研究結果の刊行物・別刷り

European Journal of Vascular and Endovascular Surgery 43 (2012) 602–608

Contents lists available at SciVerse ScienceDirect

European Journal of Vascular and Endovascular Surgery

journal homepage: www.ejves.com

Net Effect of Lymphaticovenous Anastomosis on Volume Reduction of Peripheral Lymphoedema after Complex Decongestive Physiotherapy

J. Maegawa[a,*], M. Hosono[a], H. Tomoeda[a], A. Tosaki[d], S. Kobayashi[c], T. Iwai[b]

[a] Department of Plastic and Reconstructive Surgery, Yokohama City University Hospital, 3-9 Fukuura Kanazawa-ku, Yokohama 236-0004, Japan
[b] Oral and Maxillofacial Surgery, Yokohama City University Hospital, Yokohama, Japan
[c] Department of Plastic and Reconstructive Surgery, Kanagawa Children's Medical Center, Yokohama, Japan
[d] Higashi-kanagawa Tosaki Acupuncture Clinic, Kanagawa, Japan

WHAT THIS PAPER ADDS

- This study disclosed each effect of volume reduction in peripheral lymphoedema by microlymphatic surgery and conservative therapy, respectively, for the first time because both effects were not separated in previous studies.
- A number of patients who desire to have microlymphatic surgery have recently been increasing world over. The patients want to know net and true effect of the operation; therefore, this study can contribute the patients' decision whether or not they undergo the operation. This study also gives some good information to co-medical and therapists who wonder if the operation is effective.

ARTICLE INFO

Article history:
Received 30 September 2011
Accepted 24 December 2011
Available online 24 January 2012

Keywords:
Bandage
Compressive stocking
Microsurgery
Lower limb lymphoedema
Statistical evaluation

ABSTRACT

Objective: The results of reported lymphaticovenous anastomoses include some effects of complex decongestive physiotherapy (CDP). The present study aimed to determine the net effect of lymphaticovenous side-to-end anastomosis (LVSEA) in patients with lower limb lymphoedema treated by preoperative CDP.
Design: Retrospective observational study.
Materials: 37 LVSEAs in 31 patients.
Methods: Volumes of the thigh and leg with oedema were compared between the time of initial examination, and before (application of CDP) and after LVSEA. The patients were divided into two groups based on the number of anastomoses and lymphoscintigraphic findings.
Results: Preoperative CDP resulted in a reduction of 593 ml (both leg and thigh; $p < 0.001$). After CDP, LVSEA (1–8 anastomoses; average of 5) reduced the volume by 109 ml (52 ml for the thigh ($p = 0.01$) and 57 ml for the leg ($p = 0.002$)). There was no significant difference in volume reduction on lymphoscintigraphy. Volume was significantly reduced (by 55 ml in the thigh, $p = 0.049$; 96 ml in the leg, $p = 0.006$) in the group that underwent 6–8, but not 1–5 LVSEAs.
Conclusions: The net effect of LVSEA on volume reduction was confirmed, but was not particularly large. The need for CDP decreased in some patients postoperatively, and these patients should be considered for evaluation.

Although several reports[1–8] have described the effect of microlymphatic surgery on peripheral lymphoedema, details of treatment protocols and the individual effects of the surgery and of complex decongestive physiotherapy (CDP) are limited. Several facilities have recently been established to provide lymphaticovenous anastomosis (LVA), which is a physiological and relatively noninvasive surgery,[1–3,5,6] but the net effect of surgery on oedema has not been statistically analysed. Such surgical approaches are thought to require the accompaniment of CDP and thus reported results have included some effects of CDP performed by therapists at various facilities using different procedures. Moreover, the effect of separate CDP and LVA on oedema has not been analysed and evaluated after microlymphatic surgery. Here we statistically evaluated the net effect of surgery after CDP reduction on peripheral lymphoedema before applying a combination of pre- and

* Corresponding author. Tel.: +81 45 7872800; fax: +81 45 7835351.
E-mail address: maegawaj@med.yokohama-cu.ac.jp (J. Maegawa).

1078-5884/$ – see front matter © 2012 European Society for Vascular Surgery. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.ejvs.2011.12.032

postoperative CDP and unique lymphaticovenous side-to-end anastomosis[9] (LVSEA) for patients with chronic lower limb lymphoedema. We also compared the effect of treating patients based on the number of LVSEA per surgical procedure and type classifications derived from preoperative lymphoscintigraphic findings that we believe can indicate the severity of lymphatic dysfunction.[10]

