ORIGINAL RESEARCH

Treatment Patterns and Outcomes in Patients with Varicose Veins

Rajiv Mallick, PhD; Aditya Raju, MS, BPharm; Chelsey Campbell, PharmD, MBA; Rashad Carlton, PharmD, MSPH; David Wright, MD; Kimberly Boswell, MD; Michael Eaddy, PharmD, PhD

BACKGROUND: Approximately 24% of adults in the United States have visible varicose veins, and an estimated 6% have evidence of advanced chronic venous disease. The majority of individuals with varicose veins seek treatment because of symptoms, such as aching, throbbing, fatigue, pruritus, ankle swelling, and tenderness, rather than cosmetic reasons. Furthermore, varicose veins are a manifestation of chronic venous insufficiency, which can progress to leg pain, leg edema, chronic skin changes, and nonhealing ulcers.

OBJECTIVE: To assess varicose vein treatment patterns and their corresponding outcomes, including additional treatment rates, disease progression to new ulcers, and associated costs from a US perspective.

METHODS: We conducted a retrospective claims database study using data from the Truven Health MarketScan database. Adults who were newly diagnosed with varicose veins between January 1, 2008, and June 30, 2010, and met the study inclusion criteria were eligible to participate and were divided into 6 cohorts based on the type of first or initial therapy they received after the index diagnosis date, including surveillance and compression therapy, surgery, laser ablation, radiofrequency ablation, sclerotherapy, or multiple therapies. The patients were followed for 2 years after the index diagnosis date to assess their treatment patterns and outcomes.

RESULTS: A total of 144,098 patients met the study criteria. Of these patients, 100,072 (69.5%) were under surveillance for disease progression and/or received compression therapy; 14,007 (9.7%) received laser ablation; 9125 (6.3%) received radiofrequency ablation; 4778 (3.3%) received sclerotherapy; 4851 (3.4%) had surgery; and 11,265 (7.8%) received multiple therapies. During the 2-year follow-up period, among patients receiving interventional treatment, 54.7% of patients received additional interventional treatment (either with the same mode or a different mode from the initial treatment); 30.1% had >1 postintervention claim for symptomatic varicose veins (not including additional procedures) at 8 weeks; and 44.2% had >1 postintervention claim for symptomatic varicose veins at 1 year after the initial interventional therapy.

CONCLUSIONS: A majority of the patients in the study received conservative management. For patients receiving interventional therapy, the outcomes varied based on the treatment cohort. The surgery cohort was associated with the most favorable outcome regarding the need for additional treatment and evidence of postintervention claims for symptomatic varicose veins, followed by the multiple therapies cohort. A better understanding of these treatment outcomes in the real-world setting may affect new strategies to improve the management of patients with varicose veins.

Stakeholder Perspective, page 465

Am Health Drug Benefits. 2016;9(8):455-465
www.AHDBonline.com

Received August 13, 2015
Accepted in final form June 21, 2016

Disclosures are at end of text

KEY WORDS: conservative therapy, cost, interventional therapy, observational study, outcomes, surveillance, treatment patterns, varicose veins

It has been estimated that approximately 24% of adults in the United States have visible varicose veins, and an estimated 6% have evidence of more advanced chronic venous disease (eg, hyperpigmentation or healed or active ulcer).[1] Chronic venous disease can be a source of morbidity and burden to patients, society, and the overall healthcare system. Most individuals with varicose veins seek treatment because of symptoms rather than cosmetic concerns, which may include aching, throbbing, fatigue, pruritus, ankle swelling, and tenderness.[2] Moreover, varicose veins are a manifestation of chronic venous insufficiency, which can progress to leg pain, leg edema, chronic skin changes, and nonhealing ulcers.[2,3]

Dr Mallick was Senior Director, Health Economics and Outcomes Research, BTG International, West Conshohocken, PA, during this study; Mr Raju is Assistant Director, Xcenda, Palm Harbor, FL; Dr Campbell is Assistant Director, Xcenda; Dr Carlton is Associate Director, Xcenda; Dr Wright is Vice President, Medical Affairs, BTG International; Dr Boswell is Director, Xcenda; Dr Eaddy is Vice President, Xcenda.

KEY POINTS

- Varicose veins are a manifestation of chronic venous insufficiency, which can progress to serious morbidity.
- This study used retrospective claims data of 144,098 adults with newly diagnosed varicose veins to find the choice of treatment and outcomes.
- The 6 cohorts were based on initial therapy, including surveillance and compression therapy, surgery, laser ablation, radiofrequency ablation, sclerotherapy, or multiple therapies.
- Results for 2-year follow-up of those who received active treatment for varicose veins were: 54.7% received additional treatment; 30.1% had >1 postintervention claim for symptomatic varicose veins at 8 weeks; and 44.2% had >1 claim at 1 year.
- The surgery and multiple-therapies cohorts had the best outcomes based on postintervention claims for symptomatic varicose veins.
- Sex, age, and comorbidity burden may affect the choice of conservative versus active treatment management.
- The costs associated with varicose veins greatly decreased in all the intervention cohorts in the second year posttreatment, suggesting a long-term benefit.
- Better understanding of real-world treatment outcomes may improve the management of patients with varicose veins.

Varicose veins and venous ulcers generate a considerable economic burden, because of the high prevalence of varicose veins and the chronic nature of leg ulcers.[2,4] Estimates of the US cost for the treatment of chronic venous disease, including leg ulcers, have been reported to be up to $3 billion annually.[2,4] The direct treatment-related costs include physician visits, hospitalizations, prescription drugs, and ongoing wound care for venous leg ulcers.[5] In addition, varicose veins and venous ulcers generate indirect costs, including lost work productivity.[4]

Chronic venous disease is also associated with reduced quality of life, demonstrating progressive impairment with worsening clinical, etiology, anatomy, and pathophysiology (CEAP) clinical classification from C_2 (varicose veins without skin changes) to C_6 (active venous ulcer).[6-9] The physical impairment observed with venous ulceration (C_5 and C_6) has been shown to be similar to that observed with congestive heart failure and chronic lung disease.[9]

The Society for Vascular Surgery (SVS) and the American Venous Forum (AVF) have collaborated to develop clinical practice guidelines for the management of patients with varicose veins and associated chronic venous diseases.[2] Treatment options include conservative treatment (eg, lifestyle advice related to exercise, management of weight and diet, leg elevation, and compression stockings), standard open venous surgery, endovenous thermal ablation with laser or radiofrequency energy, and sclerotherapy.[2]

Conservative therapy is typically the first-line treatment for many patients with symptomatic varicose veins. For patients with symptomatic varicose veins (Grading of Recommendations Assessment, Development and Evaluation system grade 2C), the SVS/AVF clinical practice guidelines recommend compression therapy; however, if the patient is a candidate for saphenous vein ablation, compression therapy is not recommended as the primary treatment.[2] Various interventional modalities are effective in the treatment of varicose veins, but the recurrence rates are high.[10-15]

Given the limited real-world evidence on this topic, this study was undertaken to assess varicose vein treatment patterns and the corresponding outcomes across the interventional treatment modalities, including additional treatment rates, disease progression to new ulcers, and costs from a US perspective. The evidence uncovered through this study was used to inform an economic model that evaluated the expected costs and budget impact of interventional therapies used to treat chronic venous disease; these results have been previously published.[16]

Methods

This retrospective database analysis was conducted using the Truven Health MarketScan Commercial Claims and Encounters Database and the Truven Health MarketScan Medicare Supplemental and Coordination of Benefits Database. This database includes approximately 45 million covered lives annually and, historically, more than 500 million claim records are available in the MarketScan databases. The Commercial Claims and Encounters Database includes active employees and early (non-Medicare) retirees and their dependents. The Medicare database represents Medicare-eligible active and retired employees and their Medicare-eligible dependents from employer-sponsored supplemental plans. These databases contain integrated medical and pharmacy claims data that include inpatient and outpatient medical claims, prescription drug claims, and patient enrollment data.

