One-Year Clinical and Patient-Reported Outcomes After Endovenous Radiofrequency Ablation for Varicose Veins: A Prospective Cohort Study

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Abstract- Endo-Venous Radio-Frequency Ablation (EVRF) is widely used for treating varicose veins, offering a minimally invasive alternative to traditional surgery. However, the trajectory of postoperative symptoms, recurrence patterns, and patient-centered outcomes remains variable across populations. To evaluate postoperative symptom changes, vein occlusion patterns, recurrence, cutaneous effects, patient satisfaction, and quality of life in patients undergoing EVRF over a one-year follow-up period. A prospective observational study was conducted on 125 patients treated with EVRF at Dijlah Private Hospital, Maysan, Iraq. Clinical outcomes—including paresthesia, thrombophlebitis, ecchymosis, redness and skin changes, cellulitis, recurrence, occlusion rate, patient satisfaction, and quality of life—were assessed using a standardized four-point scoring system. Evaluations were performed at week one, 30 days, and one year. Paired t-tests were applied to compare temporal changes. Significant early improvements were observed across most clinical indicators. Paresthesia decreased from 1.3462 at week one to 1.0692 at 30 days (P<0.001). Redness, skin changes, thrombophlebitis, and ecchymosis demonstrated similar reductions. Recurrence improved significantly from 0.9846 to 0.6769 at one year (P<0.001). In contrast, occlusion scores declined from 2.8846 at week one to 1.9231 at one year (P<0.001), suggesting partial recanalization. Quality-of-life scores improved significantly from 3.6154 to 2.4154 (P<0.001). Despite these objective improvements, patient satisfaction decreased from 2.8154 to 1.8538 over the same period (P<0.001). Cellulitis showed no significant change (P=0.074). EVRF provides substantial early postoperative benefits and long-term improvements in quality of life, with low complication rates. However, reduced occlusion durability and declining patient satisfaction highlight the importance of standardized imaging follow-up and enhanced patient counseling to optimize long-term outcomes.

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Introduction

One of the most common chronic venous disorders worldwide is varicose veins, which are estimated to affect 20–40% of adults and cause considerable morbidity, impaired mobility, and reduced quality of life (1). Varicose veins are characterized by venous dilation, valve incompetence, pain, and cosmetic concerns, which may lead to chronic venous insufficiency if left untreated. Symptoms include heaviness, swelling, itching, paresthesia, and nocturnal discomfort, all of which markedly impair daily functioning and negatively affect psychological and social well-being. This has contributed to a major shift in the contemporary management of venous disease, wherein treatment strategies increasingly emphasize patient-reported quality of life alongside clinical outcomes (2).

Endo-Venous Radio-Frequency Ablation (EVRF) has emerged as a minimally invasive alternative to traditional high-ligation and vein stripping procedures. EVRF delivers thermal energy via a catheter to induce vein closure and offers several advantages, including reduced

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postoperative pain, fewer complications, shorter recovery time, and improved cosmetic results. Numerous studies have demonstrated the clinical effectiveness of EVRF in achieving vein occlusion and relieving symptoms. However, postoperative experiences—such as early pain, sensory disturbances (e.g., paresthesia), and patient expectations regarding treatment outcomes—continue to influence quality of life following EVRF (3-5).

Although the use of EVRF is becoming increasingly common in daily vascular practice, there remains a notable gap in the literature regarding longitudinal changes in patient-reported outcomes across extended time periods beyond the immediate postoperative phase. Most available studies focus primarily on clinical success and anatomical closure, with limited attention given to patient satisfaction, functional recovery, and postoperative health status. Furthermore, symptoms such as paresthesia are often underreported, despite their potential to significantly affect postoperative recovery and perceived treatment efficacy (6).

As patient-centered outcomes are of paramount importance in modern healthcare, the long-term impact of EVRF on patients' physical, psychological, and functional well-being requires thorough evaluation. Understanding these changes can guide clinicians in patient counseling, postoperative management, and the development of tailored nursing care plans aimed at optimizing overall outcomes.

