RESEARCH PAPER

Role of Radio Frequency Ablation in Patients with Varicose Veins

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ABSTRACT

Background:
Varicose veins are a common manifestation of chronic venous disease and significantly impair quality of life through pain, edema, and functional limitation. Radiofrequency ablation (RFA) has emerged as a minimally invasive alternative to conventional surgery with favorable clinical outcomes. This study evaluated the effectiveness, safety, and short-term clinical outcomes of RFA in patients with varicose veins.

Methods:
A prospective observational study was conducted among 96 patients with symptomatic varicose veins who underwent RFA at a tertiary care hospital. Baseline demographic and clinical characteristics, Venous Clinical Severity Score (VCSS), and Visual Analogue Scale (VAS) pain scores were recorded. Vein closure was assessed using duplex ultrasonography on day 3, while clinical outcomes, complications, and patient satisfaction were evaluated up to 3 months. Continuous variables were compared using paired t-test, and categorical variables using Chi-square test. A p-value <0.05 was considered statistically significant.

Results:
Among the 96 participants, 58 (60.4%) were females and 34 (35.4%) belonged to the 31–40-year age group. Unilateral disease was present in 70 (72.9%), while 78 (81.2%) had primary varicose veins. At baseline, 46 (47.9%) patients had moderate and 30 (31.3%) had severe VCSS. Complete vein closure was achieved in 88 (91.7%) patients, with an overall technical success (diagnostic accuracy) of 91.7%. Mean VAS pain score decreased significantly from 6.80 ± 1.50 to 2.10 ± 1.20 (paired $t = 18.54$, $p < 0.001$), while mean VCSS improved from 9.85 ± 3.20 to 4.20 ± 2.10 (paired $t = 16.23$, $p < 0.001$). Complete vein closure was significantly associated with lower baseline disease severity ($\chi^2 = 6.21$, $p = 0.045$). Overall patient satisfaction was high, with 82 (85.4%) patients reporting being satisfied or very satisfied. Post-procedural complications were infrequent; 82 (85.4%) patients experienced no complications, while infection (5.2%), skin burns (4.2%), deep vein thrombosis (3.1%), and nerve injury (2.1%) were uncommon. Age was not significantly associated with complications ($\chi^2 = 4.87$, $p = 0.182$).

Conclusion:
Radiofrequency ablation is a safe, effective, and minimally invasive treatment for varicose veins, achieving a high vein closure rate of 91.7%, significant improvement in pain and disease severity, excellent patient satisfaction, and a low complication rate. These findings support RFA as a preferred first-line intervention for symptomatic chronic venous disease.

Keywords: Varicose veins, Radiofrequency ablation, Chronic venous disease, Venous Clinical Severity Score, Duplex ultrasonography, Endovenous therapy.

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Introduction:

Varicose veins constitute one of the most prevalent manifestations of chronic venous disease and represent a significant clinical and public health concern worldwide. According to Rutherford RB, Vascular Surgery (8th ed.), varicose veins are defined as abnormally dilated, tortuous superficial veins resulting from venous valve incompetence and sustained venous hypertension, most commonly affecting the lower extremities [1]. Expanding on this, Cronenwett JL and Johnston KW in Rutherford's Vascular Surgery and Endovascular Therapy (9th ed.) describe chronic venous disease as a progressive disorder encompassing a spectrum from asymptomatic venous dilatation to severe complications such as edema, skin changes, and venous ulceration, thereby emphasizing its chronic and disabling nature [2]. Standard surgical literature, including Schwartz's Principles of Surgery (11th ed.), reports that patients frequently experience symptoms such as limb heaviness, pain, fatigue, and swelling, which significantly impair functional capacity and quality of life [3]. Similarly, Sabiston Textbook of Surgery (21st ed.) highlights that long-standing venous hypertension leads to microcirculatory dysfunction and tissue damage, predisposing to complications such as lipodermatosclerosis and venous ulceration [4]. From a diagnostic standpoint, Grainger & Allison's Diagnostic Radiology (7th ed.) identifies duplex ultrasonography as the investigation of choice, providing detailed evaluation of venous anatomy, valve competence, and reflux patterns necessary for clinical decision-making [5].