Methods

From among 107 patients diagnosed with chronic lower limb lymphoedema at our department from a medical history and preoperative lymphoscintigraphy between June 2006 and June 2010, we selected 31 patients who had undergone 37 operations and for whom the same therapist (A.T.) qualified in manual lymph drainage had performed CDP and the same surgeon (J.M.) had performed one to eight (average of 5) LVSEAs. Thirty-one female patients (age range: 34–74 years; mean, 60 years with a standard deviation (SD) of 11 years) with cancer-related secondary lymphoedema were included. The ethics committee of Yokohama City University Hospital approved this study (Approval no. 027) and all 31 patients provided written, informed consent to participate in the study. The clinical stages of the 31 patients as proposed by the International Society of Lymphology[11] were I, II, late stage II and stage III in 1, 3, 21 and 6 patients, respectively. One, four and 26 patients underwent three, two and one operation, respectively. The patients were examined by lymphoscintigraphy before each operation and classified as type I ($n = 1$), II ($n = 3$), III ($n = 7$), IV ($n = 22$) and V ($n = 4$) according to type classifications based on preoperative lymphoscintigraphy.[10] The types are defined as follows: type I, visible inguinal lymph nodes with lymphatics along the saphenous vein and/or collateral lymphatics; type II, dermal backflow in the thigh and stasis of an isotopic material in the lymphatics; type III, dermal backflow in the thigh and leg; type IV, dermal backflow in the leg; and type V, radiolabeled colloid remaining in the foot and ankle. We assigned the patients to group TA ($n = 11$) comprising types I, II and III or group TB ($n = 26$) comprising types IV and V because the oedema was considered to be more severe in types IV and V than in types I to III.

We improved the original technique of end-to-end anastomosis[1–3,5,6] by performing LVSEA between the sidewall of the lymphatics and the proximal stump of the vein.[9] Patients with types II, III, IV and V were indicated for LVSEA because they had an obstruction, stenosis or lymph flow stasis. One patient with type I in this series underwent LVSEA because of a personal preference for surgery to minimise the need for conservative therapy. Thus, LVSEA with an average of 5 (range, 1–8) anastomoses was applied to the affected limb during one operation and comprised an average of four for the foot and leg, and one for the thigh. We also divided the patients according to the numbers of LVSEA per surgical procedure: group NA ($n = 24$), 1–5 anastomoses, and group NB ($n = 13$), 6–8 anastomoses. The median value of the number of anastomoses was 5 in this series. Whether patients with five anastomoses should be included in group NA or NB remains controversial. Our previous findings[9] revealed that the patency rate of anastomosis gradually decreases, which means more anastomoses are required to obtain favourable results. Therefore, we excluded patients with five anastomoses from group NB to evaluate the surgical effects.

The therapist (A.T.) measured the circumference of the affected limbs at the ankle, knee and 20 cm above the knee. The measurement frequency is shown in Table 1. When patients underwent multiple procedures, the first measurement after each was taken as the initial measurement. We calculated the approximate volumes of the leg and thigh using the circumferences measured in the affected limbs and compared the volume at the initial examination ($n = 37$) with mean volumes during Preop 100 ($n = 37$), between Preop 100 and Postop 100 ($n = 37$), Preop 100 and Postop 101–200 ($n = 34$), Preop 100 and Postop 301–400 ($n = 30$), Preop 100 and Postop 501–600 ($n = 14$) and Preop 100 and Postop 701–800 ($n = 8$).

Table 1
Frequency of measurement at each time.

Time	Frequency of measurement (average), times
Preop 100	2–15 (7)
Postop 100	1–13 (6)
Postop 101–200	1–14 (5)
Postop 301–400	1–14 (4)
Postop 501–600	1–13 (4)
Postop 701–800	1–9 (3)

Preop 100, preoperative day 3–100; Postop 100, postoperative day 8–100; Postop 101–200, postoperative day101–200; Postop 301–400, postoperative day 301–400; Postop 501–600, postoperative day 501–600; Postop 701–800, post-operative day 701–800.

Our protocol for treating chronic lower limb lymphoedema was as follows. We initially performed CDP as preoperative manual lymph massage to reduce the volume on an outpatient basis by having the patients wear mainly flat-knit and short-stretch single- or double-layered compressive stockings on the affected limb in the daytime and wrapping the limb with soft materials at night. We performed LVSEA when these procedures had almost maximally reduced the volume of the affected limb. The decision regarding the optimal time to undergo the operation was based on a change in the charted volume of the affected limb. Preoperative reduction of the affected limb by CDP can be estimated from a volume curve that reaches a plateau. The same CDP was repeated at 1–2 weeks postoperatively from a few days after discharge from the hospital for about 5 months on an outpatient basis. We attempted to reduce the number applications and classes of the layered stockings, the frequency and duration of manual lymph massage and the amount of time that the patients had to wear the stockings at around 6 months after surgery if the volume of the affected limb did not change. The period of CDP from the start of therapy until anastomosis was a maximum of 1024 (minimum, 37; mean, 387; SD, 272) days. Patients underwent LVSEA over a hospitalisation period of about 1 week using fluorescent near-infrared lymphangiography with indocyanine green[12,13] under general anaesthesia. Between one and eight anastomoses were performed between the foot region and the thigh. The average follow-up period after surgery was 527(265) days.