The study data were accessed using procedures that are compliant with the Health Insurance Portability and Accountability Act; therefore, informed consent and

Institutional Review Board approval were not required. Data from January 2007 through June 2012 were used in this study to allow for adequate follow-up over time.

Eligible patients met the study inclusion criteria, including (1) having at least 1 primary or secondary diagnosis *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) code 454 for varicose veins of lower extremities; (2) were aged ≥18 years at the index diagnosis date; and (3) were continuously eligible to receive medical and pharmacy services during the 1-year preindex and 2-year postindex diagnosis periods. For the purpose of estimating the diagnosed incidence of varicose veins of the lower extremity, the patients must have met the criterion for continuous health plan enrollment for 1 year before the index diagnosis date; however, the criterion on requiring continuous eligibility over the 2-year postindex diagnosis was not imposed.

The index diagnosis date was defined as the first chronologically occurring diagnosis of varicose veins from January 1, 2008, through June 30, 2010 (ie, the enrollment period). The index treatment date was defined as the date of first interventional treatment. The 1-year period before the index diagnosis date was considered the preindex period and was used to measure the patients' baseline characteristics; the period after the index diagnosis date was considered the assessment period and was used to measure the treatment patterns and outcomes. Patients were excluded from the study if they received an interventional treatment during the preindex period or if they received their first diagnosis of varicose veins outside of the enrollment period.

The number of adults with a diagnostic claim for varicose veins of lower extremities and with continuous health plan enrollment for 1 year before the index diagnosis date was used to generate an estimate of the diagnosed incidence of varicose veins. For the outcomes analyses, the patients were divided into cohorts based on the first type of therapy received after the index diagnosis date. Patients without evidence of interventional treatment for varicose veins at the assessment period were classified in the surveillance and compression therapy cohort.

Patients with evidence of interventional treatment during the assessment period were classified in 1 of the following cohorts, based on *Current Procedural Terminology* (*CPT*) codes: surgery (*CPT* codes 37700, 37718, 37722, 37735, 37760, 37765, 37766, 37780, 37785, 37799, 37500, 37761); laser ablation (36478, 36479); radiofrequency ablation (36475, 36476); sclerotherapy (36468, 36470, 36471, S2202); or multiple therapies (defined as ≥2 interventional therapies at the index treatment date). Patients in the interventional therapy cohorts were followed for 2 years after the index diagnosis date. In a subset of these patients (ie, patients with at least 1 year follow-up posttreatment), the outcomes were evaluated at 8 weeks and 1 year after the index treatment date.

Baseline characteristics included age, sex, geographic location, physician specialty, and plan type (**Table**). The comorbidity burden was measured using the Charlson Comorbidity Index during the preindex period. Also, the number of unique diagnosis codes and unique prescription classes in the preindex period were calculated as a measure of concomitant diagnoses.

Varicose vein severity at the time of the index diagnosis date was assigned using a modified (version 5.27) Thomson Reuters Disease Staging (TRDS) classification system for varicose veins of lower extremities (with 12 substages of asymptomatic through death).[17] The staging system has evolved after a panel of physicians developed, for the National Center for Health Services Research, disease staging criteria for more than 400 high-incidence diseases, including varicose veins of lower extremities. Since its completion in 1983, the staging criteria have been modified to reflect current clinical practice,[17] as well as annual updating of coded staging criteria to reflect current coding conventions.

The modified TRDS for varicose veins of lower extremities were defined as stage 1 (varicose veins, asymptomatic; *ICD-9-CM* code 454.9); stage 2 (varicose veins with other complications: edema, pain, swelling; code 454.8); stage 3 (with superficial thrombophlebitis; codes 451.0, 451.9); stage 4 (with chronic venous insufficiency: dermal pigmentation, stasis dermatitis or induration of the skin; codes 454.1, 459.81, 709.00, 709.09, 782.8); stage 5 (with stasis ulcers; codes 454.0, 454.2); stage 6 (with cellulitis; codes 681.10, 681.11, 682.6, 682.7); stage 7 (with deep vein thrombosis; codes 451.11, 451.19); stage 8 (with pulmonary embolism; codes 415.19, 416.2); stage 9 (with sepsis; code 038); stage 10 (with respiratory failure; codes 518.5, 518.8); stage 11 (with shock; codes 785.50, 785.59); and stage 12 (with death).[17]

Early stages on the modified TRDS algorithm closely reflected the comprehensive CEAP classification system for chronic venous disorders staging criteria,[18] distinguishing, for example, patients with relatively less severe symptoms (eg, edema, C_3) from those with more severe symptoms (eg, dermal pigmentation, C_4).

The outcome measures evaluated in the study include (1) the rates of new (incident) venous ulcers (codes 454.0, 454.2) at 8 weeks and 1 year after the initial intervention; (2) the rates of additional interventional treatment (defined as a claim for a procedure and/or surgery of interest at any time after the index treatment—the early additional interventional treatment was defined as occurring within 8 weeks after the index procedure and/or surgery, and later additional interventional treatment was defined as occurring after a minimum 8-week gap),