From a global epidemiological perspective, vascular disorders form a substantial component of non-communicable diseases. The World Health Organization reports that cardiovascular diseases account for approximately 17.9 million deaths annually, representing nearly 32% of total global mortality, reflecting the growing burden of vascular conditions worldwide [6]. Although varicose veins themselves are not directly fatal, they contribute significantly to morbidity and healthcare utilization. Global health estimates further indicate that chronic venous disorders affect a considerable proportion of the adult population, with prevalence estimates ranging from 10% to 30% in men and up to 40% in women, with higher rates observed in aging populations and individuals with occupational risk factors such as prolonged standing [7]. This increasing prevalence is attributed to demographic transitions, sedentary lifestyles, obesity, and increased life expectancy, making chronic venous disease an emerging public health challenge.

Evidence-based clinical guidelines play a crucial role in standardizing diagnosis and management. The National Institute for Health and Care Excellence (NICE) guideline CG168 recommends duplex ultrasound as the first-line diagnostic modality and advocates endovenous thermal ablation, including radiofrequency ablation, as the preferred initial treatment for symptomatic varicose veins due to its minimally invasive nature and favorable outcomes [8]. Additionally, NICE interventional procedure guidance recognizes endovenous radiofrequency ablation as a safe and effective technique with high occlusion rates and reduced postoperative morbidity compared to conventional surgery [9]. Despite these advances, variability in clinical practice and accessibility remains a challenge across different healthcare settings.

Venous thromboembolism and chronic venous insufficiency are closely interrelated conditions contributing to disease burden. The Centers for Disease Control and Prevention reports that venous thromboembolism affects up to 900,000 individuals annually in the United States, with significant associated morbidity and mortality, highlighting the broader spectrum of venous disorders [10]. Chronic venous insufficiency, often a consequence of venous hypertension and valvular incompetence, leads to progressive clinical deterioration if untreated, thereby reinforcing the importance of early diagnosis and effective intervention strategies such as radiofrequency ablation.

Chronic venous insufficiency represents a significant extension of the disease spectrum of varicose veins, contributing to long-term morbidity and healthcare burden. The Centers for Disease Control and Prevention highlights that chronic venous insufficiency is a progressive condition characterized by venous hypertension, edema, skin pigmentation, and ulceration, with increasing prevalence in aging populations and those with sedentary lifestyles [11]. In the Indian context, the growing burden of non-communicable diseases and vascular disorders has necessitated structured ethical and clinical research frameworks. The Indian Council of Medical Research provides comprehensive ethical guidelines for biomedical research, ensuring that studies involving vascular interventions adhere to principles of safety, scientific validity, and patient rights [12]. Furthermore, national healthcare delivery under the Ministry of Health and Family Welfare through the National Health Mission emphasizes strengthening tertiary care services and promoting early diagnosis and management of chronic diseases, including vascular disorders, although specific large-scale

screening programs for varicose veins remain limited [13].

Clinical management of venous disease is also guided by international professional bodies. The Royal College of Obstetricians and Gynaecologists underscore the importance of thromboprophylaxis in high-risk patients, particularly in perioperative settings, thereby highlighting the systemic implications of venous disease beyond localized pathology [14]. Similarly, the American Venous Forum provides evidence-based recommendations for the management of chronic venous disorders, advocating early intervention and individualized treatment strategies based on disease severity and patient characteristics [15]. The Society for Vascular Surgery further refines these recommendations by endorsing minimally invasive techniques such as endovenous thermal ablation, including radiofrequency ablation, as first-line therapy due to reduced postoperative pain, faster recovery, and improved patient satisfaction compared to conventional surgical stripping [16]. Complementing these, the European Society for Vascular Surgery guidelines emphasize standardized classification systems and structured management pathways, thereby facilitating uniformity in clinical practice and research [17].

Despite the availability of multiple guidelines and therapeutic options, several gaps persist in the existing literature. Variability in patient selection, heterogeneity in outcome assessment, and limited region-specific data particularly from developing countries such as India, pose challenges in generalizing global evidence to local populations. Moreover, while radiofrequency ablation has emerged as a preferred minimally invasive modality, there remains a need for robust clinical studies evaluating its effectiveness, safety profile, and long-term outcomes in diverse clinical settings. The absence of standardized protocols and limited comparative data in Indian populations further underscores the necessity for context-specific research.

In this context, the present study is undertaken to evaluate the role of radiofrequency ablation in patients with varicose veins, with a focus on clinical outcomes and applicability in a tertiary care setting. By addressing existing gaps in evidence and providing regionally relevant data, this study aims to contribute to improved clinical decision-making and optimization of management strategies for chronic venous disease.

