

## REHABILITATION AFTER LOWER LIMB LYMPHOEDEMA IN GYNAECOLOGICAL MALIGNANCIES – THE ROLE OF PHYSIOTHERAPY

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**Abstract.** Lower limb lymphoedema is one of the most invalidating long-term complications of treatments (such as surgery, chemo- and radiotherapy) for gynaecological malignancies, affecting approximately 15% of women treated for this condition. Lower limb lymphoedema occurrence is related to several risk factors, the most important being obesity and radiotherapy as well as the number of surgically removed lymph nodes. We conducted a retrospective study to assess the risk factors and efficiency of physiotherapy procedures in reducing lower limb lymphoedema in women who underwent an exhaustive treatment plan for gynaecological malignancies. The study enrolled 21 patients with lower limb lymphoedema, who were initially treated by a multidisciplinary team for gynaecological malignancies at the “Prof. Dr Alexandru Trestioreanu” Institute of Oncology in Bucharest. Early initiation of physiotherapy after surgical treatment and radiotherapy, along with patient education, is associated with a higher regression rate of lower limb lymphoedema compared to only patient education and awareness. The treatment response rate was better in patients benefitting from lymphatic drainage, compression bandage and an individual physiotherapy plan compared to patients who only received lymphatic drainage and compression bandage (Mann-Whitney U test,  $p = 0.05$ ). Early detection and management of lower limb lymphoedema are important to prevent complications and improve quality of life for gynaecological cancer survivors.

**Keywords:** physiotherapy, lower limb lymphoedema, gynaecological malignancies.

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### Introduction

The treatment of cancer in general and gynaecological malignancies in particular is ensured by a multidisciplinary team made up of: surgical oncologist or gynaecological oncologist, radiotherapist, medical oncologist, oncology nurse, psychologist, nutritionist and physiotherapist.

Lower limb lymphoedema is one of the most invalidating long-term complications of treatments (such as surgery, chemo- and radiotherapy) for gynaecological malignancies,

affecting approximately 15% of women treated for this condition (Biglia et al., 2017; Colombo et al., 2016).

Lower limb lymphoedema is a chronic disease that consists in the abnormal swelling of the superficial tissues. It is caused by the inability of lymphatic vessels to drain lymph after surgical removal of lymph nodes and frequent radiotherapy in gynaecological malignancies. Lower limb lymphoedema occurrence is related to several risk factors, the most important being obesity, radiotherapy and the number of surgically removed lymph nodes.

Lymphoedema is clinically obvious by an increase in thigh and/or leg volume due to lymph retention and can be expressed by disfigurement, physical discomfort, functional impairment, swelling, pain and inflammatory symptoms.

## **Methodology**

We conducted a retrospective study to assess the risk factors and efficiency of physiotherapy procedures in reducing lower limb lymphoedema in women who underwent an exhaustive treatment plan for gynaecological malignancies indicated by the multidisciplinary team (Figure 1).



Figure 1. Lower limb lymphoedema associated with gynaecological malignancies  
(Personal collection)

### *Participants*

The study enrolled 21 patients out of 480 with lower limb lymphoedema, who were initially treated by the multidisciplinary team for gynaecological malignancies at the “Prof. Dr Alexandru Trestioreanu” Institute of Oncology in Bucharest. The study group included patients aged between 24 and 68 years. Two age subgroups were highlighted by a greater number of cases: 41-50 and 51-60 accounting for 33.3% (7 patients) and 42.8% (9 patients), respectively (Figure 2).

