

# The Long -Term Effects of Complex Decongestive Physical Therapy on Lower Extremity Secondary Lymphedema and Quality of Life

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**Abstract.** [Purpose] The aim of the present study was to evaluate whether quality of life (QOL) was improved in gynecological cancer patients with lymphedema following Complex Decongestive Physical Therapy (CDPT), and whether edema volume change as a result of treatment correlated with change in QOL. [Subjects and Methods] Forty-six patients who had unilateral lower leg lymphedema were treated with CDPT for 2–4 weeks. Percentage excess volume (PCEV) and QOL were recorded at baseline, 1 month, and 6 months after CDPT. [Results] PCEV was significantly decreased at 1 month. There was a statistically significant difference in physical functioning, role-physical, mental health, and general health in the Korean version of the Short Form-36 (SF-36) Health Survey. [Conclusion] The results of this study suggest that QOL was significantly improved for gynecological cancer patients with lower leg lymphedema during the maintenance phase, and was necessarily correlated with the PCEV.

**Key words:** Quality of life, Lymphedema, Complex Decongestive Physical Therapy

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## INTRODUCTION

As effective and newer modes of treatment have become available, cancer survivorship has continued to increase. The role of rehabilitation for this patient population has also increased. Not only can there be residual functional deficits from malignancies, but, more importantly, sequelae from therapeutic interventions can result in functional impairment and decreased quality of life<sup>1)</sup>.

Lymphedema is a general term describing pathological conditions with an excessive, regional accumulation of protein-rich fluid. It can be either primary or secondary after cancer treatment, including surgery and/or radiotherapy<sup>2,3)</sup>. Cancer and its subsequent treatment are recognized as leading causes of secondary lymphedema. As a result, many cancer survivors live with disfigurement, discomfort, and disruption of activities due to limb swelling<sup>4)</sup>. Affected patients have an unsightly, uncomfortable limb that is prone to repeated episodes of infection, and are at risk of the rare, but potentially fatal complication of secondary lymphangiosarcoma<sup>5)</sup>. The disfiguring, disabling, and chronic nature of lymphedema places women at risk of psychological and social sequelae<sup>6)</sup>. Several physical and emotional factors are related to lymphedema<sup>7)</sup>, including increased weight of the edematous limb with restricted motion aggravated by fibrosis and joint contracture, and altered sensitivity and embarrassment during social interactions<sup>8,9)</sup>.

Complex Decongestive Physical Therapy (CDPT) has been widely employed in Europe and North America<sup>10,11)</sup>. CDPT combines manual lymph drainage (MLD), compression with low-stretch bandages or a sleeve, skin care, and specific exercises to reduce lymphedema of the limb<sup>5)</sup>. It was introduced to South Korea in the 1990's<sup>12)</sup>. CDPT is now recognized as an effective non-operative technique for management of lymphedema and is recommended by the International Society of Lymphology<sup>13)</sup>. The edema reduction itself is naturally a great benefit to the patient in terms of reduced weight and simplified clothing, and the perceived impact of the treatment a patient's general health profile is a factor that should also be analysed when evaluating the overall outcome of treatment<sup>14)</sup>. Accordingly, a broader clinical approach in terms of quality of life (QOL) as an assessment of treatment effectiveness would likely benefit these patients<sup>15)</sup>. Evaluation of QOL has increasingly become an important issue for cancer patients with lymphedema. Topics of study have included the emotional, social, psychological, and sexual effects of breast cancer treatment<sup>16–18)</sup>. Though there has been a great deal of research aimed at understanding the quality of life of cancer patients, most of the research has focused on lymphedema from multiple causes<sup>15,19,21)</sup> or without a control group<sup>22,23)</sup>. Relatively few studies have focused specifically on the long term effects on women of lower extremity lymphedema treatment with CDPT.

The purpose of this study was to determine the long term physical and psychological impacts of treatment for lower extremity secondary lymphedema following CDPT, and whether limb volume change, as a result of CDPT treatment, was associated with change in QOL.