Table Patients' Baseline Characteristics

Age-group	Interventional therapy					Interventional therapy (combined) (N = 44,026)	Surveillance and compression therapy (N = 100,072)
	Sclerotherapy (N = 4778)	Laser ablation (N = 14,007)	Radiofrequency ablation (N = 9125)	Surgery (N = 4851)	Multiple therapies (same day) (N = 11,265)		
Age, yrs, mean (SD)	53.3 (12.8)	53.1 (12.7)	54.2 (13.0)[a]	51.9 (12.2)[a]	52.1 (12.1)[a]	53.0 (12.6)	58.2 (15.6)[a]
Female, N (%)	4339 (90.8)	10,658 (76.1)[a]	6697 (73.4)[a]	3592 (74.1)[a]	8382 (74.4)[a]	33,668 (76.5)	68,321 (68.3)[a]
Region, N (%)							
Northeast	891 (18.7)	2576 (18.4)[a]	1820 (20.0)[a]	1103 (22.7)[a]	1940 (17.2)[a]	8330 (18.9)	19,925 (19.9)[a]
North Central	2072 (43.4)	4843 (34.6)[a]	1781 (19.5)[a]	1485 (30.6)[a]	3247 (28.8)[a]	13,428 (30.5)	25,378 (25.4)[a]
South	965 (20.2)	4633 (33.1)[a]	3608 (39.5)[a]	1241 (25.6)[a]	3491 (31.0)[a]	13,938 (31.7)	31,728 (31.7)[a]
West	799 (16.7)	1668 (11.9)[a]	1778 (19.5)[a]	936 (19.3)[a]	2379 (21.1)[a]	7560 (17.2)	20,805 (20.8)[a]
Unknown	51 (1.1)	287 (2.1)[a]	138 (1.5)[a]	86 (1.8)[a]	208 (1.9)[a]	770 (1.8)	2236 (2.2)[a]
Plan type, N (%)							
HMO	769 (16.1)	1589 (11.3)[a]	1492 (16.4)[a]	815 (16.8)[a]	1677 (14.9)[a]	6342 (14.4)	16,142 (16.1)[a]
POS	319 (6.7)	1171 (8.4)[a]	681 (7.5)[a]	484 (10.0)[a]	1092 (9.7)[a]	3747 (8.5)	6810 (6.8)[a]
PPO	2465 (51.6)	8236 (58.8)[a]	5031 (55.1)[a]	2690 (55.5)[a]	6458 (57.3)[a]	24,880 (56.5)	53,329 (53.3)[a]
Other[b]	1225 (25.6)	3011 (21.5)[a]	1921 (21.1)[a]	862 (17.8)[a]	2038 (18.1)[a]	9057 (20.6)	23,791 (23.8)[a]
Physician specialty, N (%)							
Surgeon	1535 (32.1)	4227 (30.2)[a]	3676 (40.3)[a]	1938 (40.0)[a]	4391 (39.0)[a]	15,767 (35.8)	16,628 (16.6)[a]
Medical doctor	232 (4.9)	869 (6.2)[a]	713 (7.8)[a]	434 (9.0)[a]	805 (7.2)[a]	3053 (6.9)	7069 (7.1)[a]
Dermatology	353 (7.4)	389 (2.8)[a]	157 (1.7)[a]	80 (1.7)[a]	189 (1.7)[a]	1168 (2.7)	12,387 (12.4)[a]
Internal medicine	321 (6.7)	1286 (9.2)[a]	427 (4.7)[a]	216 (4.5)[a]	560 (5.0)[a]	2810 (6.4)	10,285 (10.3)[a]
Family practice	757 (15.8)	2007 (14.3)[a]	900 (9.9)[a]	480 (9.9)[a]	1215 (10.8)[a]	5359 (12.2)	18,098 (18.1)[a]
Other[b]	1580 (33.1)	5229 (37.3)[a]	3252 (35.6)[a]	1703 (35.1)[a]	4105 (36.4)[a]	15,869 (36.0)	35,605 (35.6)[a]
CCI, mean (SD)	0.4 (0.9)	0.5 (1.0)[a]	0.6 (1.1)[a]	0.4 (0.9)	0.4 (0.9)	0.5 (1.0)	0.9 (1.5)[a]
Unique diagnoses, N, mean (SD)	10.7 (7.4)	10.4 (7.4)[a]	10.9 (7.8)	9.8 (7.1)[a]	9.6 (7.0)[a]	10.3 (7.4)	12.4 (9.2)[a]
Unique prescription classes, N, mean (SD)	5.4 (5.1)	4.9 (5.1)[a]	5.3 (5.5)	4.6 (4.8)[a]	4.7 (4.8)[a]	5.0 (5.1)	5.9 (6.0)[a]
Thomson Reuters disease stage[c] at baseline,[d] mean (SD)	3.0 (1.7)	3.3 (1.7)[a]	3.3 (1.8)[a]	2.9 (1.8)[a]	3.1 (1.7)	3.2 (1.7)	3.3 (2.2)[a]

[a]Values indicate significance ($P < .05$) versus the sclerotherapy cohort; the interventional therapy cohort was not compared with the sclerotherapy cohort.

[b]Includes "missing" and "unknown."

[c]The Thomson Reuters Disease Staging system is a proprietary coding criterion that involves a hierarchic assessment of markers of disease severity based on the presence of *ICD-9-CM* codes. A modified version (version 5.27) was used for this analysis.[17]

[d]Baseline period of the 12-month preindex diagnosis period + the index diagnosis date.

CCI indicates Charlson Comorbidity Index; HMO, health maintenance organization; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; POS, point of service; PPO, preferred provider organization; SD, standard deviation.

and the time to additional interventional treatment (defined as the number of days between the index treatment date and the date of additional interventional treatment within 1 year after treatment); (3) among symptomatic patients at baseline (modified TRDS, stage >1), the proportion of patients with 8-week and 1-year postintervention billing claims for symptomatic varicose veins; (4) the proportion of patients with disease progression after baseline, measured using the modified TRDS for varicose veins of lower extremities; and (5) treatment-specific costs for varicose veins (primary *ICD-9-CM* code 454, or claims with *CPT* codes of interventional therapies for varicose veins).

Because additional interventional treatment rates (outcome 2) were defined in terms of billing claims, which do not distinguish by the laterality of chronic venous insufficiency, an adjustment was made for the possibility that the observed additional treatment was on the other leg. Using epidemiologic evidence that approximately 33% of patients have bilateral disease,[19] we assumed that 50% (ie, one-sixth of the patients) of the observed additional treatments were on the other leg and generated a residual measure of laterality-adjusted additional treatment. The total healthcare costs were also evaluated, and were standardized to 2012 US dollars. All outcomes were evaluated within a 2-year period after the index diagnosis date.

Baseline patient characteristics were described using the mean ± standard deviation (SD) for continuous variables and counts and percentages for categorical variables. Analysis of variance testing for continuous variables and chi-square analysis for dichotomous variables were used to evaluate the differences in baseline characteristics and the outcomes between the cohorts. The sclerotherapy cohort was used as the reference group for all intercohort comparisons. Patients who did not receive additional treatment during the assessment period were censored at the last observation. All statistical analyses were conducted using SAS version 9.2 with an a priori significance level of $\alpha = .05$.

Results

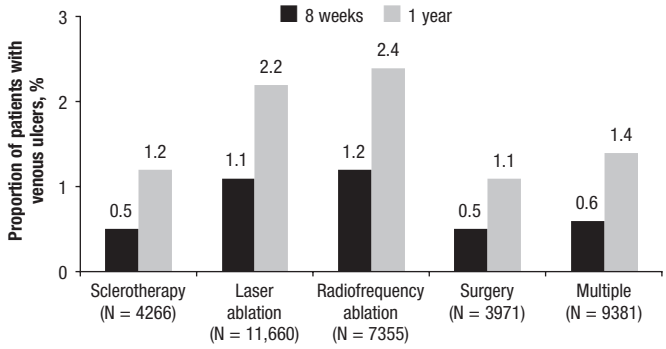
Of 45,821,615 covered lives in the database (on average, 45 million annually), 985,632 patients had a diagnostic claim for varicose veins during the analytical time frame. Among these patients, 537,919 met the criteria for continuous health plan enrollment for 1 year before the index diagnosis date and were used to generate an estimated incidence of varicose veins of 0.26%.

