

➤ **Original Article** ◀

Self-Care-Based Treatment Using Ordinary Elastic Bandages for Venous Leg Ulcers

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Objective: We aimed to study venous leg ulcer (VLU) healing and recurrence rates of VLU using a self-care-based treatment strategy.

Methods: The study included 36 patients (43 legs) who visited our clinic between April 2009 and June 2015 because of non-healing VLUs and who had been treated by us for more than a year (until June 2016). Patients or their caregivers were first provided instructions for performing the “no-intentional-stretch” bandaging technique using ordinary elastic bandages. Wounds were cleansed with tepid water daily, and bandages were re-applied by patients or their caregivers; this was continued until VLUs were healed. Compression was discontinued after healing, but was restarted if persistent swelling and/or dermatitis was noticed on their legs.

Results: The median ulcer size was 6.5 cm² (range, 1–105 cm²). The median number of clinic visits until healing was six (range, 3–35). The 6- and 12-month healing rates were 67% and 86%, respectively. Twenty (44%) legs required compression therapy after VLU healing. The cumulative recurrence-free rate at 60 months was 86%.

Conclusion: Reasonable healing and recurrence rates were achieved by applying a self-care-based VLU treatment strategy.

Keywords: venous leg ulcer, compression therapy, elastic bandage

Introduction

Venous leg ulcer (VLU) is one of the most common problems for which patients seek medical care.¹⁾ Since the time of Hippocrates, compression therapy has been considered as the gold standard for VLU treatment.²⁾ Majority of

VLUs get healed as long as proper compression is applied, regardless of modalities.³⁾ Similarly, non-compliance with compression therapy is known to lower healing rates and increase recurrence rates.⁴⁾ However, there is a shortage of expert phlebologists and nurses in Japan. In addition, compression hosiery and bandages for chronic venous diseases are not covered by national insurance policies, which results in the discontinuation of medical care in VLU patients. In this study, we primarily treated VLU patients with a self-care-based strategy involving “no-intentional-stretch” bandaging technique and evaluated the effectiveness of our strategy to reduce patient burdens and to standardize the quality of compression therapy.

Methods

This retrospective study was approved by our Institutional Review Board, and the need for obtaining individual patient consent was waived. Between April 2009 and June 2015, 41 patients visited our clinic because of non-healing VLUs (VLUs that were not healed for >6 months); of these patients, 36 (43 legs) were treated by us for more than a year (until June 2016) and were included in the study. Patient characteristics are summarized in Table 1. Duplex ultrasonography (DUS) was performed in all patients. However, because venous ulcers can develop without showing any abnormality in DUS,⁵⁾ we regarded ulcers in the area of lipodermatosclerosis as those with a venous origin. In difficult cases, the diagnosis was made based on mutual agreement between us, dermatologists, and pathologists.

Management of VLUs

In the early stages of VLU treatment, surgical interventions for superficial and/or perforator vein insufficiency were performed, if indicated. Deep vein surgery was not performed because our clinic did not have an expert surgeon. For compression therapy, we instructed patients to apply bandages between the ankle and popliteus and to use three rolls of ordinary elastic bandages (Getto[®] elastic bandage, Kawamoto Corporation, Osaka, Japan; extensibility, 108%; width, 10 cm; length, 4.5 m/roll; cost, ~450

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Table 1 Characteristics of patients, affected legs, and associated ulcers

Patients		(N=36)
Age	Years; median (range)	68 (28–91)
	>70 years	17 (47%)
Sex	Male : female	14 : 22
BMI	kg/m ² ; median (range)	23 (16–42)
	>30 kg/m ²	7 (19%)
Walking distance	<200 m/day	7 (19%)
Occupation	Standing for >8 h/day	9 (25%)
Rheumatoid arthritis		7 (19%)
Previous admission for VLU		9 (25%)
	Multiple admissions	4 (11%)
Legs		(N=43)
AROM	<20°	17 (40%)
Venous pathology	FV reflux	1 (2%)
	FV occlusion	0 (0%)
	GSV reflux	15 (35%)
	SSV reflux	2 (5%)
	PV reflux	1 (2%)
Previous surgery	Varicose, perforator veins	3 (7%)
	Skin grafting	7 (16%)
Ulcers		
Duration before treatment	Years; median (range)	0.6 (0.5–12)
Laterality	Right : left	22 : 21
	Bilateral	7 (16%)
Recurrences		15 (35%)
	Average number of recurrences	0.8
Size	cm ² ; median (range)	6.5 (1–105)
Location	Lower inner calf	24 (56%)
	Lower lateral calf	20 (47%)
	Inner ankle	9 (21%)
	Lateral ankle	0 (0%)
	Pedal	2 (5%)
	Multiple	13 (30%)