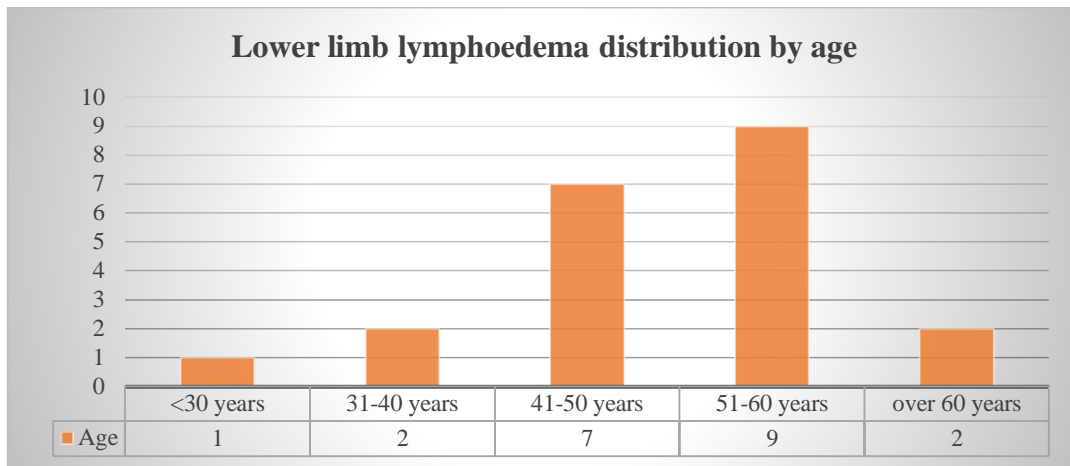


Figure 2. Lower limb lymphoedema distribution by age

### Measurements

Lower limb lymphoedema was assessed by comparative circumferential measurements of both lower limbs using a retractable tape measure.

Measurements were taken for both thigh and leg by the same person, before and after the physiotherapy programme (Figure 3).

A personal record was kept for each patient. The same protocol of assessing lower limb lymphoedema evolution was performed for each enrolled patient and was considered when a difference of at least 2 cm between both thighs and legs was encountered (Buzea & Ancuța, 2014; Taylor et al., 2006).

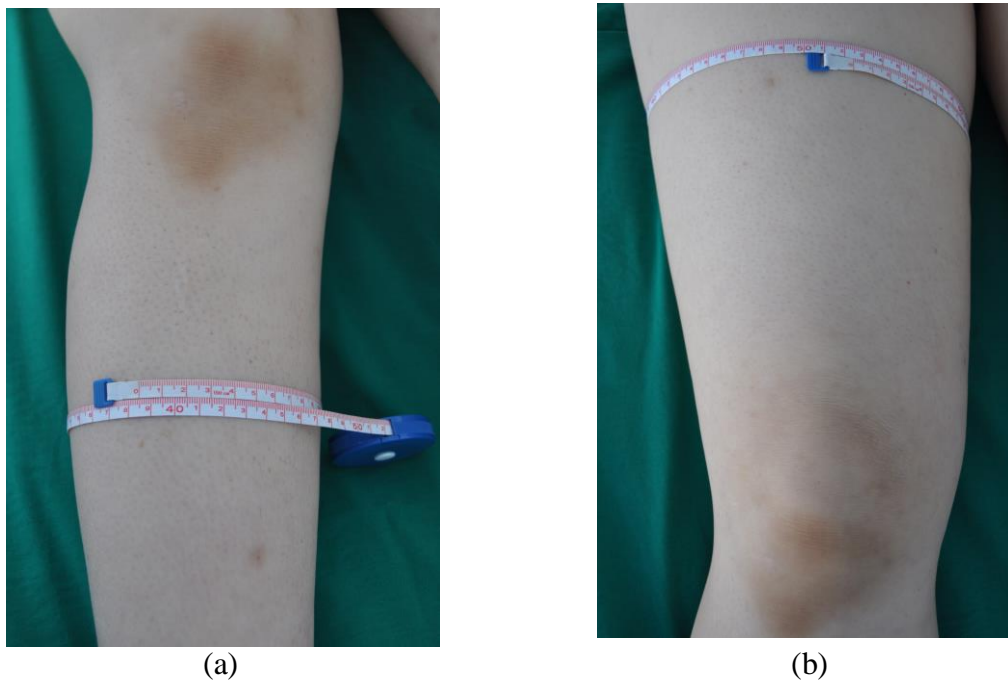


Figure 3. Thigh and leg measurements (a) before the physiotherapy programme; (b) after the physiotherapy programme (Personal collection)