Among the 985,632 patients who had at least 1 primary or secondary *ICD-9-CM* diagnosis code for varicose veins (code 454) during the study period, 841,534 patients did not meet the eligibility criteria and were excluded from the analysis. A total of 144,098 patients met all of the study criteria, with 100,072 (69.5%) classified as being under surveillance for disease progression and/or receiving compression therapy; the remainder received interventional therapy: 14,007 (9.7%) had laser ablation, 9125 (6.3%) had radiofrequency ablation, 4778 (3.3%) had sclerotherapy, 4851 (3.4%) had surgery, and 11,265 (7.8%) had received multiple therapies.

The mean patient age was 57 years, and the female-to-male ratio was 71:29 (Table). Compared with the surveillance and compression therapy cohort, the patients receiving interventional therapy were younger (58.2 years vs 53 years, respectively; $P < .0001$), were more likely to be female (68.3% vs 76.5%, respectively; $P < .0001$), were more likely to have symptomatic disease (TRDS, stage >1; 85.2% vs 69.8%, respectively; $P < .0001$), and had a lower comorbidity burden (ie, Charlson Comorbidity Index, 0.9 vs 0.5, respectively; $P < .0001$).

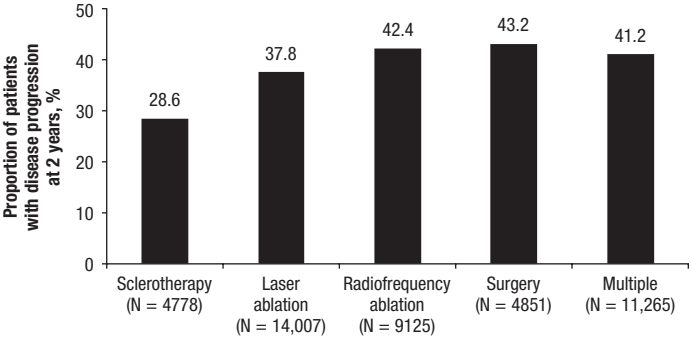
The rates of new ulcers observed for each of the interventional treatment cohorts are provided in **Figure 1** (ie, excluding patients who had evidence of ulcers during the period before their initial treatment). Overall, among patients receiving interventional treatment who were ulcer-free at baseline, 0.8% had new ulcers at 8 weeks and 1.8% had new ulcers at 1 year. In general, the sclerotherapy and surgery cohorts had the lowest rates of new ulcers (range, 0.5%-1.2%) compared with patients receiving other types of therapy (range, 0.6%-2.4% for new ulcers; $P < .05$ vs sclerotherapy for laser ablation and radiofrequency ablation at the 8-week and 1-year time points).

Figure 1 Proportion of Patients with Venous Ulcers at 8 Weeks and 1 Year



NOTE: Reference cohort: sclerotherapy. $P < .05$ for laser ablation and radiofrequency ablation cohorts at 8-week and 1-year time points. N represents the number of patients with 1-year posttreatment follow-up who were ulcer-free at baseline.

Figure 2 Proportion of Patients with Disease Progression at 2 Years



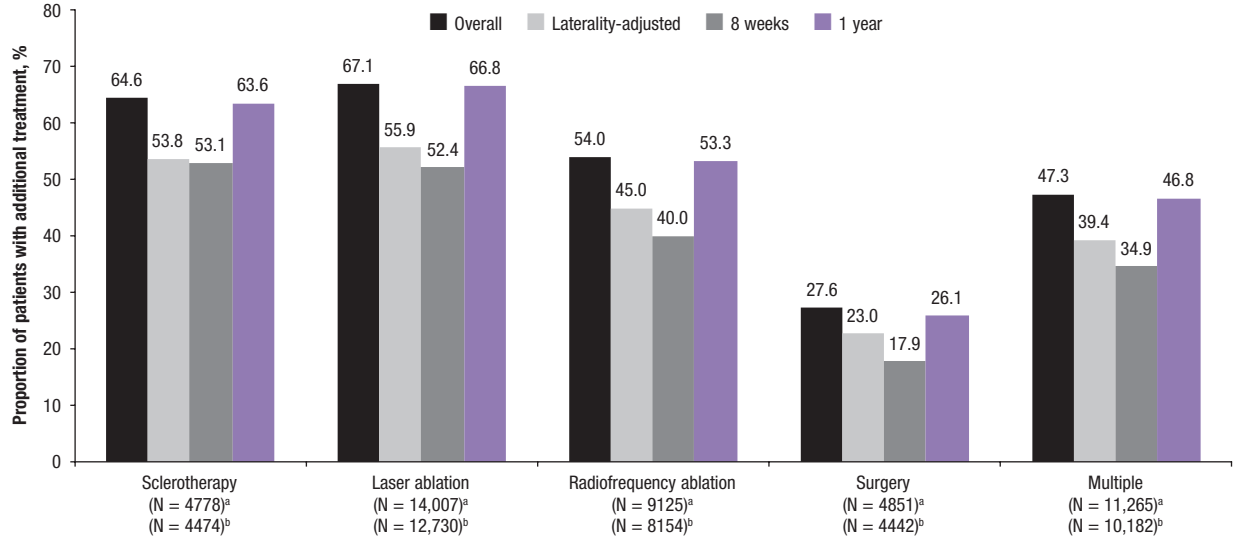
NOTE: Reference cohort: sclerotherapy. $P < .05$ for all comparisons.

Among the study cohorts, a higher proportion of patients in the interventional therapy cohorts showed disease progression during the 2-year follow-up period compared with patients in the surveillance cohort (39.2% vs 23.5%, respectively; $P < .0001$). Of the interventional cohorts, the patients in the sclerotherapy cohort had the lowest disease progression rate at the 2-year time point (**Figure 2**).

Disease progression rates at the 8-week and 1-year time points were 3.4% and 9.6%, respectively, for sclerotherapy; 6.1% and 12.5%, respectively, for laser ablation; 6.5% and 12.6%, respectively, for radiofrequency ablation; 4.0% and 9.3%, respectively, for surgery; and 5.8% and 10.8%, respectively, for multiple therapies.

Overall, among the patients receiving interventional treatment, 54.7% received additional interventional

Figure 3 Proportion of Patients Who Received Additional Treatment



NOTE: Reference cohort: sclerotherapy. $P < .05$ for all comparisons, except for the comparison at the 8-week time point with the laser ablation cohort.
[a]All patients.
[b]Patients with 1-year posttreatment follow-up.

treatment (either with the same or a different modality) during the 2-year follow-up period. Adjusted for laterality for one-sixth of additional interventional treatments, this translates to an overall laterality-adjusted additional interventional treatment rate of 45.6%. The patients in the laser ablation cohort had the highest rates of additional interventional treatment (67.1%; laterality-adjusted rate, 55.9%), followed by the sclerotherapy cohort (64.6%; laterality-adjusted rate, 53.8%), the radiofrequency ablation cohort (54%; laterality-adjusted rate, 45%), the multiple therapies cohort (47.3%; laterality-adjusted rate, 39.4%), and the surgery cohort (27.6%; laterality-adjusted rate, 23%; $P < .05$ for all intercohort comparisons) over the 2-year follow-up period (**Figure 3**).

