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Clinical Research

Aggressive Decongestion in Limbs with Lymphedema without Subcutaneous Echo-Free Space

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Background: To study the impact of aggressive decongestion in limbs with lymphedema without subcutaneous echo-free space (SEFS) in subcutaneous tissue ultrasonography.
Methods: In 13 patients with arm lymphedema (ALE) (13 arms) and 16 patients with leg lymphedema (LLE) (18 legs) without SEFS, an aggressive decongestion was performed as the first phase of complex decongestive therapy. Measurements of circumference and calculation of limb volume were performed before and after the treatment.
Results: In ALE, no significant reduction in arm volume (median −63 [range −251 to 176] mL) or edema ratio (−4 [−15 to 12]%) was confirmed. On the other hand, a small but significant reduction in leg volume (−207 [−834 to 131] mL, $P < 0.001$) and edema ratio (−4 [−14 to 2]%, $P < 0.01$) was confirmed in LLE.
Conclusion: In limbs with lymphedema without SEFS, the impact of aggressive decongestion seemed limited.

INTRODUCTION

Complex decongestive therapy (CDT), which generally involves 2 stages, is a primary treatment for peripheral lymphedema.[1] In the first phase of CDT, an aggressive decongestion by using multilayered bandages and other materials is intended. The reduction of limb volume during this phase is considered to be mainly derived from the reduction of edema (i.e., excess extracellular fluid [ECF]). We previously reported that the subcutaneous echo-free space (SEFS) observed in the limb with lymphedema correlated well with the amount of ECF in the limb assessed using bioelectrical impedance analysis (BIA).[2] Namely, the absence of SEFS in the limb with lymphedema means that the ECF level is nearly the same as that in the normal limb, although a slight excess of ECF still exists.[3] Therefore, it may be hypothesized that the first phase of CDT can be omitted for such limbs. In the present study, we reviewed the changes in limb volumes during the first phase of CDT in arm lymphedema (ALE) and leg lymphedema (LLE) without SEFS and investigated whether the aforementioned hypothesis was appropriate.

MATERIALS AND METHODS

This retrospective study was approved by our institutional review board, and the need for individual patient consent was waived. Between April 2009 and March 2017, 66 patients with ALE and 174 patients with LLE who were not complicated by an active cancer or a systemic edemagenic condition such as

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Table I. Patient characteristics

Characteristic	ALE		LLE	
	SEFS(−)	SEFS(+)	SEFS(−)	SEFS(+)
No. of patients	13	20	16	75
Age (years), median (range)	66 (44−78)	70 (43−86)	59 (44−81)	67 (22−88)
Sex (male:female)	1:12	0:20	1:15	8:67
Body mass index (kg/m^2), median (range)	24 (17−32)	22 (17−31)	22 (16−32)	23 (16−33)
Edema laterality (unilateral:bilateral)	13:0	20:0	14:2	54:21
No. of affected limbs	13	20	18	96
Edema side (right:left)	1:12	7:13	5:13	47:49
Time from onset (months), median (range)	9 (3−150)	7 (1−371)	4 (1−187)[a]	35 (1−396)
Primary:secondary	0:13	0:20	0:16	5:70
ISL stage (I:II:III)	0:13:0	0:16:4	0:18:0	2:83:11

SEFS(−), absence of subcutaneous echo-free space (SEFS) in any part of the affected limb; SEFS(+), presence of SEFS in any part of the affected limb; ISL, International Society of Lymphology.
[a]$P < 0.05$ versus SEFS(+).

cardiac/kidney failure, and who had not started compression therapy, were referred to our clinic. Of those, the patients who agreed to have subcutaneous tissue ultrasonography in the limbs on their initial visits, and also agreed to undergo 2-staged CDT in our clinic, were included in this study. The patient characteristics are summarized in Table I.

As the first phase of CDT, we attempted to perform maximum decongestion by using multilayered limb bandages (MLLBs) and/or compression hosiery either at the outpatient or inhospital clinic. The MLLB was applied basically by qualified therapists; however, if the patients had difficulties in visiting the clinic frequently, the application was done by the patients themselves and/or their caregivers. Compression hosiery that provided an interface pressure of 30 mm Hg or greater was auxiliarily used in combination with MLLB. The patients were instructed on self-care methods such as self-drainage during this phase. Appropriate exercise and meticulous skin care were also encouraged. Once maximum decongestion was achieved, which was confirmed by the stabilization of reduced limb volume, we considered that the initial phase of CDT had completed.

The extremity volume was calculated from tape measurements at 5-cm intervals from the axilla to the wrist for ALE and at 10-cm intervals from the groin to the ankle for LLE, as described by Casley-Smith.[4] These measurements were performed between 1:00 PM and 3:00 PM. The edema ratio was calculated only in unilateral cases, as shown below:

Edema ratio = {(extremity volume in the affected limb) − (extremity volume in the contralateral limb)}/(extremity volume in the contralateral limb).

The measurements were performed at the beginning and end of the initial phase of CDT.

Subcutaneous tissue was scanned using an ultrasound system (LOGIQ S6; GE Healthcare, Little Chalfont, Buckinghamshire, UK) with a 12-MHz linear transducer. The arm was scanned at 4 points (medial/lateral, upper arm/forearm), and the leg was scanned at 8 points (upper/lower, medial/lateral, thigh/leg), as reported previously.[5,6] (Fig. 1)

Statistical Analysis

The results are expressed as median (range), unless otherwise indicated. To test the differences of limb volumes and circumferences before and after decongestion, the Wilcoxon signed-rank sum test was used. The Mann-Whitney *U*-test was used to test the differences of parameters between the groups with and without SEFS. Statistical analyses were performed using JMP 11.0 (SAS Institute, Cary, NC). A *P*-value of <0.05 was considered significant.

RESULTS

Subcutaneous tissue ultrasonography could be performed in 46 patients with ALE (46 arms) and 153 patients with LLE (197 legs) on their initial visits. In these limbs, SEFS was absent in 18 arms (39%) and 18 legs (9%). Finally, 33 patients with ALE (13 arms in 13 patients without SEFS [SEFS(−)] and 20 arms in 20 patients with SEFS [SEFS(+)]) and 91 patients with LLE (SEFS(−): 16 patients, 18 legs, SEFS(+): 75 patients, 96 legs) agreed to undergo 2-staged CDT in our clinic, and these patients were included in the present study. The patients' characteristics are summarized in Table I. The