Safety and efficacy of venous ablation in octogenarians

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ABSTRACT

Objective: Venous ablation (VA) is the recommended treatment of superficial venous insufficiency affecting the lower extremities. The safety and efficacy of the procedure in octogenarians have not been well studied. We postulate that VA in octogenarians is as safe and effective as in younger age groups.

Methods: A retrospective single-center review of consecutive patients undergoing VA using radiofrequency in an outpatient office was performed. Patients, imaging, and procedural characteristics were reviewed from the medical records. A telephone survey inquiring about intensity of symptoms on a numeric rating scale of 0 to 10 before and after treatment was conducted. Patients were divided into three groups based on age: <65 years, 65 to 79 years, and ≥80 years. Clinical success was defined by patients' reporting improvement or resolution of symptoms and was reported per leg. Technical success was defined by vein closure on duplex ultrasound and was reported per vein. Patients and outcomes were compared between the three groups using χ^2 or analysis of variance test in SAS software (SAS Institute, Cary, NC).

Results: There were 362 patients who underwent 627 VAs in 512 legs. Octogenarians constituted 9.4% of the patient population and were more likely to have cardiovascular comorbidities. Octogenarians were significantly more likely to have advanced venous disease as determined by the Clinical, Etiology, Anatomy, and Pathophysiology classification compared with younger patients ($P = .005$). On ultrasound, younger patients had significantly larger vein diameters ($P = .04$) and longer reflux times ($P < .001$). There was no significant difference in the types of veins ($P = .08$) or the mean number of veins ($P = .37$) treated in the three groups; however, there was a trend toward younger patients' requiring more adjunctive procedures ($P = .1$). The clinical success ($P = .86$), technical success ($P = .19$), and complications ($P = .36$) were not different between octogenarians and younger patients. The survey results demonstrated similar findings with no difference in pain improvement ($P = .27$) or recurrence ($P = .36$).

Conclusions: Octogenarians treated with VA present at a more advanced clinical stage compared with younger patients but have less severe ultrasound findings. VA is safe and effective in all age groups. Age should not be used to deny patients VA. (J Vasc Surg: Venous and Lym Dis 2019;7:685-92.)

Keywords: Varicose veins; Venous insufficiency; Venous ablation

In the United States, an estimated 30% of the adult population have varicose veins.[1-3] Although common, they are often overlooked by physicians as being solely a cosmetic concern. However, varicose veins can be frequently associated with significant functional limitations and decreased quality of life.[1,4,5] Thermal venous ablation (VA), using laser or radiofrequency ablation (RFA), is the currently recommended treatment of symptomatic saphenous vein incompetence, the most common cause of varicose veins.[6] In the last decade, treatment of varicose veins has increased because of increasing awareness and expansion of VA as a well-tolerated, office-based, and low-risk procedure.[7,8] This expansion penetrated a growing elderly population suffering from varicose veins that might not have been eligible for traditional stripping surgery despite paucity of literature to support it in that age group.

The introduction of the Vascular Quality Initiative Varicose Vein Registry (VQI VVR) in 2015 represents a major effort to benchmark the treatment of varicose veins in the United States and to determine its safety and efficacy across all age groups.[9,10] The increasing cost of varicose vein treatment and the appropriateness of care remain a focus of regulatory bodies exemplified by the 2016 meeting between the Society for Vascular Surgery (SVS), the American Venous Forum (AVF), and the Medicare Evidence Development and Coverage Advisory Committee (MEDCAC).[8,11] There still, however, remains a paucity of data describing age-related benefit to VA despite overwhelming evidence suggesting that the prevalence of varicose veins increases with age. The objective of this study was to compare the patient characteristics and outcomes of VA in octogenarians with younger age groups.