Additional interventional treatment during the first 8 weeks (ie, the early additional interventional treatment) after the initial interventional therapy predominated. Among the patients who received additional interventional treatment over the 2-year period, the proportions of patients receiving early additional interventional treatment were 76.9% of the sclerotherapy cohort, 71.0% of the laser ablation cohort, 66.7% of the multiple therapies cohort, 66.2% of the radiofrequency ablation cohort, and 59.5% of the surgery cohort. The majority of the remaining additional interventional treatment occurred within the 1-year follow-up period; only 7.8% to 13.5% of patients within the various treatment cohorts received additional interventional treatment between the 1-year and 2-year follow-up periods.

After controlling for the baseline characteristics, including patient demographics, comorbidity burden, varicose veins disease stage, diagnosing physician specialty, region of country, and health plan type, patients in the surgery (odds ratio [OR], 0.22), multiple therapies (OR, 0.53), and radiofrequency ablation (OR, 0.67) cohorts were less likely to receive additional interventional treatment at 8 weeks compared with the sclerotherapy cohort. Similar trends were observed at 1 year.

Among all patients who received additional interventional treatment (N = 24,089), the mean time to additional interventional treatment was 58 days; the mean time to additional interventional treatment for the individual treatment cohorts was 50 days (SD, 85.4) for laser ablation, 54 days (SD, 100.0) for sclerotherapy, 61 days (SD, 99.1) for radiofrequency ablation, 61 days (SD, 99.5) for multiple therapies, and 88 days for surgery (SD, 135.5; $P < .05$ for all intercohort comparisons, except for the laser ablation cohort).

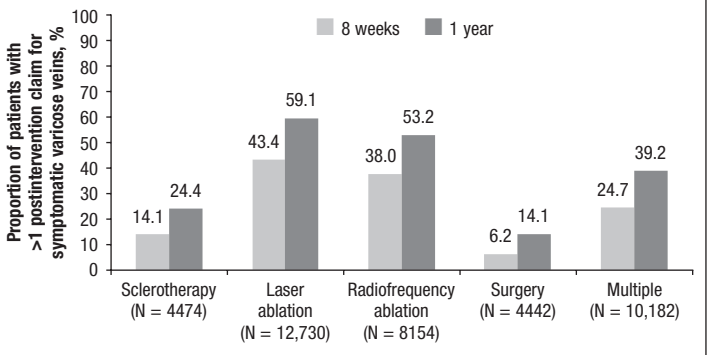
Among the patients who were symptomatic (Thomson Reuters disease stage >1) before treatment, 30.1% of patients receiving interventional treatment had >1 postintervention claim for symptomatic varicose veins (allowing a claim for routine postintervention follow-up and not counting additional follow-up interventions of interest) at 8 weeks, and 44.2% had >1 postintervention claim for symptomatic varicose veins at 1 year. The surgery cohort by far had the lowest proportion of patients with >1 postintervention claim for symptomatic varicose

veins at the respective time points (6.2% at 8 weeks and 14.1% at 1 year); the intercohort differences were significant for all comparisons (P <.05; **Figure 4**).

The treatment-specific mean costs for varicose veins during the 2 years after the index diagnosis ranged from $204 (for surveillance and compression therapy) to $5836 (for multiple therapies). The treatment-specific costs for the first year predominated across all the cohorts (82%-87% of costs in the 2-year period; **Figure 5**). For comparison, the all-cause costs (ie, the medical and pharmacy costs) were approximately equal and stable during the 2 years.

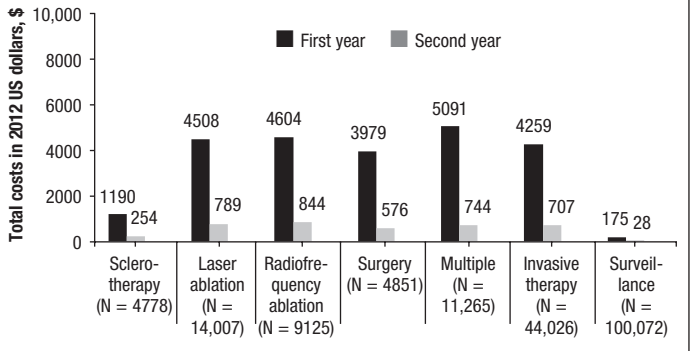
The treatment-specific mean costs for varicose veins as a proportion of the all-cause costs ranged from a low of 10.4% ($1444/$13,823) for sclerotherapy to 29.9% for laser ablation ($5298/$17,711) among the initial single-modality interventions and 31.6% ($5836/$18,455) among the multiple therapies cohort.

Figure 4 Proportion of Patients with Postintervention Claims for Symptomatic Varicose Veins



NOTE: Reference cohort: sclerotherapy. P <.05 for all comparisons. N indicates the number of patients with 1-year posttreatment follow-up.

Figure 5 Total Costs of Interventional Therapies for Varicose Veins



NOTE: Reference cohort: sclerotherapy. P <.05 for all comparisons; the invasive therapy cohort was not compared with the sclerotherapy cohort.

Discussion

Chronic venous disease, including varicose veins, is associated with substantial human and economic burdens because of the high prevalence and chronic nature of the disease. In the Bonn Vein Study, the prevalence of varicose veins without edema or skin changes was 14.3%, and 17.1% of patients had more severe venous disorders, including edema, skin changes, and venous ulceration.[20] Ours is one of the first large, real-world studies to evaluate and characterize patterns of treatment and the associated outcomes among patients with varicose veins in the United States.

The findings from our study reveal that the vast majority of patients received conservative management (eg, compression therapy and lifestyle modifications). This finding is expected, because many payers often require a trial of compression stockings before treatment with interventional modalities.[21,22] This requirement may, however, be contrary to the SVS/AVF clinical practice guidelines, which recommend against compression therapy as the primary treatment if the patient is a candidate for saphenous vein ablation.[2]

However, our evidence on the substantial use of conservative therapy may not necessarily reflect unduly restrictive payer policy constraints. The fact that the interventional cohort included patients who were younger, more likely to be female, and had lesser comorbidity burden than in the other cohorts suggests that interventional treatment preferences and the prioritization of treatment of other medical conditions may also play a role. Because nearly 25% of patients in the conservative therapy cohort demonstrated disease progression over the 2-year follow-up period, this finding is of concern. A recent study concluded that some of these patients in the conservative therapy cohort may benefit from timely interventional treatment and identified the most appropriate timing associated with interventional treatment.[23]

The recurrence of varicose veins after treatment is common; hence, additional interventional treatment is often necessary. Our findings demonstrate that the surgery cohort was associated with the lowest additional interventional treatment rates at all the evaluation time points (8 weeks, 1 year, and overall), especially at 8 weeks. This is consistent with what has been reported in the literature for comparable follow-up periods: van Rij and colleagues reported a recurrence rate of approximately 14% at 3 months, and a range from 32% to 37% has been reported for 1-year and 2-year follow-up periods.[15,24,25] After a longer period of follow-up observation, the recurrence rate after varicose vein surgery has been reported to be higher (range, 25%-70% after 5-10 years or longer).[26-29]

