

Venous leg ulcer management: low compression versus no compression across care settings

ABSTRACT

Aim To compare the characteristics of patients with venous leg ulcers (VLU)s managed with low compression therapy in an acute care wound clinic at tertiary hospital setting versus those managed without compression in a community home care setting

Method This retrospective study reviewed medical records of VLU patients managed in the community home care setting and acute care wound clinic setting between January 2016 and December 2018. Characteristics of these patients receiving care of their VLUs in two different settings were evaluated. Data on patients' medical history, demographics, and healing days were extracted from electronic records.

Results A total of 142 patient records were extracted and analysed, of which 73 were from the community home care and 69 from acute care wound clinic in a tertiary hospital. On average, patients had 1.48 ulcers (SD=0.85) from the community care and 1.59 (SD=0.84) from the acute care wound clinic. Factors such as ambulatory status, hypertension, diabetes mellitus, and anemia significantly affected VLU healing. Ulcer healing within 90 days was observed in 25 patients (34.2%) from community care, compared to seven patients (10.1%) from the acute care wound clinic.

Conclusion This study highlights differences in VLU patient profiles across care settings, suggesting that community patients managed without compression may have less complex needs. Further research including clinical factors like wound size and duration is needed to better guide treatment strategies.

Keywords community care, compression therapy, nursing, venous insufficiency, venous leg ulcers, wound care

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KEY MESSAGES

- Patients with VLUs managed in the community without compression therapy showed significantly higher healing rates within 90 days compared to those in acute care with low compression.
- Key factors influencing VLU healing included ambulatory status, hypertension, diabetes mellitus, and anemia, highlighting the importance of comorbidity assessment in care planning.

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- Community-based VLU patients may present with less complex wound profiles, supporting the need for tailored treatment strategies based on care setting and patient characteristics.

INTRODUCTION

Venous leg ulcers (VLUs) are a common, chronic, and recurrent condition resulting from venous reflux or obstruction.^{1,2} In Europe and North America, up to 10% of the population suffers from venous valvular insufficiency, with 0.2% developing venous ulceration.³ In the United Kingdom (UK), the estimated prevalence of VLUs is between 0.1% and 0.3%, with population prevalence rates ranging from 1.2 to 3.2 per 1000 people.^{4,5} Globally, the annual prevalence of VLUs per 1000 population varies, with rates of 4.5 in India, 1.7 in China, 1.5 in Brazil, and 1.2 in Australia.¹ Locally, the crude incidence rate of venous-related wounds among the general population was reported as 15 per 100,000 in 2017.⁶

VLUs are common among the older population and significantly impact their quality of life.⁷ In the UK, the prevalence of VLU is 3% in patients over 65 years old. In contrast, in the United States (US), 10–35% of adults suffer from chronic venous insufficiency, with 4% of patients over 65 years old suffering from VLU.^{1,8} Similarly, Singapore is facing an increasingly aging population that is predisposed to chronic medical conditions. A local study reported the number of people with venous-related wound conditions increased from 15 to 38 per 100,000 when compared with people aged above 50 years old.⁶

Several guidelines have recognised that compression therapy is the ‘gold standard’ treatment for VLUs; it is shown to increase VLU healing rates and reduce the risk of recurrence.^{2, 9-11} Two-layer (2LB) or four-layer (4LB) bandaging and compression stockings are common compression therapies.¹² Compression strength must be adjusted according to the treatment stage and therapeutic goal. There is a varying degree of compression level, ranging from “mild” to “very strong”, the application of which depends on the wound condition and the patient’s tolerance.^{9,10} Appropriate levels of compression and adherence are required to ensure the effectiveness of the therapy, and a higher compression is evidently proven to help VLUs heal better.^{13,14} Usually, compression bandaging is used during the decongestion and maintenance phases, while stockings are usually applied in the maintenance phase.¹⁵ In the decongestion phase, micro-perfusion is improved, edema is reduced, and ulcer healing takes place, whereas in the maintenance phase, edema and ulcer recurrence are prevented.¹⁵