The aim of this research was to examine changes in the health status of patients who underwent endovenous radiofrequency ablation (EVRF) for varicose veins, including paresthesia, occlusion rate, recurrence rate, cellulitis, and thrombophlebitis, as well as changes in procedure-related side effects such as quality of life, redness and skin changes, ecchymosis, and patient satisfaction after a full year of follow-up. Data were collected during the first week, and the data collection process was completed after one year. Appropriate statistical tests were used to assess differences in the research variables over this time period.

ccordingly, the study will evaluate the trajectory of quality-of-life improvement and patient satisfaction following EVRF at short-term (1 week), intermediate (30 days), and long-term (1 year) follow-up intervals. This research may provide valuable insights into patient experiences with EVRF and help guide improvements in postoperative care by comparing changes in health status scores, satisfaction levels, and postoperative symptoms such as paresthesia.

The significance of this study stems from the importance of its subject, which focuses on achieving the highest possible levels of health-related quality of life by examining the side effects of varicose vein intervention procedures and monitoring the nursing care provided to patients. It also aims to improve the level of care quality and promote its control in the field of healthcare services through the use of modern technologies and the involvement of professional medical staff.

Materials and Methods

This was a prospective observational study using a convenience sampling technique, conducted from June 2023 to April 2025. The study was carried out at Dijlah Private Hospital in the governorate of Maysan, Iraq. Ethical approval was obtained from the Human Ethics Committee of the College of Medicine, Al-Mustansiriyah University, Baghdad, Iraq, and all participants provided written informed consent prior to enrollment.

The study included adult patients with symptomatic primary varicose veins who underwent Endo-Venous Radio-Frequency Ablation (EVRF). Initially, 154 patients were evaluated for eligibility, and 125 met the inclusion criteria and were subsequently enrolled. Eligible participants were adults (18 years and older) with great or small saphenous vein insufficiency confirmed by duplex ultrasound and the ability to attend scheduled follow-up visits at 1 week, 30 days, and 1 year.

Patients were excluded if they had a history of prior venous surgery or endovenous treatment in the same limb, deep vein thrombosis, pregnancy, active limb infection, severe peripheral arterial disease, or uncontrolled chronic illness. Additional exclusion criteria included contraindications to tumescent anesthesia, failure to complete follow-up assessments, or undergoing other interventions such as phlebectomy or foam sclerotherapy.

The entire EVRF procedure was performed by experienced vascular surgeons following a standard protocol. The Seldinger technique, using a 6–7 Fr introducer sheath, was employed to cannulate the target vein under real-time duplex ultrasound guidance. A segmental radiofrequency catheter (ClosureFast™; Medtronic, Minneapolis, USA) was then advanced to a position 1.5-2 cm below the saphenofemoral or saphenopopliteal junction.

Tumescent anesthesia was administered perivenously along the treatment segment to ensure analgesia, provide thermal protection to surrounding tissues, and compress the vein walls around the catheter. Ablation was performed segment by segment, with each cycle lasting 20 seconds at a target temperature of 120° C,

accompanied by catheter pullback under continuous ultrasound monitoring to ensure coaptation of the vein wall. Ultrasound imaging was also conducted at the end of the procedure to confirm immediate occlusion and to exclude deep venous involvement.

Postoperatively, all patients were fitted with Class II (20-30 mmHg) compression stockings and were encouraged to ambulate early. Compression was maintained continuously for 48 hours, followed by daytime use for an additional one to two weeks.

Data were collected through structured clinical evaluations and patient interviews at three-time intervals: 1 week, 30 days, and 1 year. Age and sex were recorded as baseline demographic variables. Clinical outcomes included paresthesia, occlusion rate, recurrence, cellulitis, thrombophlebitis, ecchymosis, and postoperative skin changes. Paresthesia referred to abnormal sensory conditions such as tingling or numbness. Occlusion was determined using duplex ultrasound evidence of non-compressibility and absence of Doppler flow.

Recurrence was defined as new-onset reflux lasting more than half a second in a previously treated segment or the appearance of new symptomatic varicosities. Cellulitis was defined as acute inflammatory changes of the skin and subcutaneous tissue, while thrombophlebitis referred to superficial venous thrombosis accompanied by localized erythema or tenderness. Ecchymosis and postoperative skin changes were assessed visually and rated based on severity.

Quality of life (QOL) was evaluated according to CDC concepts of perceived physical and mental health. Patient satisfaction was defined as the patient's subjective assessment of the treatment benefit relative to expectations. A standardized four-point Likert scale was used for all patient-reported outcomes.