Statistical analysis

Assuming that fluctuations were neutralised by measurement tolerances, physical condition and minimal changes in physical condition, the lower limb circumference was regularly measured for around 100 days. Thus, we analysed mean values for 100 days at several times after surgery. When the period before surgery was <100 days, we used the measured values for the period. The effects of the CDP were judged based on differences between mean values for the 100 days before surgery and the start of CDP (initial examination) for all groups. In addition, the differences between means for 100 days before and for 100 days at each period after surgery were used to judge the effectiveness of the operations, which was considered to be the net effect. Data were analysed using IBM SPSS Statistics 18 software (SPSS Japan Inc., Tokyo, Japan). Significance was set at 0.05 (5%).

Results

The Shapiro–Wilk test of the normality of the data showed that the distribution was normal. Differences in the volumes of the leg and thigh were examined using a paired *t*-test. Mean differences between the volumes at initial examination (2969 and 2569 ml in the thigh and leg, respectively) and mean volumes during Preop 100 (312 and 281 ml in the thigh and leg (593 ml per limb), respectively) were statistically significant ($p < 0.001$). The ratio of the reduction in volume to the initial volume (reduction ratio) was 0.11 (11%) per limb. Mean volume was reduced by 52 ml ($p = 0.01$) in the thigh and 57 ml ($p = 0.002$) in the leg between Preop 100 and Postop 100. The reduction rate was 0.02 (2%), and the net volume reduction (109 ml) achieved by surgery was equivalent to 16% of the total volume reduction (702 ml; 109 + 593 ml) including that by preoperative CDP between the initial volume and the mean volume at 100 days after surgery. Mean volume reductions did not significantly differ between Preop 100 and Postop 101–200, 301–400, 501–600 and 701–800 (Fig. 1).

Mean volumes were reduced by 56 ml in the thighs ($p = 0.036$) and 71 ml in the legs ($p = 0.038$) of group TA ($n = 11$; Fig. 2), and by 51 ml in the legs ($p = 0.02$) of group TB ($n = 26$; Fig. 3) between Preop 100 and Postop 100.

Reductions in mean volumes did not significantly differ between Preop 100 and any other time frame in group NA (Fig. 4). In group NB with six to eight LVSEAs, mean volumes were significantly reduced by 55 ml in the thigh ($p = 0.049$) and 96 ml in the leg ($p = 0.006$) between Preop 100 and Postop 100 ($n = 13$), by 124 ml in the leg ($p = 0.004$) between Preop 100 and Postop 101–200 ($n = 12$) and by 85 ml in the leg between Preop 100 and Postop 301–400 ($n = 12$; Fig. 5).

Case report

Lymphoedema developed in the left lower limb of a 67-year-old woman 5 years after undergoing treatment for uterine cancer. She had received CDP for around 8 months (Fig. 6A) and lymphoscintigraphy indicated type II, which classified her into group TA (Fig. 6B). Preoperative CDP with compression stockings improved the oedema (Fig. 6A and C). She underwent LVSEA with eight anastomoses between the foot and the thigh. Oedema in the left lower limb improved after surgery with continued CDP (Fig. 6D). When she removed the stockings at about 6 months after surgery (Fig. 6E), oedema of the affected limb temporarily deteriorated. The oedema improved later without further treatment and the patient has remained free of compression stockings and bandaging for about 1 year. The overall reduction including the effect of CDP and surgery was 879 ml in the left lower limb at 18 months after surgery (Fig. 6F).

Discussion

The individual effect of LVA cannot be evaluated because it is always combined with various complex physiological therapies. We considered that oedema can be reduced using CDP with elastic stockings and/or bandaging before surgery, the net effect should be evaluated and then the net effect of subsequent LVA should be evaluated. The same examiner measured the circumference of affected limbs in patients who had undergone repeated LVSEA by the same surgeons and repeated CDP by the same therapists. Thus, the statistical reliability of the data was high. The circumference of the affected limb was influenced by factors such as weight, daily load and daily fluctuations. We suppressed variation in measured values by taking more measurements before and after surgery to generate data suitable for statistical processing. The patients included in this study differed in terms of place of residence, occupation, severity of oedema, and other factors. Therefore, the duration and frequency of CDP differed and standardising the conditions for the study was almost impossible. However, we could determine that the effects of preoperative CDP were maximal for each because we could determine when individualised reduction volume curves reached a plateau in each patient. Our experience has shown that patients with peripheral lymphoedema do not remain motivated to continue with long-term CDP. Therefore, a randomised comparative study of patients who have undergone only long-term CDP with those treated by CDP plus surgery might be a more appropriate way to separately evaluate the net effects of CDP and surgery in the future.