As far as other interventional therapies, it is common for varicose veins to be treated with multiple interventional modalities within the same treatment session (eg,

endovenous thermal ablation plus phlebectomy) or over multiple sessions (eg, laser ablation followed by sclerotherapy to treat tributary or perforator veins).[2] We observed relatively high additional interventional treatment rates for the endovenous thermal ablation modalities (ie, laser ablation or radiofrequency ablation), especially in the short-term (52.4% and 40.0%, respectively). We further observed cumulatively greater additional interventional treatment during 1 year among the endovenous thermal ablation modalities; these additional treatment rates were higher than what has generally been reported for recurrence rates associated with radiofrequency ablation, laser ablation, and sclerotherapy.[10,25,30]

Recurrent varicose veins are not always clearly defined in the literature (ie, true recurrence vs residual incompetent veins vs new incompetent veins).[31] This makes it difficult to compare evidence from our study with the literature. In addition, a reason for our finding of high additional interventional treatment rates among the sclerotherapy cohort and endovenous thermal ablation therapies (ie, laser ablation or radiofrequency ablation) may be because for specificity of attribution, these cohorts were defined by being the only treatments on the index date. If other complementary treatments occurred on the same day, which is common, those patients were classified in the multiple therapies cohort, which was associated with improved outcomes.

Multiple therapies are known to be associated with increased complication rates[32]; however, although Thomson Reuters disease stage 3 was used to separate the postoperative complications from progression, the goal of the study was to evaluate disease progression as one outcome, and the postoperative complications were not specifically examined. Furthermore, for stand-alone sclerotherapy, evidence of relatively high rates of additional interventional treatment, along with relatively low rates of disease progression, may suggest a pattern of patient selectivity, where this treatment was likely used primarily for patients with visible (tributary) varicosities, and not for the treatment of great saphenous vein reflux, and is thus intrinsically associated with low progression risk and symptomatology.

Chronic venous disease is associated with significant morbidity, depending on disease severity.[2,4] The clinical spectrum of disease ranges from telangiectasias (dilated intradermal venules <1 mm in diameter, C_1) to edema (C_3) to active leg ulcers (C_6),[4] and substantial healthcare resources are related to the complications of venous disease.[2,4] In some cases, alternative modes of treatment may be necessary when advanced stages of chronic venous disease are associated with limitations or with contraindications to conventional surgical treatment, which may include edema and active ulcers.[33] Our study evaluated the rates of new venous ulcers associated with treatment for patients who were ulcer-free at baseline. Depending on the interventional treatment modality, new venous ulcers were observed in a range from 1.1% to 2.4% of patients at 1 year after treatment. In general, all interventional modalities are known to be well-tolerated, with a low frequency of serious complications (eg, deep-venous thrombosis and pulmonary embolism).[14,25,34-38] The progression of varicose veins to advanced-stage symptoms (eg, leg ulcers) is infrequently reported in the literature.[11,14,30,34-37,39-43]

As mentioned, varicose veins can be a substantial financial burden. Varicose vein–associated complications may lead to chronic pain, disability, decreased quality of life, and loss of productivity.[2] Among patients receiving interventional therapies in our study, varicose vein treatment–specific costs accounted for almost 30% of all costs. The treatment-specific costs were higher for patients receiving interventional treatment modalities than for the surveillance and compression therapy cohort.

By contrast, the total all-cause costs were similar for patients receiving interventional therapies (all cohorts combined) and those receiving conservative management (ie, surveillance and compression therapy). The latter was also found to be associated with a higher comorbidity burden at baseline. Finally, more than 80% of varicose vein–specific costs in this study were concentrated in the first-year period, which is consistent with the evidence on the time profile of additional interventional treatments.

Limitations

The study has several limitations. Our data are derived from a large claims database that is representative of the US commercially insured population and relies on diagnostic codes in the absence of more detailed clinical factors. For example, additional interventional treatment rates may be overestimated, because measurement relies on procedure codes; hence, it cannot be confirmed whether the subsequent treatments were conducted on the same leg or a different one. The magnitude of such overestimation is, however, likely to be limited to the approximately 33% of patients who have evidence of bilateral disease.[19] This was reflected in our estimate of the laterality-adjusted interventional retreatment rate, albeit by a construct that is subject to some error. Finally, it has been suggested that it is quite feasible to perform bilateral procedures on the same day,[19] and, to that degree, observed interventional retreatment rates in our study are less likely to represent staggered bilateral disease treatment.

Because of the lack of clinical measures, disease progression was assessed using the modified TRDS system, which accords closely with the CEAP C classification up to disease stage 5, with the exceptions of stage 3 (a com-

plication) and a lack of a stage for healed ulcers.[23] This system has been recently applied in a study in chronic venous insufficiency.[23] Nevertheless, because these disease staging criteria rely on coded diagnoses to indicate clinical progression, it is subject to some misclassification.

Furthermore, the sclerotherapy treatment cohort did not distinguish between liquid and foam sclerotherapies. Foam sclerotherapy will become the treatment of interest in this type of analysis, because liquid sclerotherapy is limited to smaller veins. Although a foam composition, polidocanol injectable foam (Varithena), recently received US Food and Drug Administration approval during the period of this study, foam sclerotherapy was limited to unapproved, off-label use, because of variable administrative techniques and gas composition compromising the quality and density of the foam.[44-46]

Finally, as in any observational study, patient selectivity across cohorts is to be expected. For example, patients in the interventional cohort overall were younger, were more likely to be female, and had less comorbidity burden compared with the other cohorts. When these factors were controlled for in the multivariate modeling, it made no difference to the conclusions; however, some selectivity may have affected the overall findings.

Conclusions

Our study shows that the vast majority of patients in a claims database received conservative management for varicose veins, and that sex, age, and comorbidity burden may play a role in the choice of conservative versus interventional management. For patients who received interventional therapies, the surgery cohort was associated with the most favorable outcome regarding the need for additional interventional treatment and for the growth of new ulcers; furthermore, the varicose vein–specific costs likely reflected the low rate of additional interventions. Although sclerotherapy was associated with the lowest rate of disease progression, this may conceivably reflect some unmeasured patient selection in that traditional sclerotherapy is often used for visible (tributary) varicosities and is intrinsically less prone to progression risk.

The varicose vein–specific costs declined sharply in all interventional cohorts in the second year after treatment, suggesting a long-term benefit. By contrast, the initial and continued high all-cause costs in the surveillance and compression therapy cohort suggest that the costs associated with other medical conditions more than offset the low varicose vein–specific treatment costs and may, in fact, have guided treatment prioritization. Although our study fulfills an unmet need for large-scale, real-world studies demonstrating health outcomes associated with varicose vein treatments, the findings also highlight the need for more detailed clinical investigation of treatment issues, such as long-term recurrence and additional treatment. ■

Acknowledgment

Kylie Matthews provided copyediting assistance for this manuscript.

