



Application of Complete Decongestive Therapy in Patients with Secondary Bilateral Lower Limb Lymphedema after Comprehensive Treatment of Gynecological Malignant Tumor

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Abstract

Objective: The purpose of this study is to investigate the effect of complete decongestive therapy (CDT), based on fluoroscopy-guided manual lymph drainage (FG-MLD), combined with intermittent pneumatic compression (IPC) on patients with secondary bilateral lower limb lymphedema after comprehensive treatment for gynecological malignant tumors.

Methods: After comprehensive treatment for gynecological malignant tumors, 18 patients suffering from bilateral lower limb lymphedema were evaluated and treated by specialist nurses (with the qualification of lymphedema therapists). The treatment course included manual drainage, IPC, bandaging, functional exercise, and skincare etc., which are performed once a day for a total of 18 times.

Results: After performing the treatment 18 times, a significant reduction is observed in the patient's bilateral lower limb circumference, extracellular water (ECW) content, and lower limb segment ECW ratio. Moreover, the 50-kHz bioelectrical impedance and quality of life (QoL) scores are found to be significantly higher than before treatment (all $p < 0.05$). Subjective symptoms also improve significantly ($p < 0.05$), except for local swelling ($p = 0.289 > 0.05$).

Conclusions: CDT based on FG-MLD, combined with IPC, effectively relieves secondary bilateral lower limb lymphedema after comprehensive treatment of gynecological malignant tumors. It also improves subjective symptoms and patients' QoL, thus deserving clinical reference and promotion.

Keywords: gynecological malignant tumor, lymphedema, complete decongestive therapy, intermittent pneumatic compression

Introduction

SURGERY, RADIOTHERAPY, AND chemotherapy are the main treatment methodologies for gynecological malignant tumors. However, pelvic lymph node dissection during surgery may destroy the integrity of the pelvic and abdominal lymphatic systems, while the postoperative scar can hinder lymphatic reflux. Radiotherapy leads to pelvic lymphatic occlusion, stenosis, and fibrosis of surrounding tissues, eventually causing lymphedema.¹ This type of lymphedema

is called secondary lymphedema, compared with primary lymphedema, which usually has a definite cause.²

Literature has revealed a total incidence rate of about 25% for secondary lower limb lymphedema after comprehensive treatment of gynecological malignant tumors,³ which may occur in unilateral or bilateral lower limbs. Although morbidity is relatively low in secondary bilateral lower limb lymphedema,⁴ treatment is more difficult. Complete decongestive therapy (CDT) is internationally recognized as the most effective conservative treatment⁵ and is mainly used to treat limb

lymphedema. Additionally, intermittent pneumatic compression (IPC) is also considered an important auxiliary method.⁶

Therefore, based on the full evaluation of the characteristics of the disease, we used CDT combined with IPC to nurse patients with secondary bilateral lower limb lymphedema after comprehensive treatment of gynecological malignant tumors to improve the curative effect and their quality of life (QoL). We obtained satisfactory results and have summarized our nursing experience below.

Subjects and Methods

Subjects

Between January 1, 2019, and December 31, 2022, we selected patients who suffered secondary bilateral lower limb lymphedema after comprehensive treatment of gynecological malignant tumors in the lymphedema clinic of our hospital using the convenience sampling method.

Inclusion criteria are as follows: (1) a malignant tumor diagnosis confirmed by surgical pathology of the International Federation of Gynecology and Obstetrics; (2) patients receiving clinical treatment, including surgery, radiotherapy alone, surgery combined with radiotherapy, surgery combined with chemotherapy, and surgery combined with radiotherapy and chemotherapy; (3) patients diagnosed with bilateral lower limb lymphedema by B-mode ultrasound; (4) patients who are informed about and agreed to receive CDT and other treatments; and (5) patients who do not receive other types of treatments for lymphedema.

Exclusion criteria are as follows: (1) contraindications to CDT, including acute infection, cardiogenic edema, malignant lesions, renal failure, and acute deep venous thrombosis of the lower extremities; (2) uncontrolled or recurrent malignancy; (3) cognitive impairment; and (4) local ulcers, exudates, or chronic wounds in bilateral lower limbs.