The numbers of lymphaticovenous anastomoses affected the mid-term volume reduction after surgery. Oedema in group NB with six to eight LVSEAs was reduced particularly in the leg between Preop 100 and at several time points after surgery because

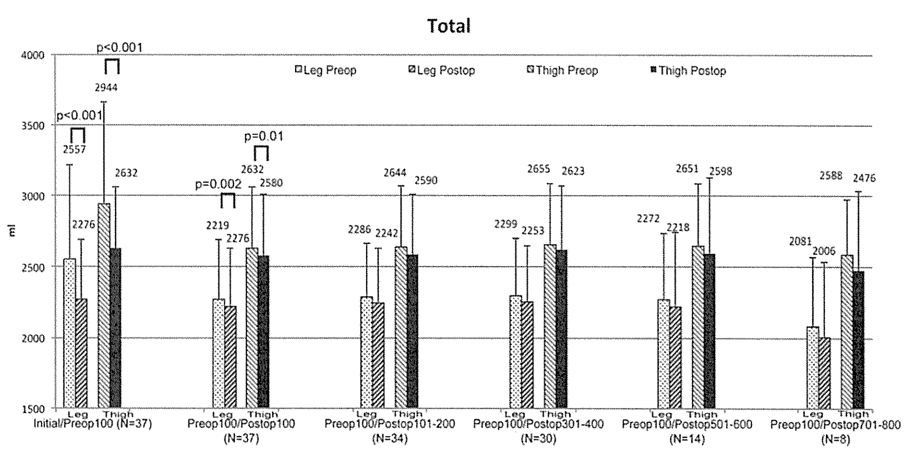

Figure 1. Comparisons of values obtained at initial examination (Initial) and mean values during 100 days before surgery (Preop 100) (Left 4 bars) and between mean values obtained during Preop 100 and by postoperative day (POD) 100 (Postop 100), POD 101 to 200 (Postop 101–200), POD 300 to 400 (Postop 301–400), POD 501 to 600 (Postop 501–600), and POD 701 to 800 (Postop 701–800) in all patients. Volumes and mean volumes of leg and thigh in each comparison are indicated above each standard error bar. *P* values indicate statistical differences ($p < 0.05$).

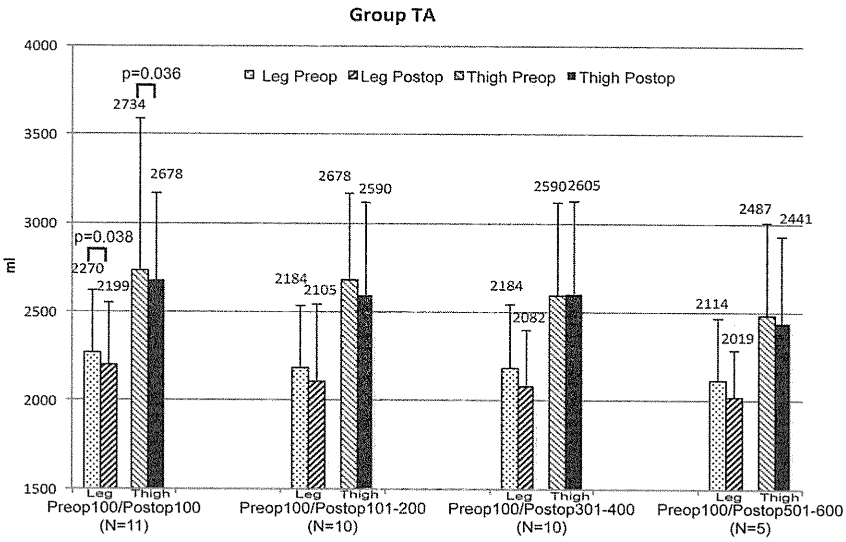

Figure 2. Comparisons between mean values obtained during Preop 100 and POD 100 (Postop 100), POD 101 to 200 (Postop 101–200), 301 to 400 (Postop 301–400) and 501 to 600 (Postop 501–600) in Group TA. Mean volumes of legs and thighs are indicated above standard error bars. *P* values indicate statistical differences ($p < 0.05$).

more anastomoses were performed in the feet and legs than in the thigh. Although a relationship between the numbers of anastomoses and volume reduction has been suggested by Hung et al.,[2] we did not find such a relationship. Furthermore, the ideal number of anastomoses required to achieve a reduction in volume reduction remains unclear. We found that over six anastomoses were required for volume reduction, which does not necessarily indicate a minimal number, but several anastomoses should be considered necessary to improve outcomes. The patency rate of LVA decreased over time as we previously reported,[9] and thus we consider that many anastomoses are needed to achieve good long-term outcomes.