BMI: body mass index; AROM: ankle range of motion; FV: femoral vein; GSV: great saphenous vein; SSV: short saphenous vein; PV: perforator vein

JPY/roll), which can be repeatedly washed and reused for several months. Details of the application technique have been reported previously.⁶⁾ Briefly, the person applying the bandage was instructed to softly place it around the leg so that it can fit the leg and smooth out wrinkles in an advancing direction without intentionally stretching the bandage. This technique effectively reduced variations in interface pressure (IP) and stiffness introduced depending on the skills of the person applying the bandage and also standardized the compression level among patients. Further, elastic bandages provided a better fit with minimal

tension compared with inelastic bandages. With this technique, IP and stiffness linearly increased with the number of bandage rolls used. Using three rolls of bandages between the ankle and popliteus, an IP of 40–45 mmHg and static stiffness index (SSI)⁷⁾ of 11–13 mmHg can be achieved in ordinary Japanese patients.⁸⁾ In cases where adequate IP and/or stiffness could not be achieved using three rolls to promote healing, additional rolls were added or the outermost bandage was replaced with an inelastic one. In most cases, another roll was required for the pedal to control edema. Bandages were applied for 24 h a day, except during bathing, until VLUs were healed. Wounds were cleansed using tepid water, and bandages were re-applied daily either by patients or by their caregivers. Medications such as iodine/sugar paste and basic fibroblast growth factor (Fiblast[®], Kaken Pharmaceutical Co., Ltd., Tokyo, Japan) were used, if indicated. Wounds were covered using simple non-adherent dressings. In cases where exudates were abundant, non-sterile diapers were directly applied. Initially, patients or caregivers were asked to visit the clinic every 1–2 weeks until they mastered the bandaging technique for appropriate wound management. Once they had perfected the technique, they visited the clinic once every 1–3 months, and we examined the wounds and bandaging techniques. During every visit, two measurements of the maximal perpendicular diameter of VLU were recorded, and these values were multiplied to determine the ulcer size as described by Stacey et al.⁹⁾ VLU was considered to be healed when epithelialization of the entire wound surface was achieved. After healing, we encouraged patients to discontinue compression therapy. Compression therapy with bandages or use of strong medical compression stockings (MCSs) was restarted only if persistent swelling and/or dermatitis was noticed on their legs.

Statistical analysis

Results are presented as mean ± standard deviation or count (percentage) unless otherwise indicated. Kaplan–Meier analysis was performed to estimate the recurrence-free survival. Statistical analyses were performed using JMP 11.0 (SAS Institute, Cary, NC, USA). A p-value of <0.05 was considered statistically significant.

Results

The median number of clinic visits to learn the bandage technique was two (range, 1–7) during a median of two (range, 1–8) weeks. Seven patients had physical disabilities, and bandages were applied by their caregivers, and the remaining 29 (81%) patients themselves applied bandages. Two patients applied bandages for <3 days per week, but the remaining 34 (94%) patients complied with

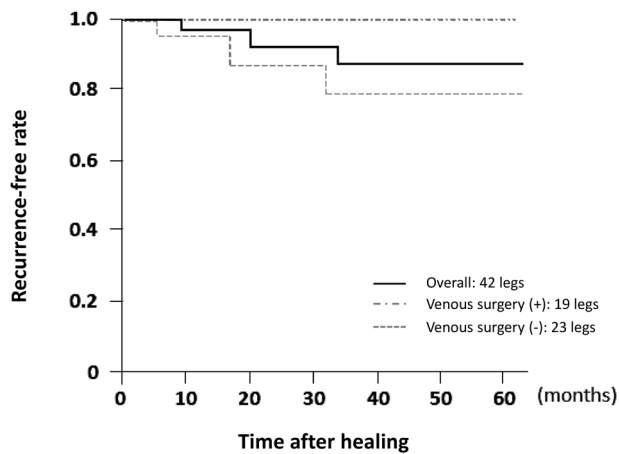


Fig. 1 Recurrence-free rate.

the instruction, i.e., bandages were applied for 24 h a day, except during bathing. The median number of visits to the clinic until healing was six (range, 3–35) during a median of five (range, 0.6–62) months. In 42 (98%) legs, VLU were healed with the aforementioned method. In the case of an 83-year-old woman, despite treating a 4.8-cm² VLU in the gaiter area for a year, the ulcer did not heal possibly because of severe anemia. This was finally managed using hyperbaric oxygen therapy. The 6- and 12-month healing rates were 67% and 86%, respectively.