Source of Funding

This study was funded by BTG International Ltd Inc.

Author Disclosure Statement

Dr Mallick and Dr Wright were employees of BTG International Inc, during the study; Dr Carlton, Dr Campbell, Dr Boswell, Mr Raju, and Dr Eaddy provided consulting services to BTG International Inc.

References

1. Kaplan RM, Criqui MH, Denenberg JO, et al. Quality of life in patients with chronic venous disease: San Diego population study. *J Vasc Surg*. 2003;37:1047-1053.
2. Gloviczki P, Comerota AJ, Dalsing MC, et al; for the Society for Vascular Surgery; American Venous Forum. The care of patients with varicose veins and associated chronic venous diseases: clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. *J Vasc Surg*. 2011;53(5 suppl):2S-48S.
3. Labropoulos N, Leon L, Kwon S, et al. Study of the venous reflux progression. *J Vasc Surg*. 2005;41:291-295.
4. Bergan JJ, Schmid-Schönbein GW, Smith PD, et al. Chronic venous disease. *N Engl J Med*. 2006;355:488-498.
5. Kumar RN, Gupchup GV, Dodd MA, et al. Direct health care costs of 4 common skin ulcers in New Mexico Medicaid fee-for-service patients. *Adv Skin Wound Care*. 2004;17:143-149.
6. Darvall KA, Bate GR, Adam DJ, Bradbury AW. Generic health-related quality of life is significantly worse in varicose vein patients with lower limb symptoms independent of CEAP clinical grade. *Eur J Vasc Endovasc Surg*. 2012;44:341-344.
7. Kahn SR, M'lan CE, Lamping DL, et al; for the VEINES Study Group. Relationship between clinical classification of chronic venous disease and patient-reported quality of life: results from an international cohort study. *J Vasc Surg*. 2004;39:823-828.
8. Andreozzi GM, Cordova RM, Scomparin A, et al; for the Quality of Life Working Group on Vascular Medicine of SIAPAV. Quality of life in chronic venous insufficiency: an Italian pilot study of the Triveneto Region. *Int Angiol*. 2005;24:272-277.
9. Carradice D, Mazari FA, Samuel N, et al. Modelling the effect of venous disease on quality of life. *Br J Surg*. 2011;98:1089-1098.
10. Luebke T, Brunkwall J. Systematic review and meta-analysis of endovenous radiofrequency obliteration, endovenous laser therapy, and foam sclerotherapy for primary varicosis. *J Cardiovasc Surg (Torino)*. 2008;49:213-233.
11. Murad MH, Coto-Yglesias F, Zumaeta-Garcia M, et al. A systematic review and meta-analysis of the treatments of varicose veins. *J Vasc Surg*. 2011;53(5 suppl):49S-65S.
12. Rigby KA, Palfreyman SJ, Beverley C, Michaels JA. Surgery versus sclerotherapy for the treatment of varicose veins. *Cochrane Database Syst Rev*. 2004:CD004980.
13. van den Bos R, Arends L, Kockaert M, et al. Endovenous therapies of lower extremity varicosities: a meta-analysis. *J Vasc Surg*. 2009;49:230-239.
14. Nesbitt C, Eifell RK, Coyne P, et al. Endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus conventional surgery for great saphenous vein varices. *Cochrane Database Syst Rev*. 2011:CD005624.
15. van Rij AM, Jiang P, Solomon C, et al. Recurrence after varicose vein surgery: a prospective long-term clinical study with duplex ultrasound scanning and air plethysmography. *J Vasc Surg*. 2003;38:935-943.
16. Carlton R, Mallick R, Campbell C, et al. Evaluating the expected costs and budget impact of interventional therapies for the treatment of chronic venous disease. *Am Health Drug Benefits*. 2015;8(7):366-374.