To minimize bias and enhance validity, a structured confounder analysis was performed. Potential confounders were identified a priori and included age, sex, baseline CEAP class, vein diameter, limb laterality, comorbid conditions (diabetes, hypertension, obesity), smoking status, and anatomical characteristics of the treated vein. Linear mixed-effects models were constructed to account for repeated measurements over time, with time specified as a fixed effect and patient identifier included as a random intercept. Each confounder was initially examined using univariable analysis, and variables with $P<0.10$ were subsequently entered into the multivariable models. Interaction terms (e.g., time×age, time×vein diameter) were tested to evaluate differential temporal changes across subgroups. Variance inflation factors were assessed to confirm the absence of multicollinearity.

Statistical analyses were performed using SPSS version 29. Continuous variables were summarized as mean±standard deviation. Longitudinal changes between paired observations across follow-up intervals were analyzed using paired t-tests, with statistical significance set at $P<0.05$. Microsoft Excel was used for graphical visualization of trends and comparative analyses.

Study outcomes and definitions

- Paresthesia was defined as an abnormal postoperative sensory perception, including tingling or numbness, as reported by the patient.
- Duplex ultrasonography was used to assess the degree of vein occlusion and was rated on a four-point scale, where grade one indicated a patent vein and grade four indicated complete occlusion, based on compressibility and Doppler flow.
- Recurrence was defined as the development of new reflux (>0.5 s) in a previously treated segment or the appearance of new symptomatic varicosities.
- Thrombophlebitis was defined as superficial venous thrombosis accompanied by localized pain or erythema.
- Cellulitis referred to an acute inflammatory process involving the skin and subcutaneous tissue requiring clinical evaluation.
- Patient satisfaction and quality of life were measured using a standardized four-point Likert scale.

Study terms and definitions

The quality of life

he Centers for Disease Control and Prevention (CDC) defines health-related quality of life as "the physical and mental well-being that an individual or group perceives over time" (7).

Paresthesia is a technical term describing abnormal sensory perceptions, including pins and needles, tingling, pricking, or sensations resembling ants crawling over or under the skin (8).

Cellulitis is an acute inflammatory condition of the dermis and subcutaneous tissue, typically occurring as a complication of a wound, ulcer, or dermatosis (9).

Thrombophlebitis refers to the presence of a blood clot within a vein, accompanied by inflammation.

Patient satisfaction is defined as the patient's perception of the care received relative to their expectations (10).

Results

Gender

Table 1 shows that 28.8% of the patients are male and 71.2% are female. Figure (1) displays the repetitive distribution and percentage of patients based on gender.

Table 1. Shows repetitive distributions and percentages of the sample individuals according to gender

Gender	No.	Percentage
Male	36	28.8
Female	89	71.2
Total	125	100

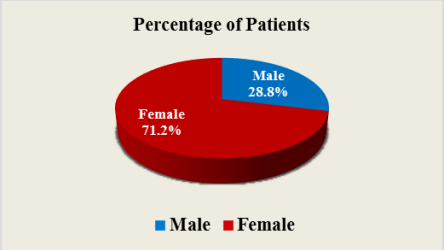

Figure 1. The repetitive distribution and percentage of the patients on the basis of gender

Age group

The data presented in Table 2 show the distribution of patients according to age categories. A total of 18.4% of patients were younger than 30 years, 38.4% were aged 30 to less than 40 years, 24.8% were aged 40 to less than 50 years, 14.4% were aged 50 to less than 60 years, and 4% were aged 60 years or older. The mean age of all participants was 37.86±1.038 years, with a range of 19 to 66 years. Figure 2 summarizes the frequency distribution and percentages of patients according to age.

Table 2. The repetitive distributions and percentage of patients according to age

Age category	No.	Percentage%
Less than 30 years	23	18.4
30 to less than 40 years	48	38.4
40 to less than 50 years	31	24.8
50 to less than 60 years	18	14.4
60 years and more	5	4
Total	125	100
Mean±SD		37.86±1.038
Range		19-66

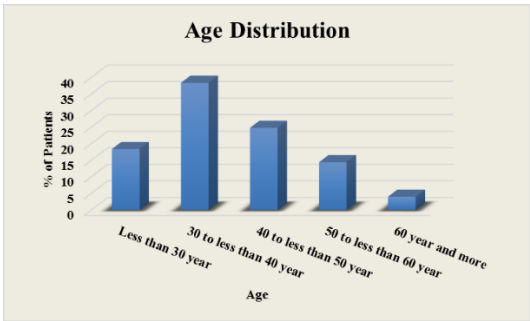

Figure 2. The repetitive distribution and percentage of the patients based on age