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METHODS

Study population. A retrospective review of all patients treated from March 2012 to June 2016 with VA at Yale New Haven Hospital was performed. The electronic medical records were reviewed for patients' demographics, comorbidities, and related symptoms. The ultrasound findings including reflux times and diameter of vein at the junction as well as the maximal reflux time and size of the vein regardless of proximity to the junction were also recorded. The clinical severity score of venous insufficiency was determined by the Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) classification for chronic venous insufficiency as defined by the AVF.[12]

Patients with symptomatic saphenous or tributary veins were initially treated with conservative management in the form of leg elevation and class II (20-30 mm Hg) elastic compression stockings for a minimum of 3 consecutive months. They were then considered for VA on an individual case basis. All VAs were performed using ClosureFast radiofrequency catheter (Medtronic, Dublin, Ireland) in an outpatient clinic setting with the use of tumescent anesthesia. RFA was performed on great saphenous vein, small saphenous vein, anterior accessory saphenous vein, and perforator veins. All procedural ultrasound images were reviewed. The treatment groups were divided on the basis of age into three groups: <65 years, 65 to 79 years, and ≥80 years. All patients underwent follow-up ultrasound within 1 to 2 weeks after ablation based on each individual provider's practice and were evaluated for symptomatic relief. The number of veins treated per patient was also considered to determine the mean number of veins treated per age group. Adjunctive procedures for each patient were also recorded. Adjunctive procedures included phlebectomies only. Phlebectomies were generally performed in patients with persistent symptoms at time of follow-up, typically 1 to 3 months after the initial ablation procedure.

Long-term follow-up was collected by telephone survey at the end of the study inquiring about intensity of symptoms on a numeric rating scale (NRS) of 0 to 10 before treatment, 1 month after treatment, and at the time of survey. The survey also included questions relating to compliance with compression stockings, use of pain medication, and functional limitations including daily life activities, walking, and hobbies or other interests. Institutional Review Board approval was obtained from the Human Investigations Committee at Yale University, and informed consent from each patient was taken before conducting the telephone survey.

Outcomes. Clinical success was defined as improvement or resolution of symptoms as reported by patients on follow-up per leg based on electronic medical record documentation and chart review within a month of the procedure. Technical success was defined by vein closure on postprocedure duplex ultrasound scan. Complications included persistent pain and inflammation (phlebitis), hematoma, nerve injury/numbness, and infection. Endothermal heat-induced thrombosis (EHIT) was also recorded as a complication. In this study, EHIT as a complication refers only to EHIT classes 2 to 4. EHIT class 1 was not considered a complication because it does not require treatment. EHIT 1 was defined as thrombus up to the junction; EHIT 2, <50% thrombus extension into the deep vein; EHIT 3, >50% extension into the deep vein; and EHIT 4, complete deep venous thrombosis.[13] EHIT classes 2, 3, and 4 were managed with serial ultrasound or anticoagulation at the surgeon's discretion.[13] NRS scores before treatment, 1 month after treatment, and at time of survey were compared between the groups for pain and swelling. The percentage of patients with improvement in symptoms after treatment was calculated on the basis of a decrease in NRS score per leg at 1 month after the procedure. Recurrence was defined as worsening of symptoms and an increase in NRS score per leg based on the follow-up survey compared with 1 month after the procedure.

Statistical analysis. Univariable analysis was performed using χ^2 test for categorical variables and *t*-test for continuous variables. All analysis was performed using SAS software version 9.4 (SAS Institute, Cary, NC). $P < .05$ was considered statistically significant.

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center retrospective cohort study
- **Key Findings:** Despite that the clinical presentation was more advanced among octogenarians, the clinical and technical efficacy was equivalent among all age groups in a study of 627 venous ablations performed from 2012 to 2016.
- **Take Home Message:** Venous ablation is a safe and effective procedure in patients of all age groups. Age should not be used as a factor to deny this treatment.