Methodology

Study Design and Study Setting

This study was conducted as a prospective observational study in the Department of Radio-Diagnosis at a Tertiary Care Hospital, Chromepet, Chennai, in collaboration with Rela Hospital. The study was carried out over a period of 18 months, during which eligible patients presenting with varicose veins were evaluated and followed up according to the study protocol . The observational design was chosen to assess real-world effectiveness, safety, and patient-reported outcomes following radiofrequency ablation (RFA) without altering routine clinical practice.

Study Population

The study population comprised patients diagnosed with varicose veins attending the outpatient and inpatient services of the participating institutions. Patients were recruited consecutively based on eligibility criteria and willingness to participate. Both primary cases and cases with recurrence following prior treatment were included to ensure representation of varied disease severity and clinical scenarios .

Eligibility Criteria

Patients were selected based on predefined inclusion and exclusion criteria. Individuals diagnosed with varicose veins and willing to provide informed consent were included. Patients with recurrent varicose veins after previous treatment were also considered eligible. Exclusion criteria included patients with pre-existing leg infections, non-ambulatory status, pregnancy, tortuous veins unsuitable for catheter placement, inability to comply with compression therapy, and those on hormonal replacement or contraceptive therapy. These criteria were applied to ensure patient safety and procedural feasibility.

Sampling Technique and Recruitment

A consecutive sampling technique was employed, wherein all eligible patients presenting during the study period were included until the required sample size was achieved. Patients were recruited after detailed clinical evaluation and confirmation of diagnosis using standard imaging modalities. The recruitment process involved screening for eligibility, explaining the study objectives, and obtaining written informed consent prior to enrolment.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Sree Balaji Medical College and Hospital prior to initiation. All procedures were conducted in accordance with ethical principles for biomedical research involving human participants. Written informed consent was obtained from all participants in both English and the local language after explaining the purpose, risks, and benefits of the study. Confidentiality of patient information was strictly maintained, and participation was entirely voluntary, with the option to withdraw at any stage without affecting standard medical care .

Sample Size Calculation

The sample size was calculated using the formula for estimation of mean based on standard deviation:

$$n = \frac{Z^2 \times \sigma^2}{e^2}$$

Where,
Z = 1.96 (corresponding to 95% confidence level)
σ = 5.0 (assumed standard deviation)
e = 1 (margin of error)
Substituting the values:

$$n = \frac{(1.96)^2 \times (5)^2}{(1)^2}$$

$$n = \frac{3.8416 \times 25}{1} = 96.04$$

The calculated sample size was approximately 96, and hence the final sample size for the study was taken as 96 patients. This sample size was considered adequate to assess the effectiveness and outcomes of radiofrequency ablation with acceptable precision.

Operational Definitions and Outcome Measures

Varicose veins were defined as dilated, tortuous superficial veins associated with venous valve incompetence. The severity of disease was assessed using the Venous Clinical Severity Score (VCSS), which evaluates ten clinical parameters including pain, varicosities, edema, pigmentation, inflammation, induration, ulcer characteristics, and compliance with compression therapy. Each parameter was scored from 0 to 3, with total scores ranging from 0 to 30. Scores were categorized as mild (0–5), moderate (6–10), and severe (11–30) .

The primary outcome of the study was the effectiveness of radiofrequency ablation, measured by successful vein closure confirmed on duplex ultrasound. Secondary outcomes included patient-reported pain reduction, improvement in cosmetic appearance, quality of life changes, and incidence of complications such as deep vein thrombosis, nerve injury, skin burns, and infection.

Data Collection Procedure

Data collection was performed using a structured clinical proforma. Baseline demographic details, clinical history, and examination findings were recorded for all participants. Duplex ultrasonography was used as the primary imaging modality to confirm diagnosis and assess venous reflux prior to intervention.

Radiofrequency ablation was performed as per standard institutional protocol under appropriate aseptic precautions. Patients were monitored in the outpatient setting and followed up at predefined intervals. Short-term outcomes were assessed at 3 days, focusing on vein closure and immediate procedural success. Intermediate outcomes were evaluated at 3 months, including pain reduction, cosmetic improvement, and quality of life using VCSS scoring. Long-term safety and complications were monitored up to 6 months .