### *Procedure*

As there is a lack of a standard classification system, the rates for secondary lymphoedema reported in the literature range from 5% to 25% (Engrich, 2019). We analysed the impact of other risk factors such as age, type of cancer, radiotherapy, body mass index (BMI), urban or rural area. The patients were scheduled for follow-up visits at 1 and 3 months after treatment over 2 years.

All 21 patients enrolled in the study received education and awareness about their individual risk factors. The patients were informed and trained regarding the preventive and protective measures against lower limb lymphoedema appearance and progression:

- Avoiding intense and difficult physical effort as well as lifting or carrying weights;
- Prevention of lower limb infections;
- Avoiding trauma and injury;
- Healthy, low-salt diet and proper weight control;
- Avoiding extreme temperatures such as sauna and iced bandages;
- Recommended sports: swimming, walking and specific medical exercises;
- Elevated position of the lower limbs during rest;
- Immediate physical examination for any signs of infection: erythema, pain, local swelling and fever. (Mateescu, 2014)

Of the 21 investigated patients, 11 were randomised and received lymphatic drainage, compression bandage and an individual physiotherapy plan (physical exercise). The other 10 randomised patients received lymphatic drainage and compression bandage.

Compression therapy is considered the gold standard treatment for lymphoedema (Level 1.b evidence) (Damstra & Partsch, 2013; Doherty et al., 2009; Pritschow & Schuchhardt 2010; Segal et al., 2017). There is strong evidence that compression therapy significantly reduces limb volume in individuals with lymphoedema, with the effect commencing within hours of compression application (Singh et al., 2016).

Wrap systems have advantages in the ease with which patients can self-apply the compression, attain equivalent interface pressure as healthcare professionals and adjust the compression.

Patients can be educated to tighten the compression system if it begins to loosen, thus creating optimal interface pressure over longer wear times (Level 1.c evidence). International clinical guidelines recommend that compression bandages are applied to achieve sub-bandage pressure of at least 45 mmHg for individuals with lymphoedema stage II or higher, or 15 to 25 mmHg in individuals who cannot tolerate higher pressure (Damstra & Partsch, 2013; Ridner, 2006; Segal et al., 2017; Stefani et al., 2017).

There are special manual lymphatic massage techniques that increase cellular oxygenation and fluid removal, which significantly reduces the diameter of the affected limbs. Lymphatic drainage massage is a gentle massage performed with special movements that help improve lymphatic flow. Manual lymphatic drainage is achieved on a certain pathway, considering the anatomical and physiological characteristics of the lymphatic system. The final goal is to open the lymphatic anastomoses and accessory drainage channels. Studies (Engrich, 2019; Földi & Strössenreuther, 2003) have shown that the lymphatics open by a stretching and

slightly sideways movement, after which the skin must be released (without lifting the hand off the skin) for the lymphatics to close and the lymph to be absorbed through the channels.

Also, the skin should not be pushed but left to come back by itself. The pressure must be high enough to mobilise the skin but so low that nothing is felt under the skin (muscle). Too much pressure can collapse the lymphatics. A certain rhythm and speed must be maintained to produce relaxation and stimulate the parasympathetic nervous system; each movement will be done 10-15 times for 2 seconds.