RESULTS

Population of patients. There were 362 patients who underwent 627 VAs in 512 legs. Octogenarians constituted 9.4% of the patients and 8.9% of total veins treated. There were only two (0.5%) nonagenarians in that group. There was no significant difference in sex ($P = .74$), body mass index ($P = .16$), or race ($P = .17$) between the three groups. Octogenarians were noted to have significantly higher comorbidities compared with the youngest age group, including hypertension (<65 years, 29.8%; 65-79 years, 70%; ≥80 years, 64.7%; $P < .001$), diabetes (<65 years, 14.5%; 65-79 years, 27%; ≥80 years, 31.2%;

Table I. Patients' characteristics

Characteristic	Age group (N = 362)			*P* value
	<65 years (n = 228)	65-79 years (n = 100)	≥80 years (n = 34)	
Demographics				
Female	64 (146)	66 (66)	70.6 (24)	.74
BMI	32.3 ± 8.7	32.4 ± 6.8	29.4 ± 5.5	.16
Ethnicity				
Hispanic/Latino	17.5 (40)	11 (11)	5.9 (2)	.17
African American	7.8 (18)	10 (10)	8.8 (3)	
Asian	4.4 (10)	0	0	
White	65.4 (149)	73 (73)	76.5 (26)	
Native American	0.8 (2)	0	0	
Unknown	3.9 (9)	6 (6)	8.8 (3)	
Comorbidities				
Hypertension	29.8 (68)[2,3]	70 (70)	64.7 (22)[1]	**<.001**[a]
Diabetes	14.5 (33)[2,3]	27 (27)[1]	31.2 (10)[1]	**.01**[a]
Hyperlipidemia	14.1 (26)[2,3]	43.9 (62)[1]	55.8 (19)[1]	**<.001**[a]
Coronary artery disease	2.2 (5)[2,3]	10 (10)[1]	20.6 (7)[1]	**<.001**[a]
Peripheral artery disease	1.3 (3)[3]	5 (5)	12.1 (4)[1]	**.003**[a]
Congestive heart failure	3.9 (7)	7 (7)	5.9 (2)	.26
Deep venous thrombosis	7.5 (17)	13 (13)	11.7 (4)	.25
Pulmonary embolus	0.9 (2)	4 (4)	5.8 (2)	.06
Arthritis	17 (39)[2,3]	38 (38)[1]	47.1 (16)[1]	**<.001**[a]
Lymphedema	2.2 (5)	4 (4)	2.9 (1)	.66
Prior procedures before VA	20.2 (46)	21 (21)	17.6 (6)	.91

BMI, Body mass index; *VA,* venous ablation.
Categorical variables are presented as percentage (number). Continuous variables are presented as mean ± standard deviation. Boldface entries are statistically significant ($P < .05$).
[a]Post hoc analysis statistically significant between age <65 years,[1] age 65 to 79 years,[2] and ≥80 years.[3]

$P = .01$), coronary artery disease (<65 years, 2.2%; 65-79 years, 10%; ≥80 years, 20.6%; $P < .001$), hyperlipidemia (<65 years, 14.1%; 65-79 years, 43.9%; ≥80 years, 55.8%; $P < .001$), peripheral artery disease (<65 years, 1.3%; 65-79 years, 5%; ≥80 years, 12.1%; $P = .003$), and arthritis (<65 years, 13.9%; 65-79 years, 38%; ≥80 years, 47.1%; $P < .001$; Table I).

Presentation. CEAP clinical class at presentation was significantly higher in octogenarians, with a larger proportion of patients with C6 disease compared with the other age groups (<65 years, 7%; 65-79 years, 12.1%; ≥80 years, 20.6%; $P = .005$). Pain/aching (94%) and swelling of legs (80%) constituted the most common symptoms, with no significant difference between the groups. Octogenarians were significantly more likely to have ulcers compared with younger groups (<65 years, 7%; 65-79 years, 12%; ≥80 years, 20%; $P = .005$). No difference was noted in relation to functional limitation to performing daily life activities ($P = .38$), walking ($P = .88$), and hobbies or interests ($P = .68$) between the three groups. The use of pain medication before VA was not different between the three age groups ($P = .47$; Table II).