Our study included a total of 18 patients, aged 47–73 years, with a mean age of 58.83 ± 7.22 years; in addition, 12 patients had cervical tumors, 3 had endometrial tumors, 2 had ovarian tumors, and 1 had a fallopian tube tumor. According to the severity of edema, seven cases belonged to stage II, nine cases to stage III, and two cases to stage IV.

The duration of edema ranged between 5 months and 9 years, with an average of 435 (216,724) days; two patients had perineal lymphedema, one had lower abdominal lymphedema, and four patients had a history of cellulitis or erysipelas. The remaining patients had no special conditions.

This study was approved by the Medical Ethics Committee of our hospital (SBQLLQ-2019-007), with all patients signing the informed consent.

Treatment

Assessment and treatment were performed by a specialist nurse from the lymphedema treatment faculty. All patients received a 21-day course of treatment, once a day from Monday to Saturday, for a total of 18 times. Bandage maintenance was performed on Sunday. Each treatment consisted of CDT based on fluoroscopy-guided manual lymph drainage (FG-MLD) combined with IPC. CDT included skin care, FG-MLD, bandaging, and functional exercise.

After the end of FG-MLD, IPC was performed for 30 minutes to consolidate the effect. Further details are given below.

Evaluation before treatment. Before treatment, the patients are evaluated for their history of gynecological malignant tumors, treatment history, edema in bilateral lower limbs, circumference measurement of bilateral lower limbs, and body composition analysis.

1. Medical and treatment history: this included the type of treatment, number of pelvic lymph node resections, and whether there is a history of erysipelas.
2. Edema: this included the time of occurrence of edema; color and integrity of skin; and lower limb activity. Additionally, texture and fibrosis of lower limbs, skin temperature, and stemmer signs are evaluated.
3. Circumference measurement of bilateral lower limbs: a nonelastic ruler was selected. The circumference measurement is done before every treatment and after the last treatment by using a bilateral, symmetrical, six-point marking method (at the root of the middle toe, the highest point of the lateral malleolus, 10 cm below the lower edge of the patella, 2 cm below the highest point of the patella, and 10 and 20 cm above the upper edge of the patellar component). The circumference values at all 6 points are added to obtain the circumference values of bilateral lower limbs of the patient.
4. Body composition analysis: before the 1st, 4th, and 7th treatment sessions and after the 18th treatment, the body composition of the patient was measured using a body composition analyzer (manufactured by Korea InBody Co., Ltd., model InBody770), and an individualized analysis was performed.

Skincare. Before each treatment, the skin was cleaned with either a neutral pH value or soap substitutes.⁷ During the course of treatment, any damage due to excessive pressure was observed and treated in time. The skin was kept moist and lubricated using Saifu moisturizer. Moreover, since the therapist's hands directly touch the patient's skin during manual drainage, the therapist should be gentle and not pull the skin excessively.

Manual lymph drainage. We used the technique of FG-MLD, which was based on fluorescence detection evidence.⁸ FG-MLD is an innovative method of MLD that focuses on delicate manipulation of edematous areas without the need to open generalized lymph nodes. This is done using a fill–flush technique for areas with edema and a gentle forward stroking technique for areas without edema.

The earlier or less severe side is first treated by manual drainage. The general order was as follows: lateral, medial, and anterior thigh (toward the groin on the same side) → knee joint and popliteal lymph nodes → anterior and posterior leg (toward the popliteal fossa) → ankle joint → foot.

It should be noted that during manual drainage, each drainage session and emptying of lymph from each part (foot, leg, and thigh) should end by emptying the axillary lymph nodes of the affected side four times. In addition, the drainage speed should be slow, while the number of times can be appropriately increased until the skin becomes soft.

Intermittent pneumatic compression. We used the Israel Lympha Press PCD-52™ IPC system for the treatment. The

patient was maintained in the supine position. The leg sleeve that wrapped the whole leg bilaterally circularly inflated and pressurized the leg from the distal end to the proximal end with appropriate pressure. The initial pressure and pressure gradient of each cavity are set according to the degree of edema and tolerance of each patient.⁹

The initial pressure was usually 25–30 mmHg, which was gradually increased with increase in the number of treatments up to the maximum treatment value (not more than 45 mmHg); from the distal to the proximal end, the pressure gradient decreased by 2–3 mmHg per cavity. IPC was performed once a day, with each treatment lasting for 30 minutes.