## SUBJECTS AND METHODS

The study was conducted at the Korea MLD Institute, Seoul, Korea. Data was collected from gynecological cancer patients who had experienced unilateral lymphedema within 5 years after cancer-related treatment. Patients were physician-referred for lymphedema treatment to the Korea MLD Institute of South Korea between April 1, 2006 and March 15, 2009. Inclusion criteria were that subjects should be 19 years or older, had no known neurological disorder that would interfere with completion of the measures, could speak and read, had no history of treatment for other types of cancer, had no known untreated or unstable medical conditions, had no edema in the upper limbs, had completed adjuvant chemotherapy, radiation and surgical treatment for gynecological cancer a minimum of 3 months and a maximum of 5 years previously, had no evidence of disease recurrence at the most recent follow-up visit, and had fully attended CDPT treatment 5 times per week for 2 weeks. Exclusion criteria were acute additional diseases, such as erysipelas, a possible malignant lymphedema, thromboembolic processes, pregnancy, hyperthyroidism, and decompensated heart insufficiency. Additionally, intolerance of the bandaging made obvious by skin reactions was declared a stop criterion. Fifty-seven patients met all eligibility criteria. Eleven patients were lost to follow-up: one patient died, and ten patients chose not to complete the SF-36 and volume measurement after treatment. Complete data were obtained from the remaining 46 eligible patients (80.0%).

After clinical examination and documentation, informed consent was obtained from each patient to study their limb volume and QOL after the purpose of the study had been explained. Each patient received treatment from a physical therapist, which consisted of a “decongestive phase” that lasted from 2 to 4 weeks, during which the patients receive treatment daily. The patients then followed a “maintenance phase” of self-care for the rest of their lives. All patients in the experimental period were treated with the CDPT program which consisted of a combination of MLD, compression bandaging, remedial exercise, and skin care as recommended by the International Society of Lymphology consensus<sup>4,13</sup>. Treatments were performed by physical therapists certified in Vodder’s technique of MLD. MLD lasted from 45 minutes to 1 hour. Then, a low- stretch compressive bandage (Rosidal K, Lohmann and Rauscher, Vienna, Austria) was wrapped in multiple layers (2–3) after covering the affected limb with padding (Artiflex, Beiersdorf).

Patients were instructed to perform exercises twice daily while wearing the bandages. The exercises are aimed at activating the muscle pump to increase pressure within the compartment formed by the low-stretch bandages. The

protocol also included teaching the patients to perform edema self-control activities that were to be continued at home in the maintenance phase. Patients were issued with compression garments as a final component of the treatment on the final day of the decongestive phase. The maintenance regime consisted of wearing compression bandages or garment at all times, a daily session of self-administered MLD, skin care, and an exercise program. The use of daytime bandages on at least three days per week was recommended during the maintenance phase. During the maintenance phase, follow-up visits were scheduled at 1 and 6 months.

A trained physical therapist measured lower limb circumferences at six locations (foot, ankle, calf, knee and two locations on the thigh) using a tape measure along the lateral aspect on each lower limb<sup>24</sup> before (baseline) and 1 and 6 months after treatment. Lymphedema volume was calculated for each segment by utilizing the formula for a truncated cone:  $\text{Volume} = H(C^2 + Cc + c^2)/12$ ,  $H$  = height,  $C$  = circumference of the top of the cone,  $c$  = circumference of the base of the cone. This method demonstrated excellent inter- and intra-observer reproducibility in comparison with water displacement, which is considered the gold standard<sup>25,26</sup>. Volumes for each segment were averaged and the reduction in lower limb circumference was calculated by the following formula with the unaffected limb used as a normal control for the affected limb (percentage excess volume; PCEV):  $\text{PCEV} = (\text{affected volume} - \text{unaffected volume}) / \text{unaffected volume} \times 100$ . Patients also completed the SF-36 questionnaire (Korean version, QualityMetric Incorporated, Lincoln, Rhode Island) on the initial visit and 1 and 6 months after completion of the decongestive phase.

Descriptive data are expressed as mean  $\pm$  SD values. Testing of all variables using the one-sample Kolmogorov-Smirnov test revealed that they were normally distributed. One-way analysis of variance (ANOVA) with repeated measures was used to detect significant effects of CDPT on the edema and QOL at before CDPT, 1 month and 6 months. In the event of significant values of  $F$  in the ANOVA, the Bonferroni correction test of critical differences was used to detect significant differences between means. Pearson’s product-moment correlation coefficients were calculated to examine the relationships between PCEV and QOL. The collected data were analyzed using standard statistics software (SPSS ver. 17.0), and a probability of  $p < 0.05$  was considered statistically significant.