Quality Control and Standardization

All procedures and assessments were carried out by trained personnel to ensure uniformity. Duplex ultrasound evaluations were performed using standardized protocols to minimize inter-observer variability. Calibration of imaging equipment was maintained as per institutional guidelines. Data entry was cross-verified to ensure accuracy and completeness.

Data Management and Statistical Analysis

Collected data were entered into a structured database and analyzed using appropriate statistical software. Descriptive statistics were used to summarize demographic and clinical characteristics, expressed as mean, standard deviation, frequencies, and percentages.

Inferential statistics were applied to assess treatment outcomes and associations. Continuous variables were analyzed using paired or unpaired t-tests as appropriate, while categorical variables were analyzed using chi-square or Fisher's exact test. Changes in VCSS scores over time were evaluated to determine treatment effectiveness. A p-value of less than 0.05 was considered statistically significant.

Where applicable, measures of association such as relative risk and confidence intervals were calculated. The results were presented in tables and graphs to facilitate interpretation and comparison.

Results:

Table 1. Baseline demographic and clinical characteristics of the study participants (N = 96)

Variable	Category	n (%)
Age group (years)	20–30	22 (22.9)
	31–40	34 (35.4)
	41–50	25 (26.0)
	>50	15 (15.6)
Gender	Male	38 (39.6)
	Female	58 (60.4)
Laterality	Unilateral	70 (72.9)
	Bilateral	26 (27.1)
Recurrence	Yes	18 (18.8)
	No	78 (81.2)

Table 1 summarizes the baseline demographic and clinical characteristics of the study participants. The majority of patients belonged to the 31–40 years age group (34, 35.4%), followed by those aged 41–50 years (25, 26.0%). Females constituted 58 (60.4%) of the study population, while males accounted for 38 (39.6%). Unilateral varicose veins were observed in 70 (72.9%) patients compared with bilateral disease in 26 (27.1%). Most participants presented with primary disease (78, 81.2%), whereas recurrent varicose veins were identified in 18 (18.8%) patients.

Table 2. Baseline disease severity and clinical parameters (N = 96)

Variable	Category/Value	n (%) / Mean ± SD
VCSS severity	Mild (0–5)	20 (20.8)
	Moderate (6–10)	46 (47.9)
	Severe (11–30)	30 (31.3)
Baseline VCSS score	Mean ± SD	9.85 ± 3.20
Baseline pain score (VAS)	Mean ± SD	6.80 ± 1.50

Table 2 demonstrates the baseline clinical severity of varicose veins. Nearly half of the patients had moderate disease (46, 47.9%), while 30 (31.3%) had severe disease and 20 (20.8%) had mild disease. The mean baseline VCSS score was 9.85 ± 3.20, indicating moderate clinical severity, whereas the mean baseline VAS pain score was 6.80 ± 1.50, reflecting moderate-to-severe pain prior to radiofrequency ablation.

Table 3. Clinical outcomes following radiofrequency ablation (N = 96)

Outcome	Category	n (%) / Mean ± SD
Vein closure (Day 3)	Complete closure	88 (91.7)
	Partial closure/Failure	8 (8.3)
Pain score (VAS)	Pre-treatment	6.80 ± 1.50
	3 months	2.10 ± 1.20
	t value	18.54
	p value	<0.001*
VCSS score	Pre-treatment	9.85 ± 3.20
	3 months	4.20 ± 2.10
	t value	16.23
	p value	<0.001*

*Paired t-test.

Table 3 summarizes the clinical outcomes after radiofrequency ablation. Complete vein closure was achieved in 88 (91.7%) patients within three days of the procedure. The mean pain score significantly decreased from 6.80 ± 1.50 before treatment to 2.10 ± 1.20 at three months ($p < 0.001$). Similarly, the mean VCSS score improved significantly from 9.85 ± 3.20 at baseline to 4.20 ± 2.10 at three months ($p < 0.001$), demonstrating marked symptomatic and clinical improvement following treatment.

Table 4. Changes in disease severity and patient satisfaction following radiofrequency ablation (N = 96)

Variable	Baseline n (%)	3 Months n (%)
Mild	20 (20.8)	58 (60.4)
Moderate	46 (47.9)	30 (31.3)
Severe	30 (31.3)	8 (8.3)

Patient satisfaction	n (%)
Very satisfied	48 (50.0)
Satisfied	34 (35.4)
Neutral	10 (10.4)
Dissatisfied	4 (4.2)

Table 4 demonstrates a substantial improvement in disease severity after radiofrequency ablation. The proportion of patients with mild disease increased from 20 (20.8%) to 58 (60.4%), while severe disease decreased markedly from 30 (31.3%) at baseline to 8 (8.3%) at three months. Patient satisfaction was high, with 48 (50.0%) reporting being very satisfied and 34 (35.4%) satisfied, resulting in an overall positive satisfaction rate of 82 (85.4%).