We did not uncover obvious evidence that surgery reduced the volume any better in patients with mildly dysfunctional lymph flow

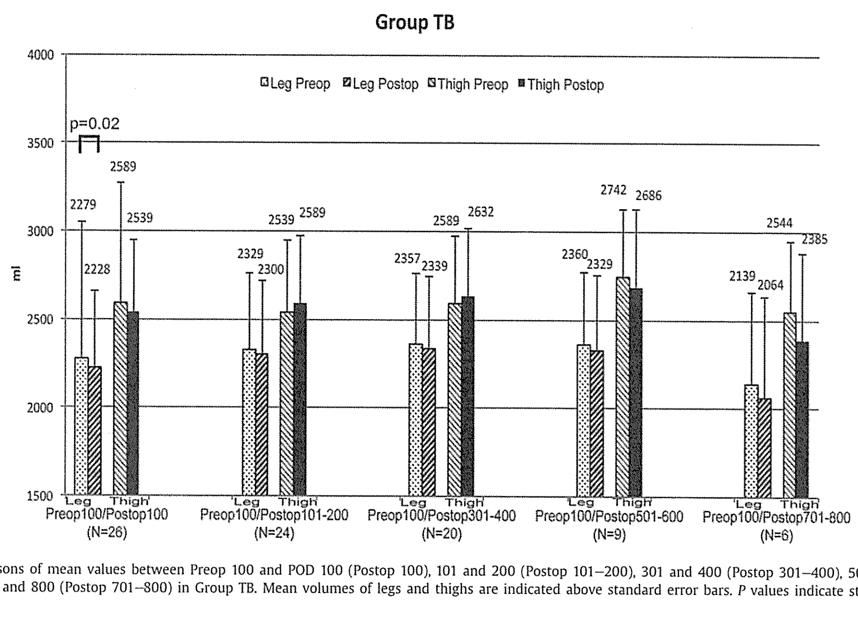

Figure 3. Comparisons of mean values between Preop 100 and POD 100 (Postop 100), 101 and 200 (Postop 101–200), 301 and 400 (Postop 301–400), 501 and 600 (Postop 501–600) and 701 and 800 (Postop 701–800) in Group TB. Mean volumes of legs and thighs are indicated above standard error bars. *P* values indicate statistical differences ($p < 0.05$).

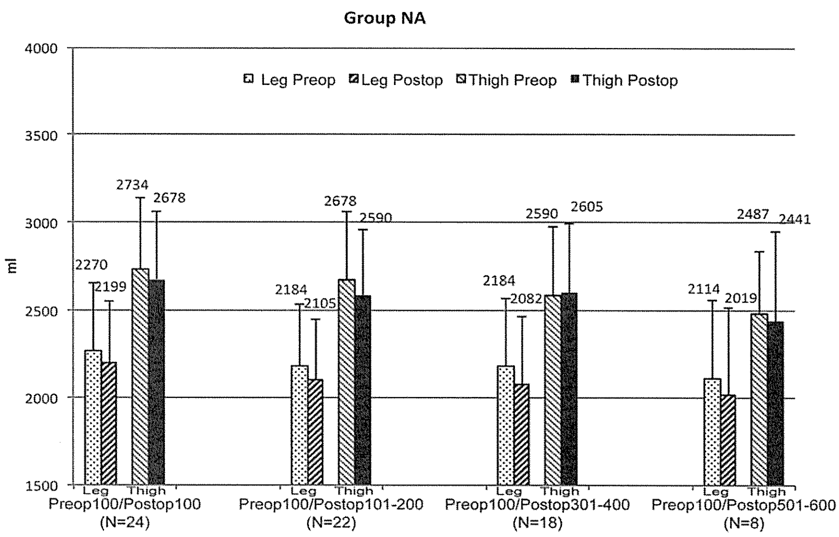

Figure 4. Comparisons of mean values between Preop 100 and POD 100 (Postop 100), POD 101 and 200 (Postop 101–200), 301 and 400 (Postop 301–400) and 501 and 600 (Postop 501–600) in Group NA. Mean volumes of legs and thighs are indicated above standard error bars. Values did not significantly differ in any comparison.

than in those with more severe lymphoscintigraphic findings. The former and latter types of patients were classified into groups TA and TB, respectively. Secondary lower limb lymphoedema has been classified using lymphoscintigraphy[14,15] and oedema tends to worsen with progressive types.[10] These types of classifications correlate to some extent with the clinical severity proposed by the International Society of Lymphology,[11] and are considered to reflect lymphatic function in patients with secondary lymphoedema. More LVSEAs are also being performed in different locations (such as the thigh) in patients with mild to moderate lymphoedema compared with patients with a more severe condition.[10] According to these results, the patients in group TA, whose lymphatic functions were relatively well maintained and reflected in the ease of surgery, should have had better volume reductions, but they did not. By

