

Impact of Deep Venous Stenting on Healing Rates of Venous Leg Ulcers

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Abstract

Objective: Venous leg ulcers (VLUs) have a significant symptomatic and quality-of-life burden for patients with chronic venous insufficiency (CVI) despite medical treatment and wound care. Recent evidence has demonstrated the benefit of deep venous stenting (DVS) for VLU healing. This study aims to report the impact of DVS in patients with chronic VLUs. **Methods:** A retrospective chart review was conducted on patients with Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) 6 disease who underwent DVS and subsequent care at a comprehensive wound center during a 2-year period. Patient demographics, procedure details, VLU healing, and stent patency were assessed. Comparisons of procedure details and wound-related outcomes were performed for patients categorized as healed, unhealed, persistent, or recurrent. **Results:** Sixteen patients met the inclusion criteria. Twelve percent of patients presented with ilio caval occlusion, and 88% were treated for stenotic venous lesions. Stenting of the right and left iliofemoral venous segments was performed in 56% and 62% of patients, respectively. Thirty-seven percent underwent inferior vena cava/venous confluence stenting. Overall patency rates during follow-up were 100%. Following venous stenting, 81% of patients had complete wound healing, while 19% experienced ulcer improvement. Of the study cohort, 12.5% had undergone prior superficial venous intervention before stenting; the remainder did not require additional procedures to facilitate wound healing. **Conclusions:** DVS leads to significant improvement in patients with persistent VLUs. High rates of wound healing were observed in this cohort, including those who underwent bilateral or venous confluence stenting.

Introduction

Venous leg ulcers (VLUs) are a common manifestation of chronic venous insufficiency (CVI), accounting for up to 70% of all lower extremity ulcers and 20% of CVI cases.¹ VLUs produce significant symptomatic and quality-of-life burdens. The mainstay of treatment includes compression therapy, wound care, and interventions for superficial venous reflux. However, refractory VLUs are present in 32% of cases up to 36 months post-treatment.² Significant recurrence rates have also been reported in patients with VLUs. Measures to reduce venous hypertension may enhance wound healing rates, with an emergent role for deep venous stenting (DVS).^{3,4}

Historically, DVS was primarily indicated for CVI with isolated iliac vein obstruction without associated reflux.⁵ However, its role has expanded due to demonstrated efficiency, symptomatic relief, and wound healing.^{5,6} Thus, DVS can benefit patients with VLUs in wound healing-related outcomes. This study aims to report the impact of DVS in patients with chronic VLUs.

Methods

A single-institution retrospective review was conducted on patients with Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) 6 disease who underwent DVS and subsequent care follow-up between 2021 and 2023. Patient demographics, procedure details, and wound location status were queried for DVS followed by chart review. Eligible patients were aged >18 years, had an active VLU on

the index-treated limb, and underwent DVS. Clinical characterization included preoperative duplex ultrasound (DUS), venous reflux (superficial/deep), ilio caval obstruction, prior medical treatment, and interventions. Computed tomography venograms (CTVs) were used for further lesion characterization if necessary. Stenosis was defined as > 50% occlusion based on intravascular ultrasound.

Patients were stratified into 4 groups based on VLU healing status: healed, unhealed, persistent, and recurrent. Primary endpoints included wound healing status, stent patency (evaluated by DUS or CTV), and reintervention rates.

Results

Sixteen patients met the inclusion criteria. The mean age was 70.31 ± 11.55 years, and 75% were men. Six percent had a history of deep vein thrombosis (DVT), and 13% had prior superficial venous reflux interventions. Complete wound healing occurred in 10 patients (63%) following DVS. Among the remaining patients, 4 (25%) demonstrated VLU improvement, 1 (6%) had persistent VLUs, and 1 (6%) experienced recurrence (**Figure**).

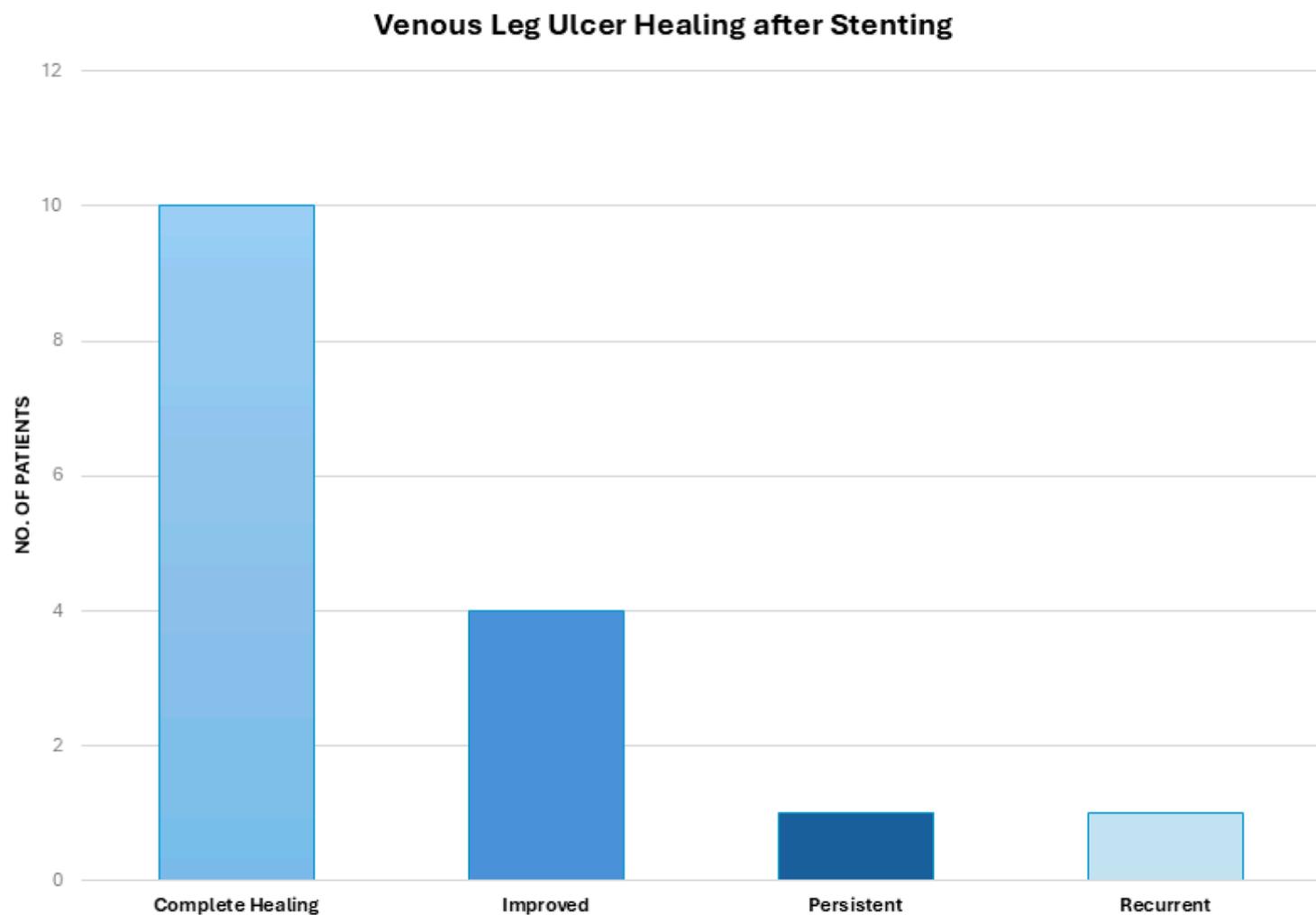


Figure. Wound healing status after intervention with deep venous stenting.

Preoperative and procedure characteristics according to VLU status are detailed in the **Table**. Wound laterality was predominantly bilateral among healed and improved VLUs. Compression stockings were universally used prior to the procedure. Wound infections were noted in 25% of patients, predominately among the healed patients. Superficial venous reflux was observed in all groups, while deep venous reflux was more common in the improved, persistent, and recurrent cohorts. Only patients with persistent VLU had a history of DVT.

Table. Patient characteristics prior to deep venous stenting and operative details

	<i>Healed</i> (n = 10)	<i>Improved</i> (n = 4)	<i>Persistent</i> (n = 1)	<i>Recurrent</i> (n = 1)
<i>Preoperative characteristics</i>				
Wound laterality				
Right	3 (30)	0 (0)	1 (100)	0 (0)
Left	1 (10)	1 (25)	0 (0)	1 (100)
Bilateral	6 (60)	3 (75)	0 (0)	0 (0)
Compressive therapy	7 (70)	4 (100)	1 (100)	1 (100)
Wound infection	3 (30)	1 (25)	0 (0)	0 (0)
Superficial venous reflux intervention	1 (10)	1 (25)	0 (0)	0 (0)
Superficial venous reflux	7 (70)	3 (75)	1 (100)	1 (100)
Deep venous reflux	4 (40)	3 (75)	1 (100)	1 (100)

History of deep venous thrombosis	0 (0)	0 (0)	1 (100)	0 (0)
<i>Operative details</i>				
Lesion type				
Iliocaval obstruction	2 (20)	0 (0)	0 (0)	0 (0)
Stenosis	8 (80)	4 (100)	1 (100)	1 (100)
Treated iliofemoral segment				
Right	8 (80)	1 (25)	1 (100)	0 (0)
Left	8 (80)	4 (100)	1 (100)	1 (100)
Inferior vena cava/venous confluence	5 (50)	0 (0)	1 (100)	0 (0)

Data presented as percentage (%).

Stenotic venous lesions were treated more frequently than ilio caval obstructions (88% vs 12%). Left iliofemoral segment treatment was more common than right iliofemoral segment treatment (62% vs 56%). Inferior vena cava (IVC)/venous confluence stenting was performed in 37% of cases, limited to healed and persistent VLUs. No intraoperative complications were reported. One patient required IVC filter deployment.

The primary patency rate was 100% during follow-up, with 14 out of 16 patients achieving complete VLU healing within 1 year. When stratified according to VLU healing, all patients within the healed, improved, and persistent groups showed 100% of primary patency. No additional interventions for wound healing were required, and median freedom from reintervention was 395 days (range, 335-487). Only 1 patient had complete healing of a left lower extremity wound and 60% improvement of a right lower extremity wound at 1-year follow-up, and another patient had bilateral lower extremity wounds with 50% improvement at 8-month follow-up. The only patient who required a reintervention corresponded with the presence of a persistent VLU at 2-year follow-up.

Discussion

The treatment of chronic VLUs in patients with prior medical and wound care interventions is debatable due to high recurrence rates and suboptimal healing.⁷ Obstructive lesions are a potential major contributor to lower improvement rates after stenting, making wound healing duration variable.³ This study demonstrates that DVS provides significant improvement in the healing of chronic VLUs.

In this cohort, venous stenosis was more prevalent and associated with optimal VLU outcomes, with low recurrence rates. Despite fewer cases of ilio caval obstruction, healing rates were equally successful. Given these results, addressing either type of etiology can significantly enhance wound resolution.

Deep venous pathology has been associated with risk of venous ulcer development, particularly for patients with therapeutic failure of superficial venous interventions.⁸ In this cohort, the majority of patients had undergone superficial venous procedures, and 63% of patients achieved either complete healing or improvement of VLUs. Thus, results for DVS are encouraging and can optimize outcomes for patients who have had prior attempts of superficial reflux resolution.

As a highlight from the study, the 1-year primary patency rate was 100%, consistent with prior reports of patency rates exceeding 97%.^{6,9} All patients had a thorough interrogation with either venous DUS or CTV as well as intraoperative use of intravascular ultrasound to obtain views in all planes and ensure accurate lesion identification, especially in the case of venous obstruction. DVS provides minimal risks with ultrasound-guided access. In terms of stent thrombosis, rates range between 4.5% and 5%, with predominance in limbs with prior thrombotic obstruction.⁹⁻¹¹ The literature has reported the results of other cohorts in which chronic VLUs healed in 51% of cases at 15 months of follow-up. A series by Neglen et al described 5-year ulcer healing rates of 58%.⁹

The observed 2-year wound healing rate for the cohort after venous stenting of 88% aligns with mid-term outcomes in similar studies. Thus, the duration of wound recurrence freedom for patients with DVS within our cohort aligns with current evidence and can support its use to enhance long-term outcomes for both stent duration and VLU resolution.

Limitations include the single-center design, reliance on one surgeon's practice, lack of quality-of-life assessments, and variable wound care practices. Similarly, the follow-up time could be considered as mid-term given our surveillance time frame. Quality-of-life questionnaire evaluations such as the chronic venous insufficiency quality-of-life questionnaire were not included, which could provide higher yield patient-reported outcomes in postoperative visits. Another limitation is the unstandardized wound care for the patients included in this cohort. Varying practice patterns could have had an influence on cases outside of hospital follow-up. Statistical analysis was also limited given the small sample size and can overestimate the power of differences among subgroups based on VLU healing status. Further studies should focus on larger cohorts, standardized wound care protocols, quality-of-life assessments, and long-term outcomes.

Conclusions

DVS produces significant improvement for patients with persistent VLUs. This intervention is safe and effective, enhancing wound healing rates as an adjunctive therapy for CVI-related recalcitrant wounds. ■

References

1. O'Donnell TF Jr, Passman MA, Marston WA, Society for Vascular Surgery, American Venous Forum, et al. Management of venous leg ulcers: clinical practice guidelines of the Society for Vascular Surgery® and the American Venous Forum. *J Vasc Surg*. 2014;60(2 Suppl):3s-59s. doi:10.1016/j.jvs.2014.04.049
2. Mousa AY, Broce M, Yacoub M, AbuRahma AF. Iliac vein interrogation augments venous ulcer healing in patients who have failed standard compression therapy along with pathological venous closure. *Ann Vasc Surg*. 2016;34:144-151. doi:10.1016/j.avsg.2015.11.036
3. Pantoja JL, Patel RP, Ulloa JG, Farley SM. Deep venous stenting improves healing of lower extremity venous ulcers. *Ann Vasc Surg*. 2022;78:239-246. doi:10.1016/j.avsg.2021.05.026
4. Rossi FH, Kambara AM, Izukawa NM, et al. Randomized double-blinded study comparing medical treatment versus iliac vein stenting in chronic venous disease. *J Vasc Surg Venous Lymphat Disord*. 2018;6(2):183-191. doi:10.1016/j.jvsv.2017.11.003
5. Raju S, Darcey R, Neglén P. Unexpected major role for venous stenting in deep reflux disease. *J Vasc Surg*. 2010;51(2):401-408; discussion 408. doi:10.1016/j.jvs.2009.08.032
6. George R, Verma H, Ram B, Tripathi R. The effect of deep venous stenting on healing of lower limb venous ulcers. *Eur J Vasc Endovasc Surg*. 2014;48(3):330-336. doi:10.1016/j.ejvs.2014.04.031
7. Lawrence PF, Hager ES, Harlander-Locke MP, et al. Treatment of superficial and perforator reflux and deep venous stenosis improves healing of chronic venous leg ulcers. *J Vasc Surg Venous Lymphat Disord*. 2020;8(4):601-609. doi:10.1016/j.jvsv.2019.09.016
8. Marston WA, Crowner J, Kouri A, Kalbaugh CA. Incidence of venous leg ulcer healing and recurrence after treatment with endovenous laser ablation. *J Vasc Surg Venous Lymphat Disord*. 2017;5(4):525-532. doi:10.1016/j.jvsv.2017.02.007
9. Neglén P, Hollis KC, Olivier J, Raju S. Stenting of the venous outflow in chronic venous disease: long-term stent-related outcome, clinical, and hemodynamic result. *J Vasc Surg*. 2007;46(5):979-990. doi:10.1016/j.jvs.2007.06.046
10. Hartung O, Loundou AD, Barthelemy P, Arnoux D, Boufi M, Alimi YS. Endovascular management of chronic disabling ilio-caval obstructive lesions: long-term results. *Eur J Vasc Endovasc Surg*. 2009;38(1):118-124. doi:10.1016/j.ejvs.2009.03.004
11. Neglén P, Berry MA, Raju S. Endovascular surgery in the treatment of chronic primary and post-thrombotic iliac vein obstruction. *Eur J Vasc Endovasc Surg*. 2000;20(6):560-571. doi:10.1053/ejvs.2000.1251

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