Table 5: Association Between Age and Complications (n=96)

Age Group	Complications n (%)	No Complications n (%)	Chi-square	p-value
20–30	2 (9.091%)	20 (90.909%)	4.870	0.182
31–40	5 (14.706%)	29 (85.294%)		
41–50	4 (16.000%)	21 (84.000%)		

>50	3 (20.000%)	12 (80.000%)		

The proportion of complications showed a gradual increase with advancing age, from 9.091% in the 20–30 years group to 20.000% in patients aged >50 years. However, the majority of patients in all age groups did not experience complications. The association between age and occurrence of complications was found to be not statistically significant ($\chi^2 = 4.870$, $p = 0.182$). This suggests that although older patients showed a slightly higher proportion of complications, age was not a significant predictor of post-procedural complications in this study.

Figure 1: Complications Following Radiofrequency Ablation

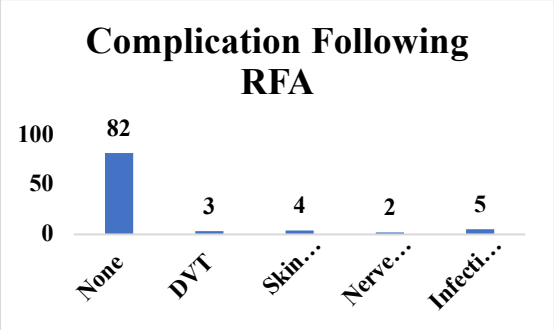


Figure 1 summarizes the post-procedural complications following radiofrequency ablation. The majority of patients (82, 85.4%) experienced no complications. Among those with adverse events, infection was the most common complication (5, 5.2%), followed by skin burns (4, 4.2%), deep vein thrombosis (3, 3.1%), and nerve injury (2, 2.1%). Overall, the low complication rate indicates that radiofrequency ablation is a safe and well-tolerated treatment modality for varicose veins.

Discussion:

The present study demonstrates strong early efficacy of radiofrequency ablation in the treatment of symptomatic chronic venous disease, with a vein closure rate of 91.667% at day 3 and statistically significant improvements in both pain and venous symptom scores. These findings align closely with established evidence from high-quality clinical guidelines and meta-analyses, confirming that RFA is an effective intervention for moderate-to-severe venous disease. The study population included a high proportion of patients with moderate and severe disease, yet achieved comparable success rates, indicating consistency across disease severities.

Evidence-based clinical recommendations strongly corroborate these results. High-quality guideline synthesis has demonstrated that endovenous thermal ablation achieves occlusion rates of 85–95% across large pooled datasets, as reported by Gloviczki and colleagues, which is consistent with the present study's closure rate [18]. Similarly, standardized European vascular guidelines have reported technical success rates of 88–94%, particularly in patients with CEAP C2–C5 disease, as described by De Maeseneer and colleagues [19]. In comparison, the present study included a high proportion of moderate and severe cases yet achieved comparable success rates, indicating consistency across disease severities, though the absence of CEAP classification limits precise severity-adjusted comparison. A systematic review incorporating randomized and observational data has demonstrated pooled closure rates ranging from 90% to 96%, as reported by Farah and colleagues [20]. The observed rate of 91.667% in the present study falls well within this interval, indicating strong consistency.

The symptomatic improvement observed in this study is particularly noteworthy. The absolute pain reduction substantially exceeds the average reductions of approximately 2–3 units reported in meta-analyses, indicating greater symptomatic improvement, which may be explained by higher baseline pain levels and early assessment at 3 months, where maximal symptomatic relief is typically observed. Comparative effectiveness across treatment modalities has been evaluated using advanced network meta-analytic models, which demonstrated that RFA provides similar anatomical success but superior pain reduction compared to endovenous laser ablation, as shown by Gasior and colleagues [21]. Meta-analyses evaluating compression therapy have demonstrated no significant effect on long-term occlusion rates but modest improvement in symptom relief, as highlighted by Hu and colleagues [22]. The high closure rate observed in the present study supports the notion that procedural efficacy is the primary determinant of anatomical success.