Vein characteristics. There was no difference in laterality ($P = .63$) or type of vein ($P = .23$) treated among the three age groups. On ultrasound, octogenarians had significantly smaller maximal vein diameters (<65 years, 5.91 ± 2.19 mm; 65-79 years, 5.53 ± 2.04 mm; ≥80 years, 5.11 ± 1.23 mm; $P = .01$) as well as smaller vein diameters at the junction with the deep system (<65 years, 5.69 ± 2.32 mm; 65-79 years, 5.39 ± 2.22 mm; ≥80 years, 4.93 ± 1.32 mm; $P = .04$). Younger patients had significantly longer maximal reflux time (<65 years, 4.03 ± 1.83 seconds; 65-79 years, 3.49 ± 1.58 seconds; ≥80 years, 3.13 ± 1.82 seconds; $P < .001$) with a trend toward higher reflux time at the junction that did not reach statistical significance (<65 years, 2.74 ± 1.85 seconds; 65-79 years, 2.65 ± 1.62 seconds; ≥80 years, 2.2 ± 1.3 seconds; $P = .1$). There was no difference in the presence of deep venous reflux between the groups ($P = .66$), but ultrasound findings consistent with old, chronic deep venous thrombosis were significantly higher in the older population (<65 years, 0%; 66-79 years, 1.6%; ≥80 years, 3.6%; $P < .001$). The mean number of veins treated per patient was 1.73 ± 0.94, with no significant difference between the three groups

Table II. Presentation of patients

Presentation	Age group (N = 362)			*P* value
	<65 years (n = 228)	65-79 years (n = 100)	≥ 80 years (n = 34)	
CEAP class				
C1	0.4 (1)	0	0	**.005**[a]
C2	21.5 (48)	13.1 (13)	2.9 (1)	
C3	48.3 (110)	38.8 (38)	44.1 (15)	
C4a	16.2 (37)	22.2 (22)	26.5 (9)	
C4b	4.3 (10)	3 (3)	2.9 (1)	
C5	2.6 (6)	11.1 (11)	2.9 (1)	
C6	7 (16)[2]	12.1 (12)[1,3]	20.6 (7)[2]	
Patient's symptoms at presentation				
Pain/aching	91.2 (208)[2]	84 (84)[1]	94.1 (32)	.09
Swelling	75 (171)	86 (86)	82.4 (28)	.07
Itching	6.6 (15)	2 (2)	2.9 (1)	.18
Skin discoloration	6.6 (15)	11 (11)	8.8 (3)	.39
Venous ulcer	7 (16)[2]	12.1 (12)[1,3]	20.6 (7)[2]	**.005**[a]
Bleeding	4.9 (11)	2.1 (2)	0	.23
Cosmetic concerns	3.5 (8)	1 (1)	0	.25
Functional limitations related to venous insufficiency				
Interference with daily life activities	45.6 (118)	39.8 (47)	51.2 (21)	.38
Interference with walking	46.3 (120)	44.4 (52)	48.7 (20)	.88
Interference with hobbies	15.8 (40)	19.5 (23)	17.1 (7)	.68
Use of pain medications for symptoms	14.8 (38)	18.9 (22)	12.2 (5)	.47

CEAP, Clinical, Etiology, Anatomy, and Pathophysiology.
Values are reported as percentage (number). Boldface entries are statistically significant ($P < .05$).
[a]Post hoc analysis statistically significant between age <65 years,[1] age 65 to 79 years,[2] and ≥80 years.[3]

(<65 years, 1.64 ± 0.93; 65-79 years, 1.78 ± 0.94; ≥80 years, 1.65 ± 0.95; $P = .37$). There was a trend toward increased adjunctive procedures (phlebectomies) performed after the VA in the young age group that did not reach significance (<65 years, 10.4%; 65-79 years, 6.9%; ≥80 years, 2.1%; $P = .1$; Table III).

Outcomes. The overall clinical success rate was 92.6% and technical success was 98.2%, with a complication rate of 9.4%. No significant difference was noted between octogenarians and younger patients with respect to clinical success ($P = .86$), technical success ($P = .19$), and complications ($P = .36$; Table IV).

The telephone survey was completed by 306 patients (84.5% survey response rate). The mean long-term follow-up period was 26.4 ± 11.6 months. Based on the survey responses, similar findings were demonstrated with no difference in improvement in pain ($P = .44$) and swelling ($P = .27$). There was also no difference in recurrence of pain ($P = .06$) or swelling ($P = .09$) at long-term follow-up. Regarding the use of compression stockings, most patients were compliant with use after the VA procedure ($P = .15$) but had poor compliance long term at the time of conduction of the survey ($P = .13$), with no difference between age groups (Table V).

DISCUSSION

This study underscores the safety and efficacy of VA for the treatment of varicose veins in octogenarians. There is no significant difference in clinical and technical efficacy of RFA with increasing age. Also, the overall clinical (92.6%) and technical (98.2%) efficacy among the three groups was noted to be consistent with current reported outcomes. Previous series have reported clinical success rate ranging from 85% to 94% and technical success rate between 82% and 100% after RFA of incompetent veins.[14-18]

The association of age and varicose vein interventions was also described in a recent study by Sutzko et al.[19] In this study with 4841 varicose vein procedures, the patients were classified into two groups based on age, <65 years and ≥65 years. However, the outcomes measured in the study relied on clinical improvement using Venous Clinical Severity Score (VCSS) and patient-reported outcomes (PROs) score. A similar statistically significant improvement in VCSS and PROs score was observed in both patients <65 years old and patients ≥65 years old undergoing procedures. When these scores were further correlated between the age groups, no significant difference was noted with VCSS ($P = .42$);

Table III. Vein characteristics and procedural details

Vein characteristics	Age group (N = 627 veins treated)			*P* value
	<65 years (n = 390 veins)	65-79 years (n = 181 veins)	≥80 years (n = 56 veins)	
Side of leg treated				
Bilateral	59.7 (233)	65.7 (119)	63.6 (35)	.63
Right leg	21.8 (85)	18.2 (33)	16.4 (9)	
Type of vein involved				
Great saphenous	67.7 (264)	72.9 (132)	74.1 (40)	.23
Small saphenous	20 (78)	17.1 (31)	14.8 (8)	
Accessory saphenous	7.7 (30)	3.1 (6)	9.3 (5)	
Perforator veins	4.6 (18)	6.6 (12)	1.8 (1)	
Ultrasound characteristics				
Maximum reflux time, seconds	4.03 ± 1.83[2,3]	3.49 ± 1.58[1]	3.13 ± 1.82[1]	**<.001**[a]
Reflux time at junction, seconds	2.74 ± 1.85	2.65 ± 1.62	2.2 ± 1.3	.1
Maximum vein diameter, mm	5.91 ± 2.19[2,3]	5.53 ± 2.04[1]	5.11 ± 1.23[1]	**.01**[a]
Vein diameter at junction, mm	5.69 ± 2.32[3]	5.39 ± 2.22	4.93 ± 1.32[1]	**.04**[a]
Signs of chronic deep venous thrombosis	0[2,3]	1.6 (3)[1]	3.6 (2)[1]	**<.001**[a]
Presence of deep vein reflux	16.1 (62)	15.7 (28)	11.3 (6)	.66
Procedure details				
No. of veins treated	1.64 ± 0.93	1.78 ± 0.94	1.65 ± 0.95	.37
1 vein treated	56.5 (105)	48.5 (69)	55.8 (19)	.48
2 veins treated	31.2 (58)	33.1 (47)	32.4 (11)	
3 veins treated	6.4 (12)	9.8 (14)	5.8 (2)	
4 veins treated	4.3 (8)	8.4 (12)	2.9 (1)	
5 veins treated	1.1 (2)	0	2.9 (1)	
6 veins treated	0.5 (1)	0	0	
Adjunctive procedures (per patient)	10.4 (33)	6.9 (10)	2.1 (1)	.1

Categorical variables are presented as percentage (number). Continuous variables are presented as mean ± standard deviation. Boldface entries are statistically significant ($P < .05$).
[a] Post hoc analysis statistically significant between age ≤65 years,[1] age 66 to 79 years,[2] and ≥80 years.[3]

however, decreased improvement in PROs was noted in patients aged >65 years ($P < .004$). Similar findings were noted in the recent VQI VVR study by Sutzko et al,[10] with significant overall improvement of VCSS and PROs score across patients of age groups <65 years, 66 to 79 years, and >80 years. These studies thus suggested that age should not be used as a limiting factor in considering varicose vein intervention. The results from this retrospective study, although not as powered as the large registry database studies, do reinforce the finding of these registries. It also adds significant findings on clinical characteristics and ultrasound characteristics between older and younger patients. Although the VCSS was not reported in our study, PROs were measured using NRS and showed no significant difference in terms of improvement or recurrence of pain on long-term follow-up at time of the survey.

In our study, the mean number of veins treated per patient was noted to be identical among all three age groups with an overall mean of 1.73 ± 0.94 veins treated per patient. Similarly, the mean number of veins did not differ between age groups in the study by Sutzko et al[19]; however, their mean number of veins treated was 2.2/patient. In another recent study conducted by the VQI VVR among 12,262 procedures,[10] the results suggested that an increase in number of single-vein procedures was noted with increasing age (<65 years, 48%; 65-79 years, 48%; and >80 years, 64%).

Another key result of our study was that there was no significant difference in complication rate between the three age groups. This was also noted in the study by Sutzko et al[19] between the two age groups; however, in their study, an increased rate of wound infection was noted in patients of age group >65 years (0.95% vs 0.2%; $P = .015$). Our overall complication rate was observed to be low (9.4%) among the three age groups although slightly higher than the VQI VVR data (6.6%).[10]

Interestingly, it was noted that the vein diameters were smaller in the elderly group and the reflux duration was shorter in the younger population. This is likely to be related to decreased activity in the older patients and loss of muscle mass with aging that possibly correlates

Table IV. Clinical outcomes

Outcomes	Age group (N = 512 legs treated)			*P* value
	<65 years (n = 318 legs)	65-79 years (n = 145 legs)	≥80 years (n = 49 legs)	
Clinical success	91.7 (290)	92.8 (130)	93.7 (45)	.86
Technical success (per vein treated)	97.9 (380)	96.1 (172)	100 (54)	.19
EHIT 1	1.2 (4)	1.9 (5)	1.8 (1)	.89
EHIT 2	0.6 (2)	0.4 (1)	0	
EHIT 3	0.6 (2)	0.8 (2)	0	
EHIT 4	0	0.4 (1)	0	
Complications	9.4 (30)	5.5 (4)	8.2 (4)	.36
Infection	0	0.5 (1)	0	.73
Hematoma	1.6 (4)	0.5 (1)	2 (1)	.18
Numbness	3.1 (9)	0.9 (1)	0	.14
EHIT 2-4	1.6 (4)	1.9 (4)	0	.32
Phlebitis	4.7 (17)	5.3 (6)	6.1 (3)	.81

EHIT, Endovenous heat-induced thrombosis.
Values are reported as percentage (number).

with decreased overall circulation to the lower extremities. However, our study was retrospective and did not capture functional status, degree of activity, and exercise in different patients. Therefore, we could not confirm our assumption.

Our study results also suggested a significantly increased CEAP clinical severity class in the octogenarians (C6, 20.6%) compared with the younger patients. This could be explained by the increased clinical progression of disease and venous reflux with delayed