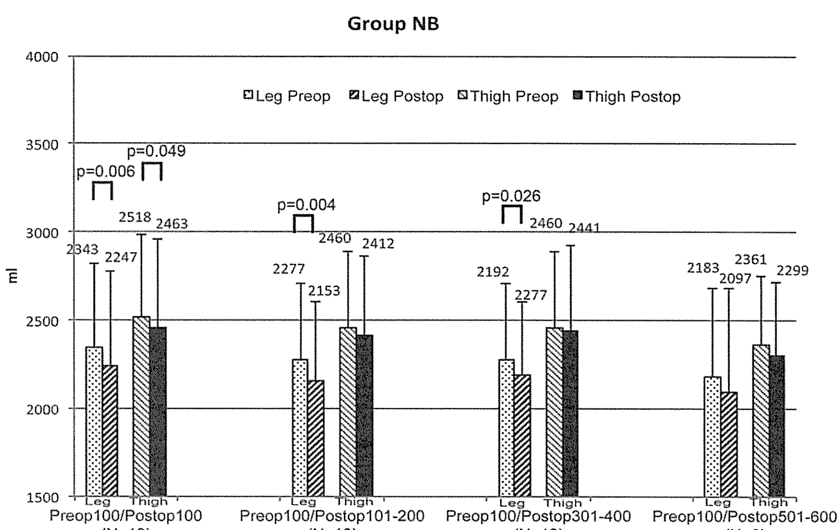

Figure 5. Comparisons of mean values between Preop 100 and POD 100 (Postop 100), POD 101 and 200 (Postop 101–200), 301 and 400 (Postop 301–400) and 501 and 600 (Postop 501–600) in Group NB. Mean volumes of legs and thighs are indicated above standard error bars. *P* values indicate statistical differences ($p < 0.05$).

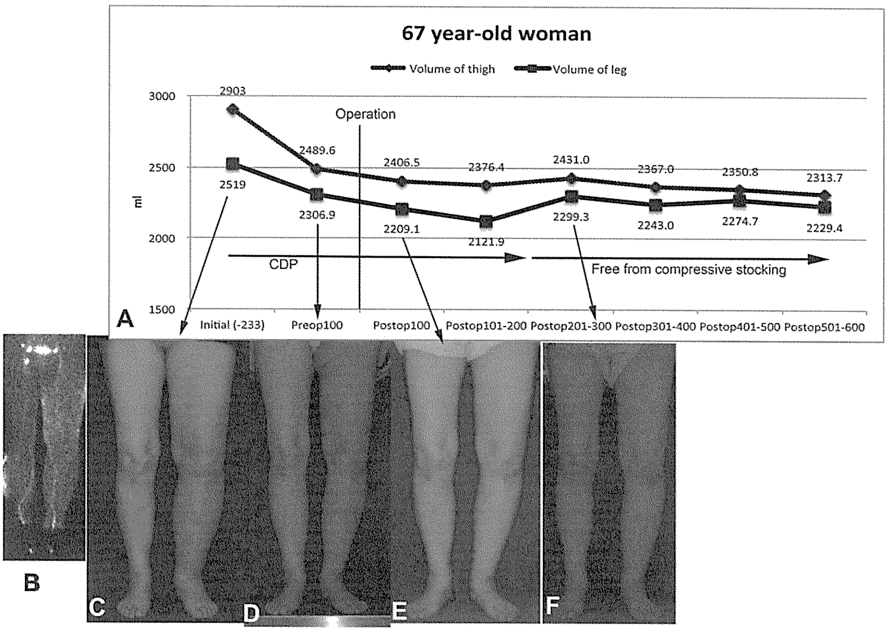

Figure 6. Line chart of volume change in leg and thigh of 68-year-old woman with left lower limb lymphoedema during CDP and lymphaticovenous anastomosis (A). Preoperative lymphoscintigraphy shows dermal backflow of contrast medium in left thigh area indicating Type II according to our classification (B). Frontal view of lower limb at initial examination shows extreme swelling with skin redness (C). Remarkable improvement in left lower limb oedema after preoperative CDP (D). Oedema has continued to improve by 3 months after surgery (E). Slight relapse of left limb oedema at 8 months after surgery when compressive garments were removed (F). Oedema has continued to improve for about 2 years (F).

contrast, functioning lymph ducts were difficult to identify during surgery in group TB with more severely affected lymphatic functions. Furthermore, fibrosis of the subcutaneous tissue was already complete in many such patients, and improving volume in the affected limb through surgery was considered difficult. Further studies are needed to conclude whether lymphoscintigraphy can be a predictor of the outcomes of strategies aimed at volume reduction in patients with a dysfunctional lymphatic system.