While medical-grade compression stockings are classified by manufacturers based on the pressure they are intended to exert, the actual compression delivered can vary.^{16,17} Several factors may influence this, including wear and tear that reduces the stocking’s elasticity over time, the method of application and removal, and individual patient characteristics such as leg shape and circumference.⁽¹⁶⁾

In Singapore, Class 1 (<20mmHg) and Class 2 (20–30mmHg) compression stockings are typically prescribed for patients whose venous leg ulcers (VLUs) are nearly healed or have fully healed, to maintain therapeutic compression. While Class 2 stockings may be more effective in preventing ulcer recurrence compared to Class 1, studies have shown no significant difference in alleviating subjective symptoms of venous insufficiency.¹⁸ Compliance with compression therapy is essential; patients who are non-adherent are at a significantly higher risk of ulcer recurrence.¹⁸

There is a relative lack of research focusing on VLU patients receiving maintenance care or those who decline compression therapy. Most existing studies emphasise the active healing phase, assessing the effectiveness of various compression modalities and strategies to prevent wound recurrence after healing.⁹ However, patients who refuse or are unable to undergo compression therapy, despite being a clinically important cohort remain underrepresented in the literature.^{19,20} These individuals often experience barriers such as discomfort with compression, limited understanding of its benefits, psychosocial concerns, or logistical challenges related to access and affordability.²¹ Understanding the needs and outcomes of this group is essential for developing inclusive, patient-centered care strategies that address both clinical and real-world challenges.

In Singapore, compression therapy for VLUs, such as the use of two-layer or four-layer bandaging and compression stockings is exclusively provided in acute hospital settings. In these settings, nurses prescribe and manage compression therapy and continue to provide wound dressing for patients at dedicated wound clinics. Patients may also be referred to community care services for ongoing wound management. However, community nurses do not administer compression therapy and instead focus on wound management and dressing the wounds.

This differs from many Western countries where compression therapy is widely available in both acute and community settings.^{9,22} Given Singapore’s unique service model, where compression therapy is offered exclusively in acute care hospitals, we aimed to examine and compare the characteristics of VLU patients managed without compression in the community with those receiving low compression therapy in an acute wound clinic. Due to the absence of community-based compression services, some patients who require compression but are unwilling or unable to attend acute care settings may opt to receive only dressing changes in the community, despite the clinical need for compression.

We specifically focused on patients receiving low compression (compression stockings) in the acute care setting, as they typically have healing or healed VLUs. This group was selected as the most appropriate comparator for community-based VLU patients, who generally present with less complex wounds and do not require advanced interventions such as conservative sharp debridement or intensive dressing regimens. These

procedures are not typically performed in the community, as nurses in this setting are not trained or equipped to manage high-acuity VLU care. Although high compression therapy remains the gold standard for VLU healing, this comparison may help inform service planning and highlight potential disparities in treatment access and clinical outcomes.

METHODS

Aim

To evaluate and compare the characteristics of patients with venous leg ulcers (VLU) managed with no compression in a community home care setting, versus those treated with low compression stockings in an acute care wound clinic at a tertiary hospital.

Study design

A retrospective medical record review was conducted, with data extracted from the acute care wound clinic (VLU patients on low compression stockings) and the community home care database (VLU patients with no compression) between January 2016 and December 2018.

Study setting and data extraction process

This study was conducted at one of Singapore's largest and oldest academic hospitals and community home care service providers. The hospital's information technology team extracted VLU patients' data from the acute care hospital, and a trained research coordinator extracted data from the community home care service database. The diagnosis of VLU was based on the International Statistical Classification of Diseases and Related Health Problems ICD-10 code during the study period (January 2016 to December 2018). This information was taken from the electronic medical records and was consistent between both settings. All data underwent a de-identification process before analysis.