17. Thomson Reuters. Disease Staging: Clinical and Coded Criteria (version 5.27). 2010. www.hcup-us.ahrq.gov/db/nation/nis/DiseaseStagingV5_27ClinicalandCodedCriteria.pdf. Accessed October 21, 2016.
18. Eklöf B, Rutherford RB, Bergan JJ, et al; for the American Venous Forum International Ad Hoc Committee for Revision of the CEAP Classification. Revision of the CEAP classification for chronic venous disorders: consensus statement. *J Vasc Surg*. 2004;40:1248-1252.
19. Gemayel G, Christenson JT. Can bilateral varicose vein surgery be performed safely in an ambulatory setting? *Eur J Vasc Endovasc Surg*. 2012;43:95-99.
20. Maurins U, Hoffmann BH, Lösch C, et al. Distribution and prevalence of reflux in the superficial and deep venous system in the general population—results from the Bonn Vein Study, Germany. *J Vasc Surg*. 2008;48:680-687.
21. UnitedHealthcare. Varicose veins treatment. Coverage summary. www.unitedhealthcareonline.com/ccmcontent/ProviderII/UHC/en-US/Assets/ProviderStaticFiles/ProviderStaticFilesPdf/Tools%20and%20Resources/Policies%20and%20Protocols/UnitedHealthcare%20Medicare%20Coverage/Varicose%20Vein%20Procedures_CS_%20SH_%20Ovations.pdf. Accessed June 9, 2014.
22. Aetna. Varicose veins. Clinical Policy Bulletin. No. 0050. 2014. www.aetna.com/cpb/medical/data/1_99/0050.html. Accessed June 9, 2014.
23. Raju A, Mallick R, Campbell C, et al. Real-world assessment of interventional treatment timing and outcomes for varicose veins: a retrospective claims analysis. *J Vasc Interv Radiol*. 2016;27:58-67.
24. Disselhoff BC, der Kinderen DJ, Kelder JC, Moll FL. Randomized clinical trial comparing endovenous laser with cryostripping for great saphenous varicose veins. *Br J Surg*. 2008;95:1232-1238.
25. Rasmussen LH, Bjoern L, Lawaetz M, et al. Randomised clinical trial comparing endovenous laser ablation with stripping of the great saphenous vein: clinical outcome and recurrence after 2 years. *Eur J Vasc Endovasc Surg*. 2010;39:630-635.
26. Fischer R, Linde N, Duff C, et al. Late recurrent saphenofemoral junction reflux after ligation and stripping of the greater saphenous vein. *J Vasc Surg*. 2001;34:236-240.
27. Blomgren L, Johansson G, Dahlberg-Akerman A, et al. Recurrent varicose veins: incidence, risk factors and groin anatomy. *Eur J Vasc Endovasc Surg*. 2004;27:269-274.
28. Allegra C, Antignani PL, Carlizza A. Recurrent varicose veins following surgical treatment: our experience with five years follow-up. *Eur J Vasc Endovasc Surg*. 2007;33:751-756.
29. Campbell WB, Vijay Kumar A, Collin TW, et al; for the Randomised and Economic Analysis of Conservative and Therapeutic Interventions for Varicose Veins Study. The outcome of varicose vein surgery at 10 years: clinical findings, symptoms and patient satisfaction. *Ann R Coll Surg Engl*. 2003;85:52-57.
30. Pronk P, Gauw SA, Mooij MC, et al. Randomised controlled trial comparing sapheno-femoral ligation and stripping of the great saphenous vein with endovenous laser ablation (980 nm) using local tumescent anaesthesia: one year results. *Eur J Vasc Endovasc Surg*. 2010;40:649-656.
31. Mundy L, Merlin TL, Fitridge RA, Hiller JE. Systematic review of endovenous laser treatment for varicose veins. *Br J Surg*. 2005;92:1189-1194.
32. Obi AT, Reames BN, Rook TJ, et al; for the Michigan Vein Health Program. Outcomes associated with ablation compared to combined ablation and transilluminated powered phlebectomy in the treatment of venous varicosities. *Phlebology*. 2016;31:618-624.
33. Viarengo LM, Potério-Filho J, Potério GM, et al. Endovenous laser treatment for varicose veins in patients with active ulcers: measurement of intravenous and perivenous temperatures during the procedure. *Dermatol Surg*. 2007;33:1234-1242; discussion 1241-1242.
34. Jia X, Mowatt G, Burr JM, et al. Systematic review of foam sclerotherapy for varicose veins. *Br J Surg*. 2007;94:925-936.
35. Rasmussen LH, Lawaetz M, Bjoern L, et al. Randomized clinical trial comparing endovenous laser ablation, radiofrequency ablation, foam sclerotherapy and surgical stripping for great saphenous varicose veins. *Br J Surg*. 2011;98:1079-1087.
36. Puggioni A, Kalra M, Carmo M, et al. Endovenous laser therapy and radiofrequency ablation of the great saphenous vein: analysis of early efficacy and complications. *J Vasc Surg*. 2005;42:488-493.
37. Rass K, Frings N, Glowacki P, et al. Comparable effectiveness of endovenous laser ablation and high ligation with stripping of the great saphenous vein: two-year results of a randomized clinical trial (RELACS study). *Arch Dermatol*. 2012;148:49-58.
38. van Rij AM, Chai J, Hill GB, Christie RA. Incidence of deep vein thrombosis after varicose vein surgery. *Br J Surg*. 2004;91:1582-1585.
39. Merchant RF, Pichot O; for the Closure Study Group. Long-term outcomes of endovenous radiofrequency obliteration of saphenous reflux as a treatment for superficial venous insufficiency. *J Vasc Surg*. 2005;42:502-509; discussion 509.
40. Siribumrungwong B, Noorit P, Wilasrusmee C, et al. A systematic review and meta-analysis of randomised controlled trials comparing endovenous ablation and surgical intervention in patients with varicose vein. *Eur J Vasc Endovasc Surg*. 2012;44:214-223.
41. de Medeiros CA, Luccas GC. Comparison of endovenous treatment with an 810 nm laser versus conventional stripping of the great saphenous vein in patients with primary varicose veins. *Dermatol Surg*. 2005;31:1685-1694; discussion 1694.
42. Shepherd AC, Gohel MS, Brown LC, et al. Randomized clinical trial of VNUS ClosureFAST radiofrequency ablation versus laser for varicose veins. *Br J Surg*. 2010;97:810-818.
43. Almeida JI, Kaufman J, Göckeritz O, et al. Radiofrequency endovenous ClosureFAST versus laser ablation for the treatment of great saphenous reflux: a multicenter, single-blinded, randomized study (RECOVERY study). *J Vasc Interv Radiol*. 2009;20:752-759.
44. Hesse G, Breu FX, Kuschmann A, et al. Sclerotherapy using air- or CO2-O2-foam: post-approval study. *Phlebologie*. 2012;41:77-88.
45. Cavezzi A, Tessari L. Foam sclerotherapy techniques: different gases and methods of preparation, catheter versus direct injection. *Phlebology*. 2009;24:247-251.
46. Varithena (polidocanol injectable foam) prescribing information. Provensis Ltd, a BTG International group company; June 2016.

Stakeholder Perspective next page

STAKEHOLDER PERSPECTIVE

Important Insights from Real-World Treatment Patterns and Outcomes for Varicose Veins Management

By Gary M. Owens, MD
President, Gary Owens Associates, Ocean View, DE

Varicose vein disease is a common condition in adults in the United States, and can be costly to payers based on its sheer prevalence. According to the article by Mallick and colleagues in this issue of *American Health & Drug Benefits*, nearly 25% of US adults have varicose vein disease.[1] Varicose veins comprise a spectrum of chronic venous diseases, including spider telangiectasias, reticular veins, and true varicosities. Although it is difficult to find definitive data on the total cost of managing varicose veins, 2 previous publications suggest that the prevalence of varicose veins, and the substantial cost of treating the associated late complications, such as chronic venous ulcers, contribute to the high economic burden on healthcare resources.[2,3] For example, chronic venous ulcerations result in the loss of 2 million workdays and cost the US healthcare system an estimated $3 billion for managing this chronic condition.[3]

PAYERS: It is in this setting that payers often struggle to manage patient access to treatments for this condition. On the one hand, they recognize that undertreatment can lead to later complications and costly sequelae, including venous ulceration and chronic wound complications. On the other hand, payers do not want to pay for unnecessary, or for potentially cosmetic, treatments.

RESEARCHERS: In their article in this issue, Mallick and colleagues report on a retrospective assessment of a database of more than 144,000 patients with diagnosed varicose veins.[1] Although there are many limitations to database-related studies that are inherent to the analytics based on claims data, this current study gives us some insight into how patients are being treated in the real world, as well as the outcomes of those treatments.

PROVIDERS: Conservative treatment was the most common mode of therapy chosen by providers for this patient population, but, as the authors note, this could have been because of multiple reasons, including a younger, predominantly female patient population, with fewer comorbidities. Nevertheless, it is also possible that payer policies that require a trial of conservative therapy for this specific condition before initiating more aggressive therapy may play a role in this treatment selection by providers.

Mallick and colleagues also note that patients who received surgical intervention required fewer subsequent interventions, and sclerotherapy resulted in the lowest rate of disease progression,[1] although this might have been the result of a selection bias in the cohort of patients choosing this treatment.

ALL STAKEHOLDERS: Although this study does not provide all the answers that payers and providers seek regarding the treatment of varicose veins and the downstream outcomes and associated costs, the authors should be commended for their work in providing important information about this condition. It is precisely this type of work—analyzing real-world treatment patterns and outcomes—that payers and providers need to help them gain insight into how to better manage their patient populations.

One hopes that this study will encourage other investigators to pursue such analytics related to this condition and to other chronic conditions to provide payers, who manage large patient populations, with real-world, evidence-based insight on the process and its impact on the outcomes of care they manage. ■

1. Mallick R, Raju A, Campbell C, et al. Treatment patterns and outcomes in patients with varicose veins. *Am Health Drug Benefits*. 2016;9(8):455-465.
2. Bergan JJ, Schmid-Schönbein GW, Smith PD, et al. Chronic venous disease. *N Engl J Med*. 2006;355:488-498.
3. McGuckin M, Waterman R, Brooks J, et al. Validation of venous leg ulcer guidelines in the United States and United Kingdom. *Am J Surg*. 2002;183:132-137.