Changes in the health status of patients after the varicose vein intervention procedure

The average patient satisfaction was calculated using a four-point scale, where one point corresponded to the response "no," two points to "mild," three points to "moderate," and four points to "severe." Thus, patient satisfaction scores ranged from 1 to 4. Scores between 1.00 and 1.49 were considered normal or minimal,

typically reflecting occasional sensations that do not interfere with daily activities. Values from 1.50 to 2.49 were categorized as mild, indicating noticeable but transient changes without any functional limitation. Scores between 2.50 and 3.49 were classified as moderate, representing more persistent symptoms that may affect comfort or routine tasks. The highest range, 3.50 to 4.00, denoted severe, characterized by frequent or pronounced discomfort with the potential to limit walking or other daily movements.

Paresthesia

The outcomes regarding paresthesia are presented in Table 3. Paresthesia scores demonstrated a significant reduction by the end of the study. The mean paresthesia score in the first week post-surgery was 1.3462, representing approximately 33.7% of the maximum symptom severity. This mean score decreased to 1.0692 after 30 days, corresponding to a severity of 26.7%. This reflects a 7.0 percentage-point reduction and a 20.8% improvement in paresthesia symptoms compared to the baseline and the first month post-EVRF. This decrease was statistically significant (paired t-test, t=4.168; P<0.001); given that the t-value exceeded the critical value of 1.984, the improvement in sensory symptoms over this period was highly significant.

Table 3. Paresthesia differences between patients over the period from the first week to 30 days.

Time point	Mean Score	% of Maximum Paresthesia	Classification	Interpretation
1st Week	1.3462	33.7%	Minimal Paresthesia	Mild tingling is expected post-EVRF.
30 Days	1.0692	26.7%	Minimal Paresthesia	Improved and nearing complete resolution
Difference	0.277	7.0%		Statistically significant improvement (P<0.001)

Occlusion rate

Table 4 summarizes the results of the occlusion rate. A significant reduction in vein occlusion was observed during the one-year follow-up period. The mean occlusion score during the first postoperative week was 2.8846, corresponding to 72.1% of the maximum possible score on the four-point scale, placing it in the High Occlusion category. After one year, the mean score decreased to 1.9231, corresponding to 48.1% of the maximum possible score, which falls within the Partial Occlusion category. This represents an absolute decrease of 24.0 percentage points and a relative decrease in occlusion status of 33.3% between the early and late follow-up periods. The paired t-test confirmed that this difference was statistically significant, with a calculated t-value of 6.765, which exceeded the critical value of 1.984, and a P≤0.001, indicating a highly significant change in vein closure over time. This deterioration is consistent with expected physiological recanalization and neovascularization that may occur following EVRF during long-term healing.

Table 4. Occlusion rate differences between patients over the period from the first week to the first year

	Mean score	% of Maximum occlusion	Classification	Interpretation
1st Week	2.8846	72.1%	High Occlusion	Strong early ablation success
1 Year	1.9231	48.1%	Partial Occlusion	Reduced closure; expected long-term recanalization
Difference	0.9615	24.0%		Statistically significant decrease (P<0.001)

Recurrence

Table 5 presents the findings related to the recurrence rate. Recurrence was found to decrease significantly during the one-year follow-up period. In the first postoperative week, the mean recurrence score was 0.9846, corresponding to 24.6% of the maximum severity of recurrence, placing it in the Low Recurrence category. After one year, the mean score declined to 0.6769, equivalent to 16.9% severity and categorized as Low Recurrence. This represents an absolute reduction of 7.7 percentage points and a relative decrease of 31.3% between the early and late follow-up periods.

The paired t-test confirmed that this reduction was statistically significant, with a calculated t-value of 5.652, exceeding the critical t-value of 1.984, and a P≤0.001, indicating a highly significant decline in postoperative venous reflux over time. These findings demonstrate effective long-term control of varicosity recurrence following EVRF.