Thromboembolic risk remains a critical safety concern. Meta-analytic evidence evaluating thromboprophylaxis strategies has demonstrated a relative risk reduction of approximately 30–50% for thrombotic events, as described by Turner and colleagues [23]. The deep vein thrombosis incidence observed in this study is slightly higher than pooled estimates of 1–2%, suggesting partial consistency. This difference may be attributed to lack of standardized thromboprophylaxis protocols, small sample size, and real-world observational design. Further evidence on thrombosis prevention has demonstrated that structured prophylaxis significantly reduces postoperative DVT risk, as reported by Alameer and colleagues [24]. The relatively higher DVT rate observed suggests potential underutilization or variability in

prophylactic strategies, highlighting an area for protocol optimization.

Long-term durability is a key determinant of treatment success. Observational cohort studies with extended follow-up have demonstrated sustained closure rates of approximately 85–90% and recurrence rates of 10–15%, as reported by Kilic and colleagues [25]. While the present study showed a higher early closure rate, lack of long-term follow-up limits assessment of durability. Comparative studies evaluating non-thermal techniques have demonstrated lower closure rates compared to RFA, as shown by Talutis and colleagues [26]. Device-specific evaluations have reported closure rates exceeding 92% with complication rates below 5%, as described by Yamashita and colleagues [27]. While the present study demonstrated comparable efficacy, the overall complication rate is higher, indicating partial consistency, which may reflect differences in operator expertise, procedural standardization, and real-world variability.

The issue of recurrence deserves particular attention. Persistent venous pathology may arise from underlying deep venous abnormalities, as highlighted in a comprehensive review where deep venous obstruction was identified in 20–30% of chronic venous disease cases, influencing recurrence and treatment outcomes, as described by Benfor and colleagues [28]. In the present study, recurrence was observed in a substantial proportion of patients, which is slightly higher than the lower recurrence rates typically reported in isolated superficial disease. This discrepancy may be attributed to lack of systematic evaluation for deep venous obstruction. Residual reflux following intervention has been identified as a significant predictor of treatment failure, with pooled recurrence rates exceeding 15%, as reported by Sussman and colleagues [29]. Anatomical variations, particularly involving accessory saphenous veins, play a crucial role in recurrence, as described by Alozai and colleagues [30]. The recurrence observed falls within the reported range, indicating consistency, although detailed anatomical mapping of accessory veins was not performed.

High-quality randomized controlled trials provide critical comparative evidence. The COMETA randomized controlled trial demonstrated that modern endovenous techniques achieve closure rates >90% with significantly improved quality-of-life scores, as reported by Bootun and colleagues [31]. Comparative trials between RFA and endovenous laser ablation have consistently demonstrated equivalent efficacy, with RFA associated with lower postoperative pain, as described by Nordon and colleagues [32]. The present findings are consistent with this established evidence. Thromboembolic risk remains an important safety consideration, with meta-analyses reporting overall incidence rates ranging from 1% to 3% following endovenous procedures, as described by Healy and colleagues [33]. The DVT rate observed in this study lies at the upper limit of this range, indicating consistency but slightly higher incidence, possibly due to small sample size and lack of standardized thromboprophylaxis. Post-procedural surveillance using duplex ultrasonography plays a crucial role in detecting complications and confirming vein closure, as reported by Suarez and colleagues [34]. The present study utilized duplex ultrasound for outcome assessment, indicating consistency with best practices.

Several limitations must be acknowledged. The study was conducted at a single center with a relatively small sample size, which may limit generalizability and statistical power. The short-term follow-up period precludes assessment of long-term durability and late recurrence. The absence of CEAP classification limits precise severity-adjusted comparisons with published literature. Lack of standardized thromboprophylaxis protocols may have contributed to the higher than expected thrombotic complication rate. The absence of validated quality-of-life instruments limits assessment of patient-reported outcomes. The lack of a comparator arm prevents direct comparison with alternative modalities. Finally, the absence of a standardized EHIT classification system limits detailed risk stratification for thrombotic complications.

The findings of this study have several important clinical implications. The high closure rate and significant symptomatic improvement support the use of RFA as a first-line intervention for symptomatic chronic venous disease, including in patients with moderate-to-severe disease. The high incidence of recurrence observed highlights the importance of comprehensive preoperative assