

Thirty-day survival rate was 96.2% (95% confidence interval [CI], 90.9-100), and 1-year survival rate was 75.1% (95% CI, 62.8-87.4) as seen in Fig 1. There were no intraoperative deaths. Thirty-day primary patency rate was 96% (95% CI, 90.7-100.0), and 1-year primary patency rate was 88.8% (95% CI, 79.4-98.2). Seven patients (14%) developed nonocclusive thrombus within the IVC. Mortality was known to be due to oncologic progression in 29% of deceased patients as seen in Fig 2.

Conclusions: IVC reconstruction is a safe option for patients requiring IVC resection during oncologic surgery as evidenced by 1-year survival of 75% and 1-year primary patency approaching 90%. Overall rate of post-operative thrombus development was low and similar across all groups. In the management of primary and secondary retroperitoneal malignant disease with IVC infiltration, IVC reconstruction should be considered to achieve appropriate oncologic resection while minimizing possible complications from caval interruption.

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Effect of Etiology and Inflow on Outcomes of Endovascular Recanalization for Nonmalignant Inferior Vena Cava Occlusion



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Objective: The aim of this study was to determine factors affecting outcomes of inferior vena cava (IVC) recanalization for nonmalignant obstruction, with focus on venous inflow and etiology of IVC occlusion.

Methods: Data from consecutive patients undergoing IVC recanalization between January 2001 and December 2017 were retrospectively reviewed. Patients were grouped by etiology of IVC obstruction, including post-thrombotic (PT), retroperitoneal fibrosis (RPF), and hypoplasia (HP). Patency of the femoral, deep femoral, and great saphenous veins was evaluated; the venous inflow was graded, assigning a point to each for stenosis or occlusion, for a total possible unilateral score of 3 and a composite score of 6. A score of 6 indicated no inflow stenosis or occlusion, whereas a score of 0 indicated disease of all 6 inflow veins. Primary outcomes included primary, primary assisted, and secondary patency rates.

Results: There were 114 patients during the 18-year period (64% male; mean age, 42 ± 15 years). Etiology was PT in 96 (84%), RPF in 5 (5%), and HP in 13 (11%) patients. Clinical, Etiology, Anatomy, and Pathophysiology classes included 3, 4a, 4b, 5, and 6 in 23, 17, 3, 11, and 23 patients,

respectively. Forty-four (38%) patients had an IVC filter, all of whom had PT etiology, and 33 (29%) had a thrombophilia. Inflow grading was 6 in 20 (18%), indicating no disease; 4 in 36 (32%); and 3 or less in 32 (30%). There was no mortality related to the procedure. Periprocedural complications occurred in 11% of patients. Median follow-up was 15.2 months (interquartile range, 6.4-35.8 months; maximum, 141.6 months). Kaplan-Meier analysis of primary, primary assisted, and secondary patency in the entire cohort at 1 year and 5 years was 78%, 85%, and 95% and 66%, 85%, and 95%, respectively. Early failures occurred in 12 PT, 2 HP, and 0 RPF patients ($P = .94$). No factors studied, including female sex, etiology of IVC occlusion, or thrombophilia, affected patency ($P > .05$). Median venous inflow in PT, RPF, and HP was 4, 5.5, and 5, respectively. Patients with grade 0 to 3 had patency rates similar to those of patients with grade 4 to 6 ($P > .05$). Presence of an IVC filter crushed aside during IVC stenting did not adversely affect stent patency.

Conclusions: Midterm results of endovascular recanalization are excellent regardless of the etiology of IVC occlusion. This cohort was predominantly PT with small numbers of RPF and HP, resulting in insufficient statistical power to demonstrate the effect of venous inflow on patency.

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Clinical Response to Combination Therapy in the Treatment of Varicose Veins



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Objective: Varicose vein ablation procedures are being performed with increasing frequency; however, there is a lack of consensus on the relative efficacy of combined treatment of saphenous incompetence and symptomatic varicosities vs a staged approach. In this study, we examined the impact on symptom severity when a procedure to eliminate varicosities is added to standard endovenous saphenous ablation.

Methods: The American Venous Registry Varicose Vein Module was established by the American Venous Forum in 2010 and collected data from 53 physicians from 37 clinical centers during a 2-year period. Our analysis includes patients with Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) class C2_s disease severity and without prior treatment. Combination therapy (CT) is defined as the use of a varicosity-treating secondary procedure (stab phlebectomy or injection of sclerosant into varicosity) in combination with endovenous saphenous vein ablation. Unimodal therapy (UT) is defined as endovenous saphenous vein ablation

Table. Compared with unimodal therapy (UT), combination therapy (CT) is associated with an additional 1-point reduction in Venous Clinical Severity Score (VCSS) on bivariate analysis

	Total (N = 1031)	UT (n = 478)	CT (n = 553)	P value
Day of follow-up	29.7 (8.23)	25.9 (0.40)	32.9 (6.20)	<.001 ^b
Age, years				<.001 ^a
<45	253 (24.6)	85 (17.9)	168 (30.4)	
45-55	221 (21.5)	103 (21.6)	118 (21.4)	
55-64	269 (26.2)	117 (24.6)	152 (27.5)	
>64	285 (27.7)	171 (35.9)	114 (20.7)	
Female	733 (71.1)	342 (71.6)	391 (70.7)	.766 ^a
White	741 (71.9)	379 (79.3)	362 (65.5)	<.001 ^a
Initial VCSS	6.68 (3.87)	7.28 (4.52)	6.15(3.10)	<.001 ^b
VCSS change	-4.06 (3.27)	-3.50 (3.95)	-4.54 (2.46)	<.001 ^b

Categorical variables are presented as number (%). Continuous variables are presented as mean (standard deviation).

^aPearson χ^2 .

^bStudent *t*-test.

alone (radiofrequency or laser). Symptom severity change is assessed using the pretreatment and 1-month follow-up Venous Clinical Severity Score (VCSS). Bivariate statistics are calculated comparing the CT and UT groups, with *P* values calculated using the Student *t*-test or Pearson χ^2 test as appropriate. A multivariable linear regression model assesses the association of CT with the change in VCSS.

Results: There were 1031 patients included for analysis (UT, 478; CT, 553). UT patients were older (35.9% were >64 years vs 20.7%; *P* < .001), were more likely to be white (79.3% vs 65.5%; *P* < .001) and to have a higher initial VCSS (7.28 vs 6.15; *P* < .001), and were assessed at an earlier follow-up visit (25.9 days postoperatively vs 32.9 days; *P* < .001). Compared with UT, CT was associated with an additional 1-point reduction in VCSS on bivariate analysis (−3.50 points for UT vs −4.54 points for CT; *P* < .001; Table). Thrombotic complications were not different between the two groups (UT, 1.04%; CT, 0.72%; *P* = .58). On the multivariable model, after adjustment for follow-up day, age group, ethnicity, and initial VCSS, CT was associated with a reduction in VCSS of 1.07 points beyond the reduction seen in UT alone (*P* < .001).

Conclusions: Invasive treatment of C2_s chronic venous insufficiency improves symptom severity. Whereas treatment of venous reflux is essential to address venous symptoms, our results suggest that patients further benefit from additional direct treatment of varicosities. For select patients, combined therapy may present a more effective treatment strategy than saphenous ablation alone.

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Economic Benefit of a Novel Dual Mode Ambulatory Compression Device for Treatment of Chronic Venous Leg Ulcers



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Objective: Compression is critical to heal chronic venous leg ulcers (VLU). A novel dual mode ambulatory pneumatic compression (APC) device was tested in comparison to multilayered compression bandaging systems for the treatment of nonhealing VLUs in a prospective randomized clinical trial (RCT).

Methods: Patients with VLUs measuring between 2 and 50 cm² present for 1 to 12 months were randomized to treatment with the APC device (ACT group; Actitouch; Tactile Medical, Minneapolis, Minn) or multilayered compression bandaging (MLB) with either Profore (Smith & Nephew, Memphis, Tenn) or Coban 2 (3M Health Care, St. Paul, Minn) compression systems. Patients in the ACT group were asked to wear the device for sustained or intermittent compression throughout the day and to wear a light compression stocking at night. The ACT group patients were seen every 2 to 3 weeks for follow-up to 16 weeks, allowing more in-home care. The MLB group was seen in the outpatient clinic weekly. Other aspects of VLU care were standardized between the two groups. The primary study objective was to compare wound size reduction at 16 weeks between the two groups in a noninferiority RCT. Secondary objectives assessed the effect of each therapy on medical resource utilization and the direct cost of care.

Results: There were 58 patients who were randomized to treatment with either MLB (*n* = 30) or ACT (*n*=28). Both groups experienced similar rates of wound healing during the 16-week follow-up period, with ACT group patients decreasing from 4.01 ± 2.4 cm² to 1.21 ± 2.5 cm² and MLB-treated wounds decreasing from 7.6 ± 7.9 cm² to 2.5 ± 6.1 cm². There was no significant difference between groups in percentage of wound closure, incidence of complete wound healing, or improvement in Venous Clinical Severity Score. ACT-treated wounds had lower utilization of non-study-related clinic visits compared with the MLB cohort (50.0% vs 63.3%, respectively). In addition, there were fewer ACT-scheduled patient visits without any associated complications, resulting in lower direct medical costs compared with the MLB cohort (− difference [−\$2733; *P* = .06]). The trial was halted before full

randomization to make improvements to the ACT device to increase the patient's comfort and usability, as suggested by both participating physicians and patients.

Conclusions: In this preliminary RCT, a novel APC device achieved similar VLU wound healing results in comparison to MLB but with lower direct costs. The study has led to important changes in device design that will allow confirmation of these findings in a larger RCT.

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The Impact of Great Saphenous Vein Size on Gender, Clinical Severity, and Outcome of Patients Undergoing Vein Ablation for Varicose Veins



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Objective: Policies of insurance carriers have used truncal vein size as a criterion for coverage. The objective of this study was to compare the effect of great saphenous vein (GSV) size ≥5 mm vs <5 mm on the patient's presentation and clinical outcomes.

Methods: Patients in a national cohort were prospectively captured in the Vascular Quality Initiative Varicose Vein Registry. From January 2015 to October 2017, the Vascular Quality Initiative Varicose Vein Registry database was queried for all patients undergoing varicose vein procedures. Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) class, Venous Clinical Severity Score, and patient-reported outcomes were compared for GSV size <5 mm (group 1) vs size ≥5 mm (group 2) before and after the procedures. Two-sample Wilcoxon test was performed to assess the difference between the two groups as defined by GSV size. To assess for improvement after the procedure in this population, a matched pairs signed rank Wilcoxon test was performed for each group separately.

Results: During the study period, 5757 vein ablation procedures were performed for GSV: 770 GSV size <5 mm and 4987 GSV size ≥5 mm. Group 1 patients were more likely to be female (81.7% vs 68.4%; *P* = .001) and older (56.8 years vs 55.6 years; *P* = .012). CEAP scores were higher in group 2 compared with group 1 (*P* = .001). Maximal GSV diameter in group 2 was significantly higher (8.32 mm vs 3.86 mm; *P* = .001); 64% of group 2 underwent radiofrequency thermal ablation compared with 59.2% of group 1 (*P* = .001). There were no deaths in either group. Group 2 had more complications after the procedure (0.6% vs 0%; *P* = .027), required postoperative anticoagulation (8.8% vs 5%; *P* = .001), developed partial recanalization rate (0.8% vs 0.3%; *P* = .001), and missed more work days (2.32 days vs 1.6 days) compared with group 1. A similar rate of hematoma developed in both groups, but there was a higher rate of paresthesia in group 1. Both groups had improvement in the Venous Clinical Severity Score and HASTI (heaviness, achiness, swelling, throbbing, and itching) score. The degree of symptomatic improvement between the groups was similar (Table).

Conclusions: All patients demonstrated improvement in both clinical outcomes and patient-reported outcomes after endovenous ablation regardless of size. Patients with preoperative GSV size ≥5 mm had similar

Table. Venous Clinical Severity Score (VCSS) and heaviness, achiness, swelling, throbbing, and itching (HASTI) improvements based on great saphenous vein (GSV) size

	Group 1, GSV <5 mm	Group 2, GSV ≥5 mm	<i>P</i> value
VCSS improvement	2.78	3.16	.833
HASTI improvement	5.61	5.71	.719