Experienced therapists or physiologists thoroughly reduced oedema before surgery by applying CDP. Some patients had already been treated at other facilities by the time of the initial examination. The period from initial examination to surgery was short for such patients. To accurately determine the limits of CDP was difficult, but experienced therapists or physiotherapists consider that they can be comparatively determined by measuring the extent to which the oedema has been reduced or the oedematous skin of the affected limb. Charts of volume changes in affected limbs might help to raise awareness of the limitation of CDP and define the optimal timing for microlymphatic surgery.

The overall findings from all of the patients indicated that CDP reduced oedema more effectively than surgery. The approximate 600 ml (11%) reduction achieved by preoperative CDP in affected limbs was significantly better than that achieved by surgery (about 100 ml; 2%). Compressive bandaging reduces volume more effectively than compression stockings.[16,17] Badger et al. reported a mean overall reduction rate of lower limb lymphoedema of 31% after bandaging followed by compression stockings compared with 15.8% using compression stockings alone.[17] However, stockings are more convenient and allow easier continuation of routine activities.[18] Layered stockings can also produce almost as much interface pressure as compression bandaging.[19] Therefore, we preferred to reduce volume by CDP mainly with stiff compressive stockings on an outpatient basis considering the medical circumstances in Japan.[20] We do not believe that surgical intervention is inferior to CDP because volume reduction is only one factor that is evaluated when considering treatment for lymphoedema. Surgical intervention such as LVA plays an important role in treating peripheral lymphoedema because lymph drainage from dysfunctional lymph vessels to a vein is essential and physiological in treating obstructive lymphoedema. From this perspective, surgical intervention seems superior to CDP. We also believe that drainage due to anastomosis does not always correlate with volume reduction.

Our experience indicated that the surgical effect should include not only the amount of oedema reduction such as lower limb volume but also changes in skin stiffness, subjective symptoms and the frequency of cellulitis. The frequency of outpatient treatment in this series sequentially decreased after surgery. The primary goals for patients with peripheral lymphoedema are, for example, oedema reduction and cellulitis control. On the other hand, the final outcomes for these patients are freedom from compressive garments or a reduction in the need for conservative therapies, which seems difficult to achieve by conservative therapy. The present series included some patients (one of whom was presented in the case report) who became free of CDP after the anastomosis and many for whom the class of pressure in the elastic stockings could be decreased. Both of these outcomes should be evaluated as effects of anastomosis. Therefore, how to perform such evaluations will require further discussion.

Acknowledgements

We thank Mr. Koukichi Hashimoto for analysing the data, and Ms. Nanae Matsuda for data collection.

Conflict of Interest

None declared.

Funding

None declared.