When an area needs to be drained, this must be started proximally, there where the lymph nodes have been surgically removed, and then move away progressively but always pushing the lymph in the direction of the ex-nodes. In this way, it frees the lymphatic path, creating a suction effect. This massage should not cause pain and, if the skin turns red, too much pressure has been applied. The massage is done directly on the skin and not through clothes. (Profir, 2016; Földi & Strössenreuther, 2003; Medina-Rodriguez et al., 2019)

An essential part of lymphoedema management and treatment is compression bandaging. This must become automatic in the daily ritual: skin hygiene - shower - application of emollient skin lotion - compression bandaging of the affected segment. When the bandage is correctly applied, it will work as a compression device every time. As the segment changes in diameter, the bandage will adapt to the new dimensions. A tubular elastic bandage will not have the same efficiency. (Szuba et al., 2000; Herpertz, 2021)

The effects of the compression bandage are to protect the skin from irritation, support the skin as the segment reduces in size and increase the efficiency of the muscular pumping mechanism that allows strong pressure during muscle work and reduced pressure during rest to stimulate lymphatic drainage, thus preventing constriction.

“Pressure drainage (automatic lymphatic drainage) has the same benefits as the manual lymphatic drainage, however the effects are given by the gradual mechanical compression provided by the air in the compartments of the special sleeves applied on the upper and lower limbs or the pants type applicator. [...] Pressure drainage is recommended as aiding maintenance therapy after the manual lymphatic drainage and elastic pressure at patients with chronic oedema.” (Profir, 2016) Contraindications to compression are: severe arterial insufficiency, uncontrolled heart failure and severe peripheral neuropathy.

Prior to commencing lower limb compression, a comprehensive cardiovascular assessment is recommended to rule out any underlying disorders.

## **Results**

In the present study, the incidence rate of lower limb lymphoedema is 4.37% after treatment for gynaecological malignancies (21/480 patients) (Figure 4).

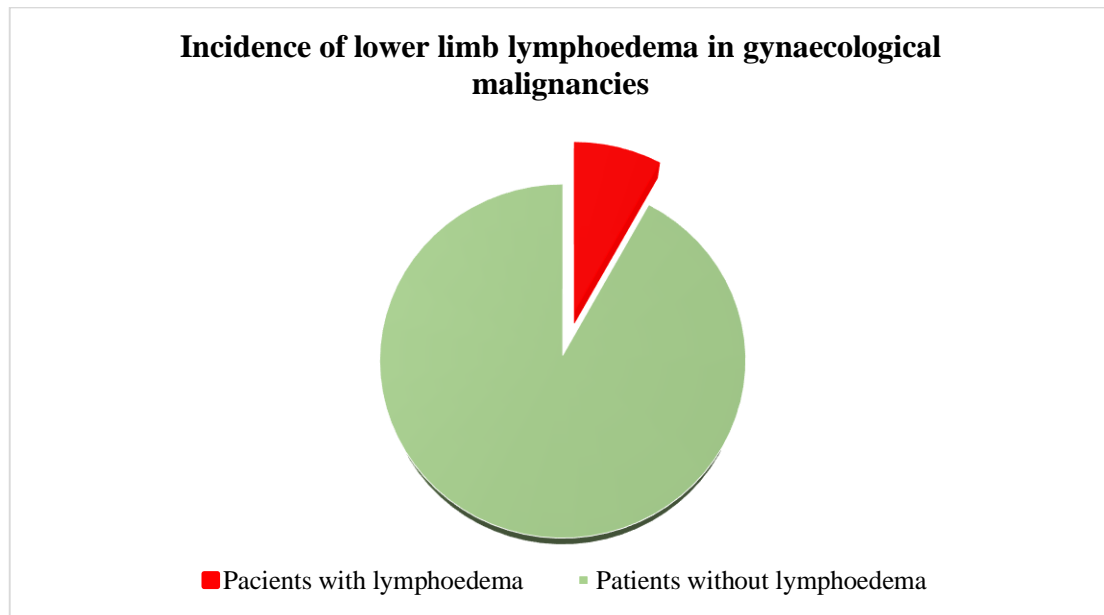


Figure 4. Incidence rate of lower limb lymphoedema

The body mass index was over 27 for 13 patients (61.9%) with lower limb lymphoedema, revealing that they were overweight or obese (Figure 5).

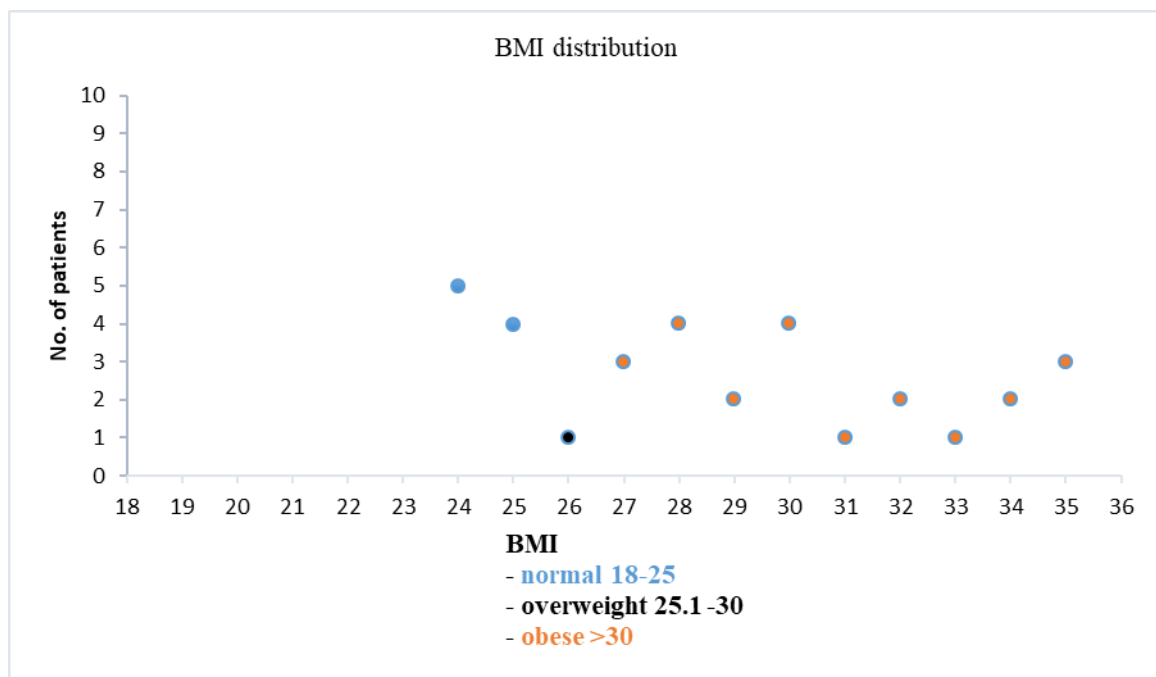


Figure 5. BMI distribution

Approximately 2/3 of the patients, namely 13 (61.90%), resided in urban areas and only 8 patients (38.1%) were from rural areas. For 6 (60%) of the 10 patients who received individual counselling and education, manual lymph drainage techniques and compressive bandage, lymphoedema decreased from stage 2 to 1 after 3 months of treatment.

Of the 11 patients who associated the above-mentioned procedures and benefitted from additional individual physiotherapy including stretching exercises, 8 (72.72%) reduced lymphoedema to stage 1, and one patient (9.08%) had a complete clinical response after treatment to stage 0 lymphoedema (Table 1). Of the 21 patients included in the study, 6 (21.57%) did not respond to the treatments provided.

Table 1. *Characteristics of patients in the studied groups*

	<b>Patients who received only counselling, manual lymph drainage and compressive bandage (Group 1)</b>	<b>Patients who received counselling, manual lymph drainage, compressive bandage and additional physiotherapy (Group 2)</b>
Patients who responded to treatment	6 (60%)	9 (81.8%)
Patients who did not respond to treatment	4 (40%)	2 (18.2%)
Total number of patients	10	11
		21

We used the nonparametric Wilcoxon Signed Rank Test to analyse the outcomes of additional physiotherapy based on the comparative data of circumferential measurements for both lower limbs before and after the treatment programme applied to experimental group 2 (N = 11) (Table 2).