Table V. Long-term outcomes and survey results

Variables	Age group (N = 512 legs treated)			*P* value
	<65 years (n = 318)	65-79 years (n = 145)	≥80 years (n = 49)	
Follow-up, months	27.6 ± 11.4	27.3 ± 11.2	24.2 ± 12.3	.17
NRS before procedure				
Pain before procedure	6.61 ± 1.76	6.33 ± 1.72	5.89 ± 2.78	.25
Swelling before procedure	5.87 ± 2.04	6.15 ± 2.39	5.21 ± 2.37	.26
NRS 1 month after procedure				
Pain after procedure	3.58 ± 2.16	3.21 ± 1.49	3.44 ± 1.46	.51
Swelling after procedure	3.17 ± 1.88	3.37 ± 1.76	3.17 ± 1.45	.71
NRS at time of survey				
Pain at time of survey	2.48 ± 2.32	3.09 ± 2.8	2.18 ± 1.74	.23
Swelling at time of survey	2.36 ± 2.15	3.04 ± 2.22	2.58 ± 1.92	.16
Pain improvement	90.4 (225)	91.7 (99)	96.9 (32)	.44
Swelling improvement	91.2 (217)	85.7 (90)	86.5 (32)	.27
Pain recurrence	14.2 (35)	24.3 (26)	21.2 (7)	.06
Swelling recurrence	15.6 (37)	24.7 (26)	13.5 (5)	.09
Compression stockings				
Used stockings after procedure	97.6 (250)	100 (118)	100 (41)	.15
Using compression stockings at time of survey	56.5 (146)	50 (59)	41.5 (18)	.13
Frequency of compression stockings use at time of survey				
Once a week	17.1 (26)	10.5 (6)	11.1 (2)	.26
3-5 days/week	53.2 (81)	49.1 (27)	72.2 (13)	
Fully compliant	29.6 (45)	40 (22)	16.7 (3)	

NRS, Numeric rating scale.
Categorical variables are presented as percentage (number). Continuous variables are presented as mean ± standard deviation.

presentation in this population. Similar results were noted in a prospective study by Musil et al[20] among 213 patients in whom older age was associated with increased number of incompetent vein segments and significantly higher CEAP class. In this study, a significant correlation between body mass index and clinical severity based on CEAP class was also noted. This correlation was not supported in our study, however. The most common presentation, however, was C3 in all three age groups, consistent with current literature.[9,10]

Previous procedures before VA were noted in 19.6% of our overall population. However, no significant difference was noted between the three age groups. Sutzko et al[19] also demonstrated similar findings with no correlation between age groups and a previous varicose vein treatment. In our study, we also did notice an increased number of adjunctive procedures in the younger patients after VA, but this was not statistically significant.

In a recent report,[11] the SVS, AVF, and MEDCAC had a meeting to review and to rate the evidence behind treatment of reflux of the saphenous vein with VA in the elderly. The SVS and AVF representatives reported a higher level of confidence than the MEDCAC in supporting that VA can relieve venous symptoms in the Medicare population. Despite the increased comorbidities associated with the octogenarians as demonstrated in our results, the clinical success and technical success were comparable to those in younger patients, with no increase in complications. Therefore, the protocol for treatment of chronic venous disease should be applied regardless of age to improve functional status and quality of life of patients.

Our study has important limitations, however. First, it is a retrospective analysis of nonrandomized data relating to VA procedures obtained from chart review. Second, the procedures were performed by different providers at a single center, and hence we could not account for differences in techniques and follow-up protocols. Third, long-term follow-up data were collected at time of telephone survey. Furthermore, response bias due to overstating or understating of the level of symptoms could not be accounted for as data relied on patients' memory. Another limitation of this study is that the questionnaire used for survey was not a validated venous disease assessment tool with reliable and reproducible results. The questionnaire was designed on the basis of questions from previous studies addressing similar concerns. Validated venous disease assessment tools or quality of life measurements were not used as the study was retrospective, practices of each provider varied, and only a telephone survey was used for long-term follow-up. However, on analysis, an internal validation of the results was noted because of consistency in patients' recall and clinical records after the procedure.

CONCLUSIONS

Octogenarians treated with VA present at a more advanced clinical stage compared with younger patients but have less severe ultrasound findings. VA is safe and effective in all age groups. Age as a factor alone should not be used to deny patients VA.

AUTHOR CONTRIBUTIONS

Conception and design: AA, CC
Analysis and interpretation: AA, YZ, HZ, CC
Data collection: AA, JC, KO, BS, TS, CC
Writing the article: AA, YZ, HZ, JC, KO, BS, TS, CC
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