The data extraction included social demographic information, such as age, gender, and ethnicity. Clinical data, such as VLU patients' functional status and comorbidities, were also extracted. Wound data included the number of ulcers, location, and type of compression therapy used. The VLU wound bed characteristics were based on the Triangle of Wound Assessment framework (wound bed, wound edge and peri-wound skin).²³ The index wound would be the biggest VLU wound on any of the lower limbs. Patients from acute care used compression stocking (low compression) and patients from community home care did not use any form of compression therapy including compression stockings. The community care patients only had their wounds dressed.

Compression stockings

The compression stockings used in the acute care wound clinic were either Class I (15–20mmHg) and Class II (20–30mmHg).

Ethical considerations

This study conformed to the ethical guidelines of the Declaration of Helsinki and was approved by the SingHealth

Centralised Institutional Review Board (CIRB), reference number (2020/2104). Additional approval was sought from the institution's data protection officer to access patients' electronic medical records. A waiver of informed consent was approved due to the nature of the study.

Data analysis

Data were analysed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics of patients who sought VLU care in the community home care and acute care wound clinic were described with means and standard deviations (SD) for continuous variables, frequencies and percentages for categorical variables. Independent sample t-tests and Pearson chi-square tests were used to analyse continuous and categorical variables, respectively, to examine the differences in demographics and outcomes of VLU patients in the community home care (no compression) versus acute care wound clinic (low compression stocking). The level of significance was set at $p < 0.05$.

RESULTS

Data were extracted from 142 medical records: 73 patients with no compression from the community home care and 69 patients using low compression stockings from the acute care wound clinic (Table 1). Patients from both settings were mainly of Chinese ethnicity. Age and gender were comparable in both settings. Community home care patients with no compression had shorter days to heal (median=163, min=13, max=1518) compared to acute care wound clinic patients on low compression stocking (median=299, min=17, max=1136) (Table 1).

When comparing VLU patients on low compression stockings to those without compression, significant differences were observed in ambulatory status, hypertension, diabetes mellitus, anemia, and healing outcomes (Table 1). VLU patients in the acute care wound clinic were more ambulant than those managed by community home care nurses (63.8% versus 30.1%, $p < 0.001$). Notably, patients in community home care had more comorbidities, such as hypertension, diabetes, and anemia, compared to those in the acute care wound clinic (all $p < 0.05$). Patients in the community home care had mostly one ulcer (69.9% versus 56.5%) whereas in the acute care, more patients had two to three ulcers (39.1% versus 27.4%). There was also a higher proportion of patients who healed within 90 days in community home care compared to those in acute care wound clinics (34.2% versus 10.1%, $p = 0.008$). However, more patients in the acute care who were on compression stockings had their ulcers healed within 366–730 days.

DISCUSSION

This study compared the characteristics of patients with VLUs managed with low compression therapy in an acute care setting with those managed without compression in a community care setting.

Table 1. Comparison of demographics and outcomes of VLU patients in the community home care (no compression) versus acute care wound clinic (low compression stocking)