Among the 19 legs on which venous surgery was performed, compression therapy was restarted for four (21%) legs after healing (two bandages and two MCSs). Of the 23 legs on which surgery was not indicated, compression therapy was restarted in 16 (70%) after healing (11 bandages and five MCSs). In this group, VLUs recurred on five legs, which were successfully treated by applying the same self-care-based strategy. The cumulative recurrence-free rate at 60 months was 86% (Fig. 1). Patients that were indicated for venous surgery were recurrence-free during the current observation period, while the recurrence-free probability was 78% at 60 months in patients who were not indicated for surgery. Because the recurrence rate was low and the sample size was small, risk analysis for recurrence was not performed.

Discussion

A general recommendation of applying compression therapy for a prolonged period because of high recurrence rates of VLUs imposes significant economic and social burdens on patients.^{4,10} In Western countries, medical personnel who provide compression therapy significantly contribute to treatment costs.¹¹ Elderly individuals are at an increased risk for developing VLUs¹²; however, they also find it difficult to make frequent hospital visits. Our self-care-based strategy for the healing of VLUs at

home may contribute to reducing these burdens while maintaining comparable healing and recurrence-free rates compared with those reported previously.^{3,4,13,14} In fact, during the treatment, patients gained confidence in managing the VLU treatment by themselves and found it unnecessary to make frequent hospital visits, which altogether resulted in a reduced number of hospital visits.

VLUs are open wounds with an active blood supply and these should be spontaneously healed if venous stasis is properly managed. Therefore, the application of an appropriate compression level is critical for the healing of VLUs. Compared with custom-made hosiery that require regular refitting, ordinary elastic bandages are cheaper, reusable, and can fit legs of any shape, even when used with dressings. These bandages are particularly beneficial for patients in Japan where hosiery for venous diseases are not covered by national insurance policies. Moreover, patient compliance with the use of strong MCSs is known to be very poor.^{15,16} Further, elderly individuals prefer bandages because they are easy to use.¹⁷ Our “no-intentional-stretch” technique rarely led to complications, such as ischemia and skin injury due to constriction, and ensured that IP and stiffness could be easily maintained and controlled.⁸ This bandaging technique is expected to generate an IP of 40–45 mmHg and an SSI of 11–13 mmHg, and the values measured at the clinic were similar to these values. It has been reported that a higher IP is associated with a higher VLU healing rate.¹⁸ Mosti et al. have recently reported that VLUs with moderate ischemia can be successfully managed with an IP of approximately 40 mmHg¹⁹; however, an IP of approximately 50 mmHg can reduce blood flow to the toe.²⁰ These results indicate that an IP of 40–50 mmHg, which is equivalent to the values observed in our study, may be sufficient and safe for the healing of VLUs. It has also been reported that the healing of VLUs is strongly related with a higher stiffness.²¹ Importantly, the bandaging technique applied by Mosti et al. generated an SSI as high as 18 mmHg even at the time of bandage removal. However, our results suggest that an SSI of > 10 mmHg may be sufficient for the healing of most VLUs.

In the present study, the probability of VLU recurrence in patients who underwent superficial and/or perforator surgery was less, although some of them (21% of legs) required some form of compression therapy after healing. Thomas et al. have reported that 52% of legs do not require compression therapy after the healing of VLUs by venous surgeries.²² Therefore, it can be assumed that some patients with VLUs due to superficial and/or perforator vein insufficiency do not require life-long compression therapy. However, despite the absence of venous disorders in a duplex scan, other risk factors, such as occupations requiring prolonged standing peri-

ods,⁵⁾ obesity, and reduced ankle range of motion,²³⁾ can lead to VLUs. VLU recurrence is always preceded by C3–4 symptoms described by the Clinical-Etiology-Anatomy-Pathophysiology classification.²⁴⁾ Therefore, we recommend that patients should discontinue the compression therapy once the ulcers are healed and should restart the therapy only when symptoms of recurrence are noticed. Because patients had already mastered the self-care based strategy, they could easily restart it, if needed. We speculate that this strategy will relieve a considerable number of VLU patients from life-long compression therapy.

Limitation

Because this was a single-center and retrospective study that included a limited number of patients, reaching a definite conclusion was difficult. Although IP and SSI are important factors in compression therapy, methods such as Holter electrocardiography used to monitor these factors in real time are lacking; such methods need to be developed in the future.

Conclusion

Healing and recurrence-free rates obtained with our self-care-based treatment strategy for VLU were comparable to those reported previously. We believe that this strategy has the potential to reduce economic and social burdens on patients.

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Ethical Approval

This retrospective study was approved by the Institutional Review Board of Yamaguchi University Hospital (Center for Clinical Research, Ube, Yamaguchi, Japan), and the need for obtaining individual patient consent was waived.

Disclosure Statement

The authors declare that there is no conflict of interest.

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Data collection: KS, TH, MS, YT, TM

Analysis: KS

Investigation: KS

Writing: KS

Funding acquisition: NM, KH

Critical review and revision: all authors

Final approval of the article: all authors

Accountability for all aspects of the work: all authors

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