The patient's toe skin color and subjective feelings are closely observed during the treatment. In case of any discomfort, the treatment was immediately suspended.

Bandaging. After the IPC and until the 2nd day before the treatment, bilateral lower limbs are bandaged with multilayer pressure bandaging using low-elastic bandages.¹⁰ The more advanced or severe side is treated first by bandage. The bandage had four layers, namely tubular bandages, finger bandages or foam pads, polyurethane pads, and low-elastic pressure bandages from inside to outside. The pressure value was measured using a simple manometer matching the bandage.

The presentation of the pressure gradient was adjusted by selecting different widths of the low-elasticity bandage and also different stretching strengths. Bilateral lower limbs were initially treated with less bandaging pressure and then adjusted slowly to normal pressure as the number of treatments increased.

During the bandage period, the skin temperature, skin color, and sole movement of toes in bilateral lower limbs are observed.

Functional exercise guidance. Regular and effective functional exercise can accelerate lymphatic circulation, which plays a very important role in alleviating limb edema and improving limb function. Under the protection of pressure bandages, patients with lymphedema could carry out moderate and daily life activities along with the feasibility of performing light exercises.

During the daytime, it is recommended that they exercise 3–5 times a day, for 10–15 minutes each time, and not more than 30 minutes. Exercise includes walking, climbing stairs, and other sitting sports.¹¹ Patients should be instructed to avoid holding a single position for a long time.

Psychological care. The appearance of lymphedema after treatment of a malignant tumor may be mistakenly considered as recurrence of disease,¹² and therapists should pay more attention while talking to patients. Therefore, therapists should share more positive cases with good treatment results and encourage patients so that they regain confidence.

Observation index

Circumference of lower limbs. We selected data of two circumference measurements before and after treatment for comparison (circumference data before the first treatment and after the last treatment).

Edema-related indicators. The edema-related indexes selected for this study are as follows: extracellular water (ECW),¹³ ECW/total body water (TBW), ECW/TBW in bilateral lower limbs, and 50-kHz bioelectrical impedance in bilateral lower limbs.

Subjective symptoms and lower limb motion/range of motion. We adopted the Gynecologic Tumor Lymphedema Questionnaire designed by Carter et al.¹⁴ Patients' self-reported symptoms are assessed before and after treatment. The questionnaire included a total of 20 items and seven symptom groups, including heaviness (1), global swelling (2), local swelling (4), infection symptoms (3), pain (2), numbness (2), and limb dysfunction (6). The questionnaire is scored as 0 and 1, with each symptom group score of ≥ 1 point considered as positive.

Quality of life. The Chinese version of the European Organization for Research and Treatment of Cancer Quality of Life Core Scale, version 3.0 (EORTC QLQ-C30),¹⁵ was used to evaluate the QoL of patients before and after treatment. We selected five functional dimensions in the functional rating scale to evaluate the QoL. The higher the scores of patients, the better their QoL.

Statistical methods. SPSS 26.0 statistical software was used for data analysis. Enumeration data are expressed as the number of cases and percentages, while measurement data are expressed as $\bar{X} \pm S$. A paired *t* test was used to compare the enumeration data before and after treatment. The percentage of improvement in subjective feeling was compared before and after treatment using a paired fourfold table chi-square test.

The inspection level was at 0.05, while the difference was considered statistically significant at $p < 0.05$.

Results

1. Comparison of the circumference of bilateral lower limbs before and after treatment is shown in Table 1. The results showed that the circumference of bilateral lower limbs before and after treatment was significantly different ($p < 0.05$).
2. Table 2 provides the comparison results of ECW, ECW/TBW, ECW/TBW in bilateral lower limbs, and 50-kHz bioelectrical impedance in bilateral lower limbs before and after treatment. The results showed significant differences in ECW, ECW/TBW, ECW/TBW in bilateral lower limbs, and 50-kHz

TABLE 1. COMPARISON OF THE CIRCUMFERENCE OF LOWER LIMBS BEFORE AND AFTER TREATMENT

Project	Before treatment	After treatment	Difference	t	p
Circumference of both lower limbs (cm)	500.26 ± 31.85	446.98 ± 32.58	-53.27 ± 15.28	17.89	0.00

TABLE 2. COMPARISON OF EXTRACELLULAR WATER, EXTRACELLULAR WATER/TOTAL BODY WATER, EXTRACELLULAR WATER/TOTAL BODY WATER OF BOTH LOWER LIMBS SEGMENTS, AND 50-KHZ BIOELECTRICAL IMPEDANCE IN BOTH LOWER LIMBS SEGMENTS BEFORE AND AFTER TREATMENT

Project	Before treatment	After treatment	Difference	t	p
ECW (L)	14.22 ± 1.95	12.46 ± 1.71	-1.76 ± 0.53	14.13	0.00
ECW/TBW	0.4252 ± 0.0095	0.4068 ± 0.0079	-0.0183 ± 0.0065	11.95	0.00
ECW/TBW of both lower limbs segments	0.4330 ± 0.0096	0.4126 ± 0.0085	-0.0204 ± 0.0077	11.26	0.00
50-kHz Bioelectrical impedance of both lower limbs (Ω)	97.93 ± 12.44	152.27 ± 18.79	53.34 ± 13.02	-17.70	0.00

ECW, extracellular water; TBW, total body water.

bioelectrical impedance in bilateral lower limbs before and after treatment (all $p < 0.05$).

- Table 3 provides the comparison results of subjective symptoms and lower limb activity before and after treatment. Except for local swelling, there was no significant difference ($p = 0.289, 2890.05$). The rest of the subjective symptoms are statistically significant before and after treatment ($p < 0.05$).
- Table 4 lists the comparison results of the QoL of patients before and after treatment. After treatment, significantly higher differences are observed in the scores of each dimension of the QoL of patients than before treatment (all $p < 0.05$).

Discussion

CDT combined with IPC can effectively improve secondary bilateral lower limb lymphedema

Lymphedema usually recovers slowly and is a highly disabling disease. The pathological changes caused by it are generally irreversible, with no effective cure currently available.² Therefore, early treatment becomes key to control the progress of disease. Lymphedema in bilateral lower limbs exhibits pathological changes, including swelling in the bilateral lower limbs.

This brings in greater risk of infection and difficulty of treatment. MLD is an important part of CDT for lymphedema. In our hospital, therapists use innovative MLD, namely fill-flush of FG-MLD, to regularly pull the skin in the edema area of patients. This promotes regular expansion and contraction of subcutaneous lymphatic capillaries in the affected limbs, thereby accelerating superficial lymphatic circulation.

The IPC apparatus uses a multichamber airbag for inflation and deflation, producing progressive and directional extrusion, thus promoting lymphatic reflux. Lymph accumulated in bilateral lower limbs can be bandaged and drained to normal parts by physical pressure, which can reduce the re-

aggregation of lymph, increase reabsorption of macromolecular substances such as protein, and further alleviate local fat accumulation and skin fibrosis.

This study shows that after the CDT (based on FG-MLD) is performed in combination with IPC, a significant improvement was observed in the circumference of bilateral lower limbs and edema-related indicators compared with those before treatment (all $p < 0.05$). Hence, the CDT combined with IPC can effectively improve secondary bilateral lower limb lymphedema after comprehensive treatment of gynecological malignant tumors. Moreover, these results are consistent with Luo Qinghua's¹⁶ study.

CDT combined with IPC can significantly improve subjective symptoms and QoL of patients

In this study, continuous improvement of limb circumference and edema-related indicators further leads to significant improvement in the subjective symptoms of patients before and after treatment. Moreover, subjective symptoms, including heaviness of limbs, overall swelling, pain, and lower limb dysfunction, show significant improvement after treatment (all $p < 0.05$).

However, local swelling of the perineum and lower abdomen did not show significant improvement ($p = 0.289 > 0.05$), which may be due to the small sample size of our study. Additionally, after treatment, the scores of each dimension of the QoL of patients significantly increased compared with those before treatment (all $p < 0.05$). This indicates that CDT combined with IPC can effectively improve the QoL of patients.

Notably, results of the QoL survey in this study show that the QoL of patients in this group was generally low before treatment, indicating the significant impact of lymphedema on their QoL. This may be attributed to symptoms such as limb swelling, heaviness, or limb activity disorders caused by lymphedema of bilateral lower limbs. However, this may also be caused by greater psychological pressure on patients.

TABLE 3. COMPARISON OF SUBJECTIVE SYMPTOMS AND RANGE OF MOTION IN LOWER LIMBS BEFORE AND AFTER TREATMENT

Time	Number of cases	A heavy feeling	Pain	Numbness	A general feeling of swelling	Local swelling of perineum and lower abdomen	Infection	Limb dysfunction
Before treatment	18	11	6	6	15	3	4	4
After treatment	18	3	0	1	4	1	0	0
χ^2		7.481	—	4.433	13.486	1.125	—	—
p		0.006	0.007	0.035	0.00	0.289	0.034	0.034

TABLE 4. COMPARISON OF THE QUALITY OF LIFE OF PATIENTS BEFORE AND AFTER TREATMENT

Project	Before treatment	After treatment	Difference	t	p
Emotional function	60.11 ± 3.25	85.50 ± 4.76	-25.39 ± 4.35	-24.74	0.00
Role function	49.67 ± 3.33	66.11 ± 2.40	-16.44 ± 3.91	-17.83	0.00
Physiological function	62.28 ± 2.87	88.28 ± 3.27	-26.00 ± 4.22	-26.17	0.00
Social function	64.11 ± 2.68	88.50 ± 2.20	-24.39 ± 2.81	-36.82	0.00
Cognitive function	60.11 ± 3.25	84.06 ± 3.56	-23.94 ± 3.39	-29.99	0.00

Individualized assessment

Adequate assessment is very important to treat lymphedema, which includes the patient's history of previous surgery or treatment and the damage and repair of lymph nodes and other lymphoid tissues during previous treatment. While draining the lymph into the normal tissue area during FG-MLD, the therapist should avoid the patient's operation and radiotherapy area to achieve the best effect.

Moreover, adequate assessment provides an understanding of the different needs of individual patients, which can be targeted to fine-tune the individualized CDT treatment, including the size of the lower limb pressure gradient. In addition, since some patients have higher tolerance to pressure, the pressure can be increased accordingly, and vice versa.

The sequence and pressure strategies of CDT in lower limbs

The sequence principle adopted in this study is based on the summary of our clinical experience. We recommend that FG-MLD should be started from the limb with earlier staging because the loss of (or injury to) lymph nodes and lymphatic vessels in such a limb will be relatively small. Hence, the drainage effect may be better when the lower limb with later staging is drained after progressive drainage on the side with early staging.

During bandaging, we suggest that the lower limb at the later stage should be bandaged first because it can be protected by pressure products. When the limb with an earlier stage is bandaged, the lymph in this limb can be reduced, and the side with a severe stage can be drained.

Current status and the prospect of treatment

Difficulty in treatment of lower limb lymphedema. Edema or fibrosis of the toe and dorsal foot is difficult to treat. Due to the special location of these parts, no suitable pressure products are available and therefore the therapeutic effect cannot be maintained well. In this study, the toe and fibrosis of the dorsum of the foot in two patients are not effectively controlled; thus, treatment for these special parts should be explored and enhanced in the future.

Determining the course of treatment for bilateral lower limbs. In this study, we completed only one course of treatment for bilateral lower limbs. However, analyses of the mechanisms of lymphedema and stress treatment suggest two or more courses of treatment, which may be more satisfactory and more beneficial to patients.

However, no reports are available on relevant studies, and further research focusing on the effectiveness of multiple

courses of treatment for lymphedema is needed, which may improve the treatment effect and QoL of patients.

Conclusions

In this study, we used a combination of CDT (based on FG-MLD) and IPC in patients with secondary bilateral lower limb lymphedema after comprehensive treatment of gynecological malignant tumors. The results show that the treatment program effectively alleviated edema in bilateral lower limbs, significantly improving subjective symptoms and QoL in patients, which is worthy of clinical reference and promotion.

However, this study has some shortcomings, such as the poor controlling effect on the toe and edema-fibrosis of the dorsum of the foot and the lack of comparison between a single course and multiple courses of treatment. In the future, it is necessary to design controlled trials and monitor long-term treatment effects, which can enhance the scientific validity of this study.

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Authors' Contributions

All authors contributed to the design; data collection, analysis, and interpretation; and reporting of results. Z.A., supervised by Z.Y., analyzed the data. All authors contributed to and approved the final version of the manuscript.

Author Disclosure Statement

All authors declare no conflicts of interest.

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