Table 5. Recurrence rate differences between patients over the period from the first week to the first year

Time Point	Mean Score	% of Maximum Severity	Classification	Interpretation
1st Week	0.9846	24.6%	Low Recurrence	Mild postoperative reflux is expected early.
1 Year	0.6769	16.9%	Low Recurrence	Improved control and reduced reflux
Difference	0.3077	7.7%		Statistically significant improvement (P<0.001)

Cellulitis

Table 6 presents the findings on postoperative cellulitis. Overall, cellulitis was uncommon, and there was minimal fluctuation during the first 30 days following EVRF. In the first postoperative week, the mean cellulitis score was 0.9769, corresponding to 24.4% of the maximum severity and classified as Mild Cellulitis. At 30 days, the mean score decreased slightly to 0.9154, corresponding to 22.9% severity, which also fell within the Mild category. This 1.5 percentage-point reduction represents a 6.1% relative change and was neither clinically nor statistically significant.

The paired t-test yielded a t-value of 1.804, which was below the critical value of 1.984, and the P-value of 0.074 further confirmed the absence of statistical significance. These findings indicate that cellulitis remained at a low level and did not change significantly during the early postoperative period.

Table 6. Cellulitis differences between patients over the period from the 1st week to 30 days

Time point	Mean score	% of Maximum severity	Classification	Interpretation
1st Week	0.9769	24.4%	Mild Cellulitis	Minor localized inflammation
30 Days	0.9154	22.9%	Mild Cellulitis	Slight improvement; clinically stable
Difference	0.0615	1.5%		Not statistically significant (P=0.074)

Thrombophlebitis

The results regarding thrombophlebitis are presented in Table 7. A significant reduction in postoperative thrombophlebitis was observed during the first 30 days following EVRF. In the first postoperative week, the mean thrombophlebitis score was 1.1077, representing 27.7% of the maximum possible severity and classified within the Mild Thrombophlebitis range. At the 30-day assessment, the mean score decreased to 0.9769, corresponding to 24.4% severity and remaining within the Mild category. This 3.3-percentage-point reduction, representing an 11.8% relative decrease, indicates a slight yet significant improvement in superficial venous inflammation over time.

The paired t-test confirmed the statistical significance of this improvement, yielding a t-value of 3.273, which exceeded the critical value of 1.984. The p-value ≤0.001 further demonstrated that the decline in thrombophlebitis severity was highly significant. These findings reflect favorable early postoperative vasoreactivity and reduced inflammatory changes in the vein following EVRF.

Table 7. Thrombophlebitis differences between patients over the period from the 1st week to 30 days

Time point	Mean Score	% of Maximum Severity	Classification	Interpretation
1st week	1.1077	27.7%	Mild Thrombophlebitis	Localized tenderness and superficial inflammation
30 days	0.9769	24.4%	Mild Thrombophlebitis	Improved; reduced inflammatory involvement
Difference	0.1308	3.3%		Statistically significant decrease (P=0.001)

The quality of life

The outcomes related to quality of life (QOL) are presented in Table 8. A marked and clinically meaningful improvement in quality-of-life scores was observed at the one-year follow-up. During the first postoperative week, the mean QOL score was 3.6154 (90.4% of the maximum possible severity), placing patients in the Poor Quality of Life category. By the one-year follow-up, the mean score had decreased substantially to 2.4154, corresponding to 60.4% of the maximum severity level and classified as Fair Quality of Life.

This change represents an absolute reduction of 30.0 percentage points and a relative improvement of 33.2% in quality of life during the study period. The paired t-test confirmed that this improvement was statistically significant, with a calculated t-value of 7.043, which exceeded the critical value of 1.984. The P<0.001 further indicates that the change was highly significant. These

findings suggest that patients experienced considerable functional and symptomatic improvement following EVRF, leading to a markedly better quality of life at the one-year follow-up.

Table 8. Quality of life differences between patients over the period from the 1st week to 1 year

Time point	Mean Score	% of Maximum Severity	Classification	Interpretation
1st week	3.6154	90.4%	Poor QOL	Significant discomfort and early postoperative limitations
1 year	2.4154	60.4%	Fair QOL	Noticeable long-term improvement in symptoms and function
Difference	1.200	30.0%		Statistically significant improvement (P<0.001)

Redness and skin changes

Table 9 presents the findings related to postoperative redness and skin changes. An observable increase was noted during the first 30 days after EVRF. In the first postoperative week, the mean score for redness and skin changes was 1.2462, representing 31.2% of the maximum severity and categorized as Mild Skin Changes. By the 30-day follow-up, the mean score had decreased to 0.9769, corresponding to 24.4% severity, which also falls within the Mild category. This reduction reflects a notable decrease in superficial cutaneous reactions. The improvement corresponds to an absolute change of 6.8 percentage points and a 21.8% relative reduction in redness and skin discoloration compared with the early postoperative period. The paired t-test confirmed the statistical significance of this improvement, with a calculated t-value of 5.845, exceeding the critical value of 1.984. The $P \leq 0.001$ further supports the significance of this decline. These findings indicate that EVRF is associated with early acute skin reactions, most of which substantially subside during the first month after the procedure.

Table 9. Redness and skin changes between patients over the period from the 1st week to 30 days

Time point	Mean Score	% of maximum severity	Classification	Interpretation
1st week	1.2462	31.2%	Mild Skin Changes	Superficial erythema and transient discoloration
30 days	0.9769	24.4%	Mild Skin Changes	Clear improvement and fading of erythema
Difference	0.2693	6.8%		Statistically significant improvement (P<0.001)

Ecchymosis

Table 10 presents the findings related to ecchymosis. Ecchymosis showed clear improvement within the first 30 days after EVRF. In the first postoperative week, the mean ecchymosis score was 1.1538, representing 28.8% of the maximum severity and classified within the Mild Ecchymosis category. By the 30-day follow-up, the average score had decreased to 0.9769, corresponding to 24.4% severity, which also remained in the Mild category but reflected a meaningful reduction in bruising. This improvement represents an absolute decrease of 4.4 percentage points and a 15.3% relative reduction compared with the early recovery period. The paired t-test confirmed that this decline was statistically significant, with a calculated t-value of 3.993, exceeding the critical value of 1.984. The corresponding $P \leq 0.001$ further demonstrated the significance of the improvement. These findings indicate that post-EVRF bruising is generally mild and shows substantial healing within the first month after the procedure.

Table 10. Ecchymosis differences between patients over the period from the 1st week to 30 days

Time point	Mean Score	% of Maximum Severity	Classification	Interpretation
1st week	1.1538	28.8%	Mild Ecchymosis	Localized and expected postoperative bruising
30 days	0.9769	24.4%	Mild Ecchymosis	Clear improvement with fading discoloration
Difference	0.1769	4.4%		Statistically significant decrease (P<0.001)

Patient satisfaction

Table 11 presents the results of patient satisfaction. The level of satisfaction decreased significantly between the early postoperative period and the one-year follow-up. The mean satisfaction score during the first postoperative week was 2.8154, representing 70.4% of

the maximum possible satisfaction level and classified within the High Satisfaction category. At the one-year follow-up, the mean score had decreased to 1.8538, corresponding to 46.3%, which falls within the Moderate Satisfaction category.

This change represents an absolute decrease of 24.1 percentage points and a relative reduction of 34.2% in perceived satisfaction over the long-term follow-up period. The paired t-test confirmed that this decline was statistically significant, with a calculated t-value of 6.466, which exceeded the critical value of 1.984. The $P<0.001$ further demonstrates the significance of this change. These findings suggest that although initial satisfaction with EVRF is high—likely due to early symptomatic improvement—long-term satisfaction may be influenced by factors such as partial occlusion, recurrence, or evolving patient expectations over time.

Table 11. Patient satisfaction differences between patients over the period from the first week to the first year

Time point	Mean Score	% of Maximum Satisfaction	Classification	Interpretation
1st week	2.8154	70.4%	High Satisfaction	Strong early positive perception of treatment
1 year	1.8538	46.3%	Moderate Satisfaction	Reduced satisfaction influenced by long-term outcomes
Difference	0.9616	24.1%		Statistically significant decrease ($P<0.001$)

Discussion

In this research, the postoperative course of patients who underwent Endo-Venous Radio-Frequency Ablation (EVRF) was evaluated, and the progression of symptoms and patient-reported outcomes was recorded over a one-year period. Recurrence scores showed improvement over time, indicating effective long-term control of venous reflux. However, despite a marked improvement in quality of life, the mean occlusion score worsened significantly at one year, which was associated with a reduction in patient satisfaction. The incidence of cellulitis remained low and did not change significantly during follow-up.

Recurrence increased significantly within one year; however, it remained within the low recurrence range, consistent with major reflux registries reporting durable reflux resolution (11).

The substantial decline in occlusion scores contrasts with most contemporary studies, in which ultrasound-confirmed occlusion rates of 90% or higher at one year have been reported (12). This discrepancy may be attributed to several factors, including the semi-quantitative scoring method used in this study, technical variations, interobserver variability in ultrasound interpretation, or recanalization influenced by vein diameter and anatomical differences. Future research may benefit from adopting a standardized duplex-based definition of occlusion, as widely applied in the international literature.

