics, CA: *Cancer J Clin*, 2011;61(2):69-90; DOI: 10.3322/caac.20107.
- Lacomba MT, Sánchez MJY, Goñi ÁZ, Merino DP, Del Moral OM, Téllez EC, Mogollón EM. Effectiveness of early physiotherapy to prevent lymphoedema after surgery for breast cancer: randomised, single blinded, clinical trial. *BMJ (Online)*, 2010;340(7738):140-148. doi:10.1136/bmj.b5396.
- Liao SF, Li SH, Huang HY. The efficacy of complex decongestive physiotherapy (CDP) and predictive factors of response to CDP in lower limb lymphedema (LLL) after pelvic cancer treatment. *Gynecol Oncol*, 2012;125(3):712-715. doi: 10.1016/j.ygyno.2012.03.017.
- Marcos AL, Animar El Gaaed AB, Ayed FB, Hassen SB, Zervoudis S, Navrozoglou I, Pechlivani F, Iatrakis G. Lymphedema of the arm after surgery for breast cancer: New physiotherapy, *Clin Exp Obstet Gyn*, 2012;39(4):483-488.
- Martin ML, Hernández MA, Avendaño C, Rodríguez F, Martínez H. Manual lymphatic drainage therapy in patients with breast cancer related lymphoedema, *BMC Cancer*, 2011; 11(1):94-100. doi:10.1186/1471-2407-11-94.
- McNeely ML, Campbell K, Ospina M, Rowe BH, Dabbs K, Klassen TP, Mackey J, Courneya K. Exercise interventions for upper-limb dysfunction due to breast cancer treatment. *Cochrane database of systematic reviews (Online)*, 2010; 6(6):CD005211-CD005286. doi: 10.1002/14651858.CD005211.pub2.
- Nesvold IL, Dahl AA, Løkkevik E, Marit Mengshoel A, Fosså SD. Arm and shoulder morbidity in breast cancer patients after breast-conserving therapy versus mastectomy. *Acta Oncol*, 2008; 47(5):835-842. doi:10.1080/02841860801961257.
- Păcurar R, Miclăuș C, Miclăuș M. Morbidity associated with breast cancer therapy and the place of physiotherapy in its management. *Timișoara Phys Educat Rehab J*, 2011;3(6):46-54.
- Pocock G, Richards CD. *Human Physiology. The Basis of Medicine*, Oxford Core Texts, 1999, 309-310.
- Seung AL, Kang JY, Yong DK, Ah RA, Kim SW, Kim YS, Lim JY. Effects of a scapula-oriented shoulder exercise programme on upper limb dysfunction in breast cancer survivors: a randomized controlled pilot trial. *Clin Rehabil*, 2010;24(7):600-613. doi: 10.1177/0269215510362324
- Sperry L. Breast Cancer, Depression, Culture, and Marital Conflict, *The Family Journal*, SAGE Publications, 2010; 18(1):62-65, DOI: 10.1177/1066480709356228.
- Stout NL, Binkley JM, Schmitz KH, Andrews K, Hayes SC, Campbell KL, McNeely ML, Soballe PW, Berger AM, Chevillat AL, Fabian C, Gerber LH, Harris SR, Johansson K, Pusic AL, Prosnitz RG, Smith RA. A prospective surveillance model for rehabilitation for women with breast cancer. *Cancer*, 2012; 118(S8):2191-2200. doi: 10.1002/cncr.27476
- Tambour M, Tange B, Christensen R, Gram B. Effect of physical therapy on breast cancer related lymphedema: protocol for a multicenter, randomized, single-blind, equivalence trial. *BMC CANCER*, 2014;14(1):239-245.
- Verbelen H, Gebruers N, Beyers T, De Monie AC, Tjalma W. Breast edema in breast cancer patients following breast-conserving surgery and radiotherapy: a systematic review. *Breast Cancer Res Tr*, 2014;147(3):463-471. doi: 10.1007/s10549-014-3110-8.
- Vignes S. Lymphoedèmes secondaires des membres. *Presse Med*, 2010;39(12):1287-1291. doi: 10.1016/j.lpm.2009.06.023.