Table 2. *Wilcoxon Signed Rank Test – Initial and final test results*

<b>Wilcoxon Test</b>	<b>Initial test vs. Final test Circumference</b>
Wilcoxon	3
Z	-2.100
P	0.05
R	0.63

The Wilcoxon test value is 3 (rank 1 was assigned to the lowest value). Since the calculated value is lower than the critical value ( $3 < 5$  and  $p = 0.05$ ), it can be concluded that there is a statistically significant difference between the post-intervention results (after the treatment programme) and the pre-intervention results of the experimental group 2. The effect size index has the value 0.63, meaning that the impact of the specific intervention on the participants in experimental group 2 is very strong as regards the obtained results.

The nonparametric Mann-Whitney *U* test allows comparison of two treatments without assuming that the values are normally distributed. By means of the Mann-Whitney *U* test and using the computerised test calculation version (Predoiu, 2020), we checked whether there were statistically significant differences between the compared groups in terms of treatment outcomes for lower limb lymphoedema, with or without added exercise (Table 3).

Table 3. Mann-Whitney U test assessing treatment efficiency of added exercise

Mann-Whitney (U) Test	Group 1 vs. Group 2 Circumference
U value	15.5
Z	-2.746
p	0.05
r	0.82

The U-test value is 15.5. Since the calculated U-value is lower than the critical U-value ( $15.5 < 26$ ) and the alpha significance threshold is 0.05, it can be concluded that there are significant differences between the two investigated groups in terms of treatment outcomes for lower limb lymphoedema. The effect size index has the value 0.82, which means that the effect of the group variable is very strong as regards the obtained results. The results have demonstrated that implementing additional exercise in the treatment programme (for patients in experimental group 2) significantly contributes to lymphoedema regression.

## Discussion

While age is a known risk factor for lymphoedema in general, its specific role in gynaecological malignancies is less clear. Research suggests that age may indeed be a risk factor for lymphoedema in gynaecological malignancies. There seems to be a correlation between age and an increased risk of lymphoedema in gynaecological malignancies. This may be due to decreased lymphatic vessel function and decreased lymphatic flow in older adults. It is important for healthcare providers to be aware of this potential risk factor and take appropriate precautions to prevent and manage lymphoedema in elderly patients.

Research also suggests that the incidence of lower limb lymphoedema may vary depending on the type of gynaecological cancer and the treatment modalities used. For example, Laufer et al. (2019) found in their study that 30% of women with vulvar cancer developed lower limb lymphoedema after treatment, while another study (Wedin et al., 2019) found that only 7% of women with endometrial cancer developed lower limb lymphoedema.

Overall, while cervical cancer does increase the risk of lower limb lymphoedema, other gynaecological cancers can also lead to lymphatic system damage and result in this condition. It is important for healthcare providers to be aware of the potential risk of lymphoedema in patients with gynaecological cancers and adopt appropriate preventive measures and management strategies to improve patient outcomes.

Several studies have shown that radiation therapy increases the risk of lower limb lymphoedema in cervical cancer patients. Thus, a study conducted by Laufer et al. (2019) found that 28% of women who received radiation therapy for cervical cancer developed lower limb lymphoedema. Another study (Salehi et al., 2019) found that radiation therapy increased the risk of lower limb lymphoedema in cervical cancer patients, especially in those who received a higher dose of radiation.

The risk of lower limb lymphoedema may also be higher in patients who undergo radiation therapy after surgery compared to those who undergo surgery alone. A study by Iuchi et al. (2015) found that patients who underwent radiation therapy after surgery for



cervical cancer had a higher risk of lower limb lymphoedema than those who underwent surgery alone.