The events documented in this study—namely, the statistically significant reductions in thrombophlebitis, ecchymosis, and cutaneous changes between week 1 and day 30—are consistent with the expected inflammatory and soft-tissue recovery phase following EVRF.

The increasing recurrence rate observed in the present study suggests sustained long-term control of reflux in most patients and aligns with the findings of several multicenter randomized controlled trials and registry-based studies. The persistence of symptom relief and the low rate of clinically significant recurrence after radiofrequency ablation are supported in longitudinal reports by Brittenden *et al*., (13) and Rasmussen *et al*., (14), despite minor changes occasionally detected on duplex imaging over extended follow-up periods.

The lower durability of occlusion observed in this study contrasts with most duplex-based reports and is likely related to methodological differences in occlusion assessment. This inconsistency may be partly methodological: the current study employed a semi-quantitative 4-point occlusion score rather than a strict duplex definition (e.g., complete occlusion of the treated segment) and may have included more distal or tributary segments. In the final manuscript, it will be important to describe precisely how occlusion was calculated and graded, and to clarify that this scoring system is not directly comparable to the binary occlusion rates commonly reported in RFA trials and registries.

Regarding quality of life, the trend observed in this study—namely, a significant improvement from very poor quality of life during the first postoperative week to a fair level of quality of life at one year—is largely consistent with the international literature (15,16). Randomized trials and prospective cohort studies consistently demonstrate that disease-specific quality-of-life instruments (e.g., AVVQ, CIVIQ, VCSS) show significant positive changes following endovenous

interventions compared with baseline, and that these improvements are sustained over 1-5 years. The present study utilized a 4-point measurement scale, which is acknowledged as a limitation; however, this does not affect the overall direction of the observed benefit.

A strength of this study is its systematic, time-dependent assessment of multiple clinical outcomes using a unified scoring approach, allowing comparison of the same outcomes across different follow-up periods. The inclusion of both symptom-based measures and patient-reported outcomes provides a comprehensive evaluation of postoperative recovery.

Future studies should incorporate validated symptom and quality-of-life instruments, standardized duplex criteria for occlusion assessment, and extended follow-up (2–5 years) to capture late recurrence and neovascularization. To enhance generalizability, multicenter studies with larger sample sizes are recommended. These investigations should also include cosmetic outcomes, psychological perceptions, and return-to-work measures to better understand patient satisfaction. Finally, the role of adjunctive modalities (e.g., foam sclerotherapy of tributaries) and optimization of compression therapy duration should be evaluated to improve long-term outcomes. Future research should incorporate validated patient-reported outcome measures (PROMs) to enhance comparability and interpretability of patient-reported data.

Limitations

Several limitations should be acknowledged. Patient-reported outcomes were assessed using a non-validated four-point Likert scale rather than established disease-specific PROMs such as CIVIQ-20, AVVQ, VCSS, or VEINES-QOL/Sym, which may limit direct comparisons with international studies. Occlusion was evaluated using a semi-quantitative scoring approach instead of standardized duplex-based binary criteria, which may have influenced the reported durability rates. Although key clinical and demographic variables were included in the analysis, residual confounding cannot be entirely ruled out. The single-center design and sample size limited the ability to conduct extensive subgroup analyses, and cosmetic satisfaction outcomes were not specifically assessed.

Endo-Venous Radiofrequency Ablation results in substantial early postoperative improvements, including reductions in paresthesia, inflammation-related symptoms, ecchymosis, skin changes, and recurrence. Long-term quality of life also improves significantly, indicating good functional recovery. However, the decline in occlusion and patient satisfaction scores one year later highlights the importance of standardized duplex examinations, optimized perioperative practices, and effective management of patient expectations. EVRF was associated with significant early clinical improvement and long-term enhancement of patient-reported quality of life. Nevertheless, partial loss of occlusion durability and decreasing patient satisfaction over time underscore the need for standardized imaging follow-up and thorough patient counseling. Despite these challenges, EVRF remains a safe and effective intervention for managing varicose veins, with minimal complications and favorable recovery outcomes. Continued long-term follow-up and patient-centered care are essential to ensuring durable results and maximizing overall treatment satisfaction.

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