Variables	Patients in community home care (no compression) n=73	Patients in acute care wound clinic (low compression stocking) n=69	p-value
Age, mean (SD)	68.56 (11.93)	67.57 (10.87)	0.605 ^a
Total number of ulcers, mean (SD)	1.48 (0.85)	1.59 (0.84)	0.422 ^a
Total number of days to heal ulcer, median (min, max)	163.0 (13, 1518)	299.0 (17, 1136)	0.093 ^a
Gender	n (%)	n (%)	
Male	45 (61.6)	32 (46.4)	0.092 ^b
Female	28 (38.4)	37 (53.6)	
Race	n (%)	n (%)	0.227 ^c
Chinese	44 (60.3)	42 (60.9)	
Malay	14 (19.2)	6 (8.7)	
Indian	13 (17.8)	17 (24.6)	
Others	2 (2.7)	4 (5.8)	
Ambulatory status	n (%)	n (%)	<0.001 ^{c*}
Independent	22 (30.1)	44 (63.8)	
Wheelchair-Bound	22 (30.1)	16 (23.2)	
Walking Aid	21 (28.8)	9 (13.0)	
Bedbound	8 (11.0)	—	
Presence of comorbidities	n (%)	n (%)	
Hypertension			
Yes	62 (84.9)	46 (66.7)	0.011 ^{c*}
No	11 (15.1)	23 (33.3)	
Heart failure			0.535 ^b
Yes	7 (9.6)	4 (5.8)	
No	66 (90.4)	65 (94.2)	
Diabetes mellitus			<0.001 ^{b*}
Yes	64 (87.7)	38 (55.1)	
No	9 (12.3)	31 (44.9)	
Deep vein thrombosis			0.263 ^b
Yes	2 (2.7)	5 (7.2)	
No	71 (97.3)	64 (92.8)	
Respiratory disease			0.353 ^b
Yes	2 (2.7)	3 (4.3)	
No	71 (97.3)	66 (95.7)	
Anaemia			0.045 ^{b*}
Yes	17 (23.3)	7 (10.1)	
No	56 (76.7)	62 (89.9)	
Number of ulcers			0.255 ^c
1 only	51 (69.9)	39 (56.5)	
2–3	20 (27.4)	27 (39.1)	
≥4	2 (2.7)	3 (4.3)	
Outcomes			0.008 ^{c*}
Ulcer healed within 90 days	25 (34.2)	7 (10.1)	
Ulcer healed within 91–180 days	12 (16.4)	17 (24.6)	
Ulcer healed within 181–365 days	14 (19.2)	18 (26.1)	
Ulcer healed within 366–730 days	22 (30.1)	27 (39.1)	

Note: Frequencies may not add up to the total sample size due to missing responses.

^aIndependent t-test, ^bFisher's exact, ^cChi-squared and were used for categorical and continuous variables, respectively; * $p < 0.05$.

Age is a frequently cited comorbidity in several studies, with an increased prevalence of VLUs reported among patients over 65 years old.^{1,24,25} Similarly, our study showed that the mean age ranged from 65 to 70 years and was comparable between VLU patients in the community home care and acute wound care clinic. It is relatable to the results from a systematic review, that VLU occurs between the average age of 47–65 years, typically affecting the older age.³ Older age has a higher likelihood of vascular diseases as the endothelial dysfunction in older adults reduces vasodilation reserve, increases prothrombotic factors, and decreases anticoagulant properties, elevating their risk of deep vein thrombosis and consequent VLU.^{24,26-28}

Patients in community care also had more comorbidities and were bedbound compared to those seen at the acute care clinic. Prior studies concluded that the common comorbidities among VLU patients were venous hypertension, obesity, non-insulin-dependent diabetes, dyslipidemia, smoking, and leg trauma.^{24,29,30} Likewise, in this study, diabetes mellitus, hypertension, and anaemia were the most common risk factors identified. Diabetic patients are at risk of arterial disease due to the degeneration of the arterial wall.^{31,32} Furthermore, atherosclerosis, which is common among diabetic patients, leads to slower wound healing and other complications such as peripheral neuropathy.^{25,30,33} The delayed wound healing is often associated with the impact of insufficient angiogenesis, reduced vascularity, and capillary density which is common in diabetic-related wounds.^{32,33}

Like diabetes, hypertension also affects the circulatory system, which impacts arterial microcirculation by increasing arterial stiffness. Peripheral vascular disease and hypertension can lead to poor circulation, hinder healing, and make the skin susceptible to injury and ulceration.^{24,34} There is a possibility that poor control of diabetes ($p < 0.001$) and hypertension ($p = 0.011$) in our study population had an impact on the VLU healing process. We also found that anemia had a significant relationship with the healing outcomes of VLU in both settings ($p = 0.045$). Studies have indicated that patients with low circulating hemoglobin concentrations ($< 100\text{g/L}$) may encounter challenges in wound healing due to inadequate tissue oxygenation.³⁵ However, a recent review reported a lack of evidence, and that more robust research is needed to determine how iron and low hemoglobin affect VLU wound healing.³⁶ Moreover, various anemia types have diverse underlying causes that could not be determined due to study design limitations. We lack information on the severity of ulcers in patients not using compression stocking or those with heart failure, which limits our ability to draw definitive conclusions. The authors noted that patients with comorbidities achieved improved VLU outcomes without compression stocking, which can be attributed to several factors. Comorbidities like diabetes and hypertension often compromise blood circulation and tissue oxygenation. Consequently, the application of compression stocking may exacerbate these circulatory issues or be less tolerated by patients with multiple health conditions. Patients from the community were more confined to chairs