To minimise the risk of lower limb lymphoedema in cervical cancer patients who receive radiation therapy, healthcare providers should recommend preventive measures such as compression stockings, physical therapy and exercise. They should also advise patients to avoid certain activities that may put additional stress on the lymphatic system, such as standing for long periods of time or wearing tight-fitting clothing. Early detection and management of lower limb lymphoedema are important to prevent complications and improve quality of life for cervical cancer survivors.

Cancer treatment has a multidimensional impact on patients' lives, affecting their level of physical, sensory, cognitive, psychological, family, social and spiritual functioning. Rehabilitation is part of the cancer care plan and has been recognised as a necessity and right of the cancer patient alongside cancer treatment. It is a way to minimise the impact and side effects of cancer treatment at various levels to help patients improve their quality of life and return to their normal lives (Morishita & Tsubaki, 2017; Newton, 2019).

The postoperative period is the most critical time phase: it is very important for the patient to mobilise as soon as possible (even from the hospital bed) to prevent the formation of lymphoedema. At this early moment, the physiotherapist's intervention is more than necessary because this specialist will show the patient the most suitable exercises and do the lymphatic drainage (Földi et al., 2012).

It is also important to know that radiation therapy can damage the lymphatic system, and some chemotherapy regimens can cause peripheral nerve impairments known as polyneuropathy, which induces sensitive and motor disturbances in the lower limbs (Liao et al., 2003).

Cancer patients can safely perform a moderate amount of exercise during and after treatment. Clinicians should advise patients to follow a consistent exercise programme and refer them to specialised physiotherapists (Drăgan & Pădure, 2018; Stefani et al., 2017).

The Canadian Society for Exercise Physiology and the American College of Sports Medicine (Buchan et al., 2015; Van Waart, 2015) recommend some basic exercise guidelines for cancer patients, namely:

- Each session should include a warm-up and cool-down period.
- Moderate-intensity exercise and exercises to increase endurance should be scheduled twice a week.
- Exercises aimed at increasing endurance should involve large muscle groups and be performed 2-3 times a week (8-10 muscle groups, 8-10 repetitions, 2 sets).
- Weekly lymphatic drainage is advised in order to improve lymphatic circulation.

There is sufficient evidence to show the benefits of physiotherapy in oncology both during and after the disease (Segal et al., 2017; Traves et al., 2013). The physiological effects of this therapy are the growth of the vascular bed by opening more capillaries under the influence of blood pressure, the increase of tissue blood oxygenation, hyperthermia, the release into circulation of an increased number of immune-competent cells, the stimulation of their production at the haematogenous bone marrow level, and thus the improvement of the immune response.

## Conclusion

Early initiation of physiotherapy after treatment for gynaecological malignancies, along with patient education, is associated with a higher regression rate of lower limb lymphoedema compared to only patient education and awareness.

The treatment response rate was 81.8% in patients who benefitted from lymphatic drainage, compression bandage and an individual physiotherapy plan compared to 60% in patients who only received lymphatic drainage and compression bandage.

Following the statistical analysis, a significant difference was found in the results for lower limb lymphoedema after the treatment programme compared to the pre-intervention results of the experimental group 2. The calculated effect size showed a very strong effect of the specific intervention on the participants included in experimental group 2 as regards the obtained results. The Mann-Whitney *U* test has revealed that there are significant differences between the two investigated groups in terms of treatment outcomes for lower limb lymphoedema. It has been concluded that implementing additional exercise in the treatment programme (for patients in experimental group 2) significantly contributes to lymphoedema regression. Early detection and management of lower limb lymphoedema are important to prevent complications and improve quality of life for gynaecological cancer survivors.

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**Informed Consent Statement:** The participants provided their written informed consent to participate in this study.

**Data Availability Statement:** Data are available upon request to the contact author.

**Conflicts of Interest:** The authors declare no conflict of interest.

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