References

1 O'Brien BM, Mellow CG, Khazanchi RK, Dvir E, Kumar V, Pederson WC. Long-term results after microlymphaticovenous anastomoses for the treatment of obstructive lymphoedema. *Plast Reconstr Surg* 1990;**85**:562–72.
2 Huang GK, Hu RQ, Liu ZZ, Shen YL, Lan TD, Pan GP. Microlymphaticovenous anastomosis in the treatment of lower limb obstructive lymphoedema: analysis of 91 cases. *Plast Reconstr Surg* 1985;**76**:671–85.
3 Gloviczki P, Fisher J, Hollier LH, Pairolero PC, Schirger A, Wahner HW. Microsurgical lymphovenous anastomosis for treatment of lymphoedema: a critical review. *J Vasc Surg* 1988;**7**:647–52.
4 Baumeister RG, Siuda S. Treatment of lymphoedemas by microsurgical lymphatic grafting: what is proved? *Plast Reconstr Surg* 1990;**85**:64–76.
5 Campisi C, Eretta C, Pertile D, Da Rin E, Campisi C, Macciò A, et al. Microsurgery for treatment of peripheral lymphoedema: long-term outcome and future perspectives. *Microsurgery* 2007;**27**:333–8.
6 Koshima I, Nanba Y, Tsutsui T, Takahashi Y, Itoh S. Long-term follow-up after lymphaticovenular anastomosis for lymphoedema in the leg. *J Reconstr Microsurg* 2003;**19**:209–15.
7 Yamamoto Y, Horiuchi K, Sasaki S, Sekido M, Furukawa H, Oyama A, et al. Follow-up study of upper limb lymphoedema patients treated by microsurgical lymphaticovenous implantation (MLVI) combined with compression therapy. *Microsurgery* 2003;**23**:21–6.
8 Becker C, Assouad J, Riquet M, Hidden G. Postmastectomy lymphoedema: long-term results following microsurgical lymph node transplantation. *Ann Surg* 2006;**243**:313–5.
9 Maegawa J, Yabuki Y, Hosono M, Yasumura K. Technique, results, and post-operative patency of lymphaticovenous side-to-end anastomosis in peripheral lymphoedema. J Vasc Surg, in press.
10 Maegawa J, Mikami T, Yamamoto Y, Satake T, Kobayashi S. Types of lymphoscintigraphy and indications for lymphaticovenous anastomosis. *Microsurgery* 2010;**30**:437–42.
11 International Society of Lymphology. The diagnosis and treatment of peripheral lymphoedema. Consensus document of the International Society of Lymphology. *Lymphology* 2003;**36**:84–91.
12 Ogata F, Narushima M, Mihara M, Azuma R, Morimoto Y, Koshima I. Intraoperative lymphography using indocyanine green dye for near-infrared fluorescence labeling in lymphoedema. *Ann Plast Surg* 2007;**59**:180–4.
13 Unno N, Nishiyama M, Suzuki M, Yamamoto N, Inuzuka K, Sagara D, et al. Quantitative lymph imaging for assessment of lymph function using indocyanine green fluorescence lymphography. *Eur J Vasc Endovasc Surg* 2008;**36**:230–6.
14 Pecking AP, Albérini JL, Wartski M, Edeline V, Cluzan RV. Relationship between lymphoscintigraphy and clinical findings in lower limb lymphoedema (LO): toward a comprehensive staging. *Lymphology* 2008;**41**:1–10.
15 Gloviczki P, Calcagno D, Schirger A, Pairolero PC, Cherry KJ, Hallett JW, et al. Noninvasive evaluation of the swollen extremity: experiences with 190 lymphoscintigraphic examinations. *J Vasc Surg* 1989;**9**:683–9.
16 King M, Deveaux A, White H, Rayson D. Compression garments versus compression bandaging in decongestive lymphatic therapy for breast cancer-related lymphoedema: a randomized controlled trial. *Support Care Cancer* 2011 May 8 [Epub ahead of print].
17 Badger CM, Peacock JL, Mortimer PS. A randomized, controlled, parallel-group clinical trial comparing multilayer bandaging followed by hosiery versus hosiery alone in the treatment of patients with lymphoedema of the limb. *Cancer* 2000;**88**:2832–7.
18 Matthews K, Smith J, Aust J. Effectiveness of modified complex physical therapy for lymphoedema treatment. *Physiother* 1996;**42**:323–8.
19 Hirai M, Niimi K, Iwata H, Sugimoto I, Ishibashi H, Ota T, et al. Comparison of stiffness and interface pressure during rest and exercise among various arm sleeves. *Phlebology* 2010;**25**:196–200.
20 Yamamoto R, Yamamoto T. Effectiveness of the treatment-phase of two-phase complex decongestive physiotherapy for the treatment of extremity lymphoedema. *Int J Clin Oncol* 2007;**12**:463–8.

V　班員名簿

班構成員名簿

平成22～23年度　原発性リンパ浮腫患者におけるリンパ機能評価による重症度分類と新たな治療法の検討に関する研究班

区分	氏名	所属等	職名
研究代表者	前川二郎	横浜市立大学大学附属病院形成外科	准教授
研究分担者	青木一郎	横浜市立大学大学院医学研究科　分子病理学	教授
	井上登美夫	横浜市立大学大学院医学研究科　放射線医学	教授
	雫石一也	横浜市立大学大学院医学研究科　放射線医学	准教授
	三上太郎	横浜市立大学大学附属病院形成外科	助教
	山本康	横浜市立大学大学附属病院形成外科	助教
	安村和則	横浜市立大学大学附属病院形成外科	助教
	細野味里	横浜市立大学大学附属病院形成外科	指導診療医
	友枝裕人	横浜市立大学大学附属病院形成外科	指導診療医
	矢吹雄一郎	横浜市立大学大学附属病院形成外科	指導診療医
研究協力者	大石季美江	横浜市立大学大学附属病院形成外科	指導診療医
	永田可彦	産業技術総合研究所	主任研究員
	戸崎綾子	東神奈川とさき治療院	院長、鍼灸按摩マッサージ指圧師
	松田奈菜絵	東神奈川とさき治療院	鍼灸按摩マッサージ指圧師
	橋本孝吉	東神奈川とさき治療院	治療院顧問
	田中寿志	グローバルヘルス株式会社	代表取締役社長
	中村久子	東光株式会社	開発研究部部長
事務局		横浜市立大学附属病院 形成外科 〒236-0004 横浜市金沢区福浦3-9 Tel　045-787-2709　Fax 045-783-5351 E-mail　maegawaj@med.yokohama-cu.ac.jp	
経理事務担当者	中川　淳孝	横浜市立大学　先端医科学研究課 Tel:045-787-2503 Fax:045-787-2509 E-Mail:nakagawa@yokohama-cu.ac.jp	