($n = 22$; 30.1%) or beds ($n = 8$; 11%), suggesting a potential practice of elevating their legs regularly. This practice could positively impact VLU healing by reducing wound breakdown and the likelihood of recurrence. Leg elevation is crucial in VLU healing, as it reduces stress on the leg valves, accelerates ulcer healing, and helps avoid prolonged standing.^{37,38} Raising the legs for one hour each day was notably linked with a reduced risk of venous ulcer recurrence.^{38,39} Furthermore, we are unable to determine whether patients in the community received alternative treatments or interventions that might have unintentionally contributed to better healing outcomes without compression therapy.

Several studies have compared compression therapy with no compression for venous ulcer management, but the results were inconsistent.^{10,40,41} Guest et al (2018)¹¹ conducted a retrospective cohort study involving 505 patients in the UK, where 13% of patients had never been prescribed any compression system, but 78% of their wounds healed. Of the 87% prescribed the compression system, 52% of their wounds healed. They reported that the mean time to healing was significantly longer among patients who never received compression than those who did.¹¹ Comparably, a local retrospective study of VLU patients compared healing outcomes between three types of compression therapy: two-layer bandaging (2LB), four-layer bandaging (4LB), and compression stockings,¹⁷ found that patients on 2LB reported a significantly higher proportion of healed ulcers at three months. However, at six months, there was no difference in healing rates between the three types of therapy. The authors concluded that as VLU healing duration becomes more prolonged, resistance in healing occurs despite being on compression therapy.⁴² A systematic review done by Shi et al (2021)¹⁰ further concluded that there is moderate-certainty in evidence that there is probably a shorter time to complete healing of VLUs in patients receiving compression bandages or stocking than for those who did not wear compression (95% CI 1.52-3.10; $I^2 = 59\%$; 5 studies, 733 participants). Patients on compression therapy were also more likely to experience complete ulcer healing within 12 months than those not on compression therapy.¹⁰ There is ample evidence that VLU heals faster with compression therapy. However, in our study, patients with no compression in community home care had their VLUs heal faster. There is the possibility that patients at home were more confined in their environment with limited movements, and had the opportunity to elevate their legs often. While patients who were more independent and ambulant from the acute care wound clinic may have their dressings loosened due to excessive movements and compliance issues, leading to inadequate consistent pressure delivered by the compression stocking. Another contributing factor may be the tropical climate, characterised by high humidity and warmth, which could have led to suboptimal adherence to compression stocking usage among the patients. In addition, the dressing materials for VLU wound care used by the different settings may have an impact on the VLU healing rates.

In this study, the VLU healing rates between the two settings are not directly comparable, as patients in the acute care setting typically present with more complex VLUs. Furthermore, community care patients with severe or infected VLUs are often referred back to acute care, as such cases cannot be managed effectively in the community setting due to limited resources. Compared to other previous studies, 73 community home care patients only (n=25: 34.2%) had complete healing within 90 days, as reported in our findings. Guest et al (2013)³⁷ also reported similar findings; patients who were not on any compression therapy had a higher healing rate than those who received some compression therapy.³⁷ A recent meta-review concluded that there is a statistically significant difference in healing rates when compression is used compared to no compression, with moderate certainty evidence.⁴³ However, there is no statistically significant difference in healing rates between using different compression bandages versus compression stockings.⁴³

Hence, more research is required to fully understand the factors involved in wound ulcer healing beyond compression therapy and different care settings. Future studies are needed to understand the selection process and compliance while on compression therapy.

Limitations

Due to the study design, the authors could not deduce if the ambulatory status is due to pre-existing medical conditions or is related to their current VLU, as the information was not documented. We were unable to determine which class of compression stockings (for example Class I or Class II) patients from the acute care wound clinic were using, as different classes exert varying levels of pressure. We also could not ascertain the severity of VLUs among patients not on any compression therapy, as it was not recorded. A more objective assessment of the venous clinical severity, such as pain score, presence of varicose veins, induration, oedema, pigmentation, inflammation, ulcer size, and duration, is needed in the electronic health system for more reliable observation and documentation. An electronic wound documentation system with wound images will help to overcome poor documentation. Data extraction was carried out by the information technology team at the acute hospital, while a skilled research coordinator managed the process at the community home care setting. It is important to note that variations may exist in the information extracted by different experts, potentially resulting in differences in details. The acute care setting could have potentially offered more comprehensive insights regarding VLU-related data, whereas the community home care database may have contained less detailed information. These variations can be attributed to the distinct IT systems employed in each setting for safeguarding patient information.

Patients in the community do not have access to any form of compression therapy, as community nurses are not trained in performing any form of compression therapy. Apart from the type of compression therapy, we could not determine the type

of dressing materials used for the VLUs, or determine if any of the patients had superficial vein ablation, as this information was not retrieved. There is a possibility that pressure in the veins could have been reduced through ablation and aided in VLU healing among these patients. We also could not ascertain the severity of the VLU wounds in the community. Complex VLU wounds requiring debridement of sloughy tissue are not managed in the community due to the lack of resources for community nurses to perform conservative sharp debridement.

The sample size was inadequate, and it did not include the size and duration of the wound at baseline, and the arbitrary reduction of the cohort receiving compression stockings.

There is a lack of data on patients' adherence with compression stocking and the tightness or lifespan of the stockings. Our data extraction did not include the medication list; therefore, we are unable to determine if the VLU patients were taking medication, such as pentoxifylline, which has been suggested could aid in VLU healing rate. In this study, the available data from both the acute care and community home care databases were limited, with significant gaps in key clinical information. As a result, we were unable to draw definitive conclusions regarding the effectiveness of compression therapy versus no compression in the healing of VLUs. This limitation highlights the need for more comprehensive and standardised documentation in wound care databases across both settings. Improving data capture and storage will not only enhance clinical decision-making but also support more robust research in the future.

CONCLUSIONS

This study described clinical characteristics of patients with VLUs managed with and without compression across two different care settings. The findings highlight notable differences in patient profiles between the acute and community settings, suggesting that those receiving care without compression in the community may represent a less complex clinical population. These results underscore the importance of tailoring VLU care based on individual patient factors, comorbid conditions, and the context of service delivery. Further research incorporating key clinical variables such as wound size and duration is needed to better understand factors influencing VLU outcomes and to inform comprehensive, equitable treatment strategies.

IMPLICATIONS FOR CLINICAL PRACTICE

- This study highlights differences in patient characteristics between community-based care without compression and acute care with low-compression therapy, reflecting potential variations in clinical complexity and access to standard VLU treatment.
- Given that compression therapy remains the gold standard for VLU management, the findings emphasise the need to evaluate how patients are selected for compression therapy and whether current service models support equitable access.

- Further research is needed to explore factors such as ulcer severity, duration, and patient preferences or compliance, which were not captured in this study but are crucial for optimising VLU care.
- Insights from this descriptive comparison may inform healthcare providers and policymakers in tailoring service delivery models and improving continuity of care for VLU patients across settings.

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AUTHOR CONTRIBUTIONS

Fazila Aloweni (FA), Ang Shin Yuh, Nanthakumahrie Gunasegaran (NG), Tan Wei Xian (TWX), Hafidah Saipollah (HS) conceived and designed the study.

NG, TWX, HS, Goh Wee Ting, Raden Nurheryany Sunari (RNS) and Nurliyana Agus were involved in acquisition of subjects, data collection, data management and review of manuscript.

FA, NG, and RNS performed statistical analyses, analysed and interpreted data.

NG, TWX and FA prepared the manuscript writing.

All authors reviewed and extensively edited the manuscript and approved the final version of this manuscript.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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