## RESULTS

Demographics of patients are shown in Table 1. The study group consisted of 46 patients, with an average age of  $53.0 \pm 5.4$  years. Their body mass index (BMI) ranged from 20.25–29.52 ( $M = 25.68$ ;  $SD = 2.8$ ). Patients, in general, tended to be obese. Most of patients had swelling in the left leg (52.2%). The cancer sites related to lymphedema encompassed five categories and most of the patients (52.2%) had had cervical cancer: 35 (78.3%) practised religion and 39 (84.78%) had no occupation. With regard to their cancer-related treatment, 34 women (73.9%) had

**Table 1.** Demographics of Quality of Life Study Group (N=46)

Characteristics	Study group	
Age (years)	Mean (SD)	53.0 (5.4)
	Range	37.4–75.8
BMI	Mean (SD)	25.68 (2.8)
	Range	20.25–29.52
Main site of edema	Right	22
	Left	24
Site of cancer	Uterus	7
	Ovary	5
	Cervix	24
	Vulva	2
	Other	8
Religion	Yes	35
	No	11
Occupation	Yes	7
	No	39
Cancer-related treatment	Surgery only	9
	Radiotherapy only	3
	Surgery and radiotherapy	34
Time since surgery /radiotherapy (years)	Mean (SD)	2.7 (1.7)
	Range	0.2–4.5

received surgery and radiotherapy. The average length of time since surgery/radiotherapy was from 0.2–4.5 years (M=2.7; SD=1.7).

The PCEV differences between the abnormal and normal side were  $80.12 \pm 25.31\%$ ,  $28.54 \pm 21.24\%$ , and  $39.24 \pm 30.15\%$ , at baseline, 1 month, and 6 months respectively ( $p < 0.05$ ). Bonferroni correction tests indicated that the PCEV was higher at baseline than at 1 and 6 months. The lymphedema volume was higher at 6 months than at 1 month, in overall, it decreased significantly in the decongestive phase and the maintenance phase.

Table 2 presents the mean scores of all the domains of the SF-36 for the patients. The scores for physical functioning ( $p = 0.004$ ), role-physical ( $p = 0.002$ ), mental health ( $p = 0.004$ ) and general health ( $p = 0.003$ ) differed significantly between baseline and 6 months. The scores for physical functioning, social functioning, role-physical, mental health and general health at 1 month and 6 months were significantly higher than at baseline; that is, quality of life gradually improved in these domains. The Pearson coefficient was calculated to examine the relationship between PCEV and QOL. Table 3 indicates that PCEV of lymphedema was negatively correlated with the SF-36 subscales, except for social functioning at 6 months ( $r = -0.30$ ,  $p = 0.06$ ), role-emotional at baseline ( $r = -0.26$ ,  $p = 0.08$ ), 1 month ( $r = -0.24$ ,  $p = 0.09$ ), and 6 months ( $r = -0.18$ ,  $p = 0.31$ ), mental health at baseline ( $r = -0.21$ ,  $p = 0.13$ ), vitality at baseline ( $r = -0.18$ ,  $p = 0.21$ ), 1 month ( $r = -0.23$ ,  $p = 0.06$ ), and 6 months ( $r = -0.28$ ,  $p = 0.06$ ) and bodily pain at baseline ( $r = -0.24$ ,  $p = 0.07$ ).

## DISCUSSION

Several short term studies<sup>15,17,20</sup> have reported reduced QOL in the area of physical health among lymphedema patients. Our previous long term study<sup>27</sup> of unilateral arm lymphedema showed that improvement of QOL of lymphedema patients through CDPT was especially effective in the areas of physical function, mental health, and role-physical. Populations in previous studies<sup>15,21</sup> comprised patients with multiple causes and small sample of patients with lymphedema. The present study included only gynecological cancer patients with lymphedema in a long term follow-up. Few studies investigated patients with lymphedema of the lower limb following CDPT. The present study ascertained the long term physical and psychological impacts of CDPT for patients with unilateral lymphedema of the lower limb and determined limb volume changes resulting from CDPT treatment and their associations with changes in the QOL.

Changes in lower limb volume reduction were controlled for by using the subjects' normal lower limbs as controls for their affected lower limbs. During the decongestive phase, we noted a decrease of PCEV from  $80.12 \pm 25.31\%$  at baseline to  $28.54 \pm 21.24\%$  at 1 month and  $39.24 \pm 30.15\%$  at 6 months ( $p < 0.05$ ). There was a significant decrease of edema volume in the decongestive phase. Kim et al.<sup>27</sup> reported similar results in volume reduction of patients with unilateral upper arm lymphedema. Boris et al.<sup>28</sup> reported persistence of reduced lymphedema volume was associated with compliance. In the study of Foldi et al.<sup>10</sup>, more than 50% of the patients maintained the initial reduction in lymphedema obtained after the decongestive phase in a 3-year follow-up program. Maintaining decrease of lymphedema volume in our study was due to patients' success with compliance for low stretch bandages, self-MLD, skin care, and remedial exercise.

There were statistically significant differences in self-reported physical functioning, role-physical, mental health, and general health which were associated with participation in the CDPT program, a trend toward increases in the scores of each domain was seen. Sitzia and Sobrido<sup>20</sup> reported similar improvements in QOL of patients following MLD or simple massage and compression bandaging. Using the Nottingham Health Profile Part 1, they reported that patients had the greatest improvement in physical mobility. The present study showed the greatest improvements in role-physical ( $p = 0.002$ ) and general health ( $p = 0.003$ ). The trend toward increases in physical functioning and role-physical scores of functional status and mental and general health scores of well-being supports the theory that CDPT is beneficial for the physical, and psychological health of women with secondary lymphedema after gynecological cancer treatment<sup>5, 25, 26</sup>. Subjects expressed feeling more confident using their affected lower limb for activities of daily living, and some mentioned that they had returned to walking long distances, playing sports, performing housework and shopping after the decongestive phase.

CDPT resulted in a significant edema reduction. The results of this study support an association between PCEV

**Table 2.** Baseline, 1-month, and 6-months QOL values (mean  $\pm$  SD) assessing functional status and well-being attributes of patients with unilateral leg lymphedema

	Baseline	1 month	6 months
Functional status			
Physical functioning	61.25 $\pm$ 16.10	64.68 $\pm$ 15.87	67.30 $\pm$ 13.51
Social functioning	64.30 $\pm$ 21.83	63.54 $\pm$ 18.26	69.59 $\pm$ 16.98
Role-physical	52.34 $\pm$ 16.97	54.76 $\pm$ 17.18	60.24 $\pm$ 11.63
Role-emotional	57.75 $\pm$ 24.85	62.42 $\pm$ 13.52	63.11 $\pm$ 19.76
Well-being			
Mental health	54.18 $\pm$ 17.44	60.18 $\pm$ 15.19	62.49 $\pm$ 12.39
Vitality	56.53 $\pm$ 12.41	57.43 $\pm$ 18.12	58.25 $\pm$ 18.40
Bodily pain	59.38 $\pm$ 15.12	60.24 $\pm$ 25.21	62.34 $\pm$ 15.26
General health	65.24 $\pm$ 18.46	66.15 $\pm$ 17.32	74.15 $\pm$ 15.39

**Table 3.** Pearson correlations between PCEV and QOL

	Before (baseline)	1 month	6 months
Functional status			
Physical functioning	-0.52*	-0.55*	-0.48*
Social functioning	-0.58*	-0.60*	-0.30
Role-physical	-0.47*	-0.52*	-0.48*
Role-emotional	-0.26	-0.24	-0.18
Well-being			
Mental health	-0.21	-0.32*	-0.45*
Vitality	-0.18	-0.21	-0.28
Bodily pain	-0.24	-0.31*	-0.51*
General health	-0.38*	-0.41*	-0.42*

\*p&lt;0.05.

and scores in most domains of SF-36. The association suggests that lymphedema volume reduction is an important factor in the improvement of QOL. Thus, it is reasonable to postulate that the CDPT program for edema control influences the association between PCEV and QOL.

The main strengths of the present study were that it was a long term study and dealt only with patients with lymphedema after gynecological cancer. The treatment was homogeneous and provided by the same physical therapist who was specialized in cancer rehabilitation. However, because there was no other treatment control groups in this study, the results of the study must be interpreted with caution. The effects of CDPT should be compared with other treatments to investigate their long term effects on QOL and lymphedema. Such studies may determine the best treatment methods and best means of improving QOL for gynecological cancer patients with incurable chronic lymphedema.

This is the first study to examine the long term effect of CDPT on QOL of gynecological cancer patients with lymphedema. CDPT program for lymphedema management had a substantial long term impact on QOL, and improvement in QOL is an important reason to consider it as therapy for secondary lymphedema resulting from gynecological cancer treatment.

## REFERENCES

- 1) Cohen SR, Payne DK, Tunkel RS: Lymphedema: strategies for management. *Cancer*, 2001, 92(4 Suppl): 980-987.
- 2) Logan V: Incidence and prevalence of lymphoedema: a literature review. *J Clin Nurs*, 1995, 4: 213-219.
- 3) Mortimer PS, Bates DO, Brassington HD, et al.: The prevalence of arm oedema following treatment for breast cancer. *Q J Med*, 1996, 89: 377-380.
- 4) International Society of Lymphology: The diagnosis and treatment of peripheral lymphedema. Consensus document of the International Society of Lymphology. *Lymphology*, 2003, 36: 84-91.
- 5) Foldi E: Treatment of lymphedema and patient rehabilitation. *Anticancer Res*, 1998, 18: 2211-2212.
- 6) MacWayne J, Heiney S: Psychologic and social sequelae of secondary lymphedema. *Cancer*, 2005, 104: 457-466.
- 7) Passik SD, McDonald MV: Psychosocial aspects of upper extremity lymphedema in women treated for breast carcinoma. *Cancer*, 1998, 83 (12 Suppl): 2817-2820.
- 8) Didem K, Ufuk YS, Serdar S, et al.: The comparison of two different physiotherapy methods in treatment of lymphedema after breast surgery. *Breast Cancer Res Treat*, 2005, 93: 49-54.
- 9) Liao SF, Huang MS, Li SH, et al.: Complex decongestive physiotherapy for patients with chronic cancer-associated lymphedema. *J Formos Med Assoc*, 2004, 103: 344-348.
- 10) Foldi E, Foldi M, Clodius L: The lymphedema chaos: a lancet. *Ann Plast Surg*, 1989, 22: 505-515.
- 11) Ko DS, Lerner R, Klose G, et al.: Effective treatment of lymphedema of the extremities. *Arch Surg*, 1998, 133: 452-458.
- 12) Kim SJ: Lymphedema. Seoul: Jungdam media publishing Co, 2002, pp 5-20.
- 13) International Society of Lymphology: The diagnosis and treatment of peripheral lymphedema. Consensus document of the International Society of Lymphology Executive Committee. *Lymphology*, 1995, 28: 113-117.
- 14) Sitzia J: A review of outcome indicators in the treatment of chronic limb edema. *Clin Rehabil*, 1997, 11: 181-191.
- 15) Pereira de Godoy JM, Braille DM, de Fatima Godoy M, et al.: Quality of life and peripheral lymphedema. *Lymphology*, 2002, 35: 72-75.

- 16) Ganz PA: Sexual functioning after breast cancer: a conceptual framework for future studies. *Ann Oncol*, 1997, 8: 105–107.
- 17) Lee CO: Quality of life and breast cancer survivors. *Psychosocial and treatment issues. Cancer Pract*, 1997, 5: 309–316.
- 18) Moyer A (1997) Psychosocial outcomes of breast-conserving surgery versus mastectomy: A meta-analytic review. *Health Psychol*, 1997, 16: 284–298.
- 19) Moffatt CJ, Franks PJ, Doherty DC, et al.: Lymphoedema: An underestimated health problem. *Q J Med*, 2003, 96: 731–738.
- 20) Sitzia J, Sobrido L: Measurement of health-related quality of life of patients receiving conservative treatment for limb lymphoedema using Nottingham Health Profile. *Qual Life Res*, 1997, 6: 373–384.
- 21) Weiss JM, Spray BJ: The effect of complete decongestive therapy on the quality of life of patients with peripheral lymphoedema. *Lymphology*, 2002, 35: 46–58.
- 22) Carter BJ. Women's experiences of lymphedema. *Oncol Nurs Forum*. 1997, 24: 875–882.
- 23) Woods M, Tobin M, and Mortimer P: The psychosocial morbidity of breast cancer with lymphoedema. *Cancer Nurs*. 1995, 18: 467–471.
- 24) Horsley JS, Styblo T: Lymphedema in the postmastectomy patient. In: Bland KI, Copeland EM, (ed) *The Breast*. WB Saunders, Philadelphia, 1991, pp701–706.
- 25) Boris M, Weindorf S, Lasinski B: Persistence of lymphedema reduction after non-invasive complex lymphedema therapy. *Oncology (Huntingt)*, 1997, 11: 99–109 discussion 110, 113–114.
- 26) Casley-Smith JR, Casley-Smith JR: Modern treatment of lymphedema. Complex physical therapy: the first 200 Australian limbs. *Australas J Dermatol*, 1992, 33: 61–68.
- 27) Kim SJ, Yi Ch, Kwon OY: Effect of complex decongestive therapy on edema and the quality of life in breast cancer patients with unilateral lymphedema. *Lymphology*, 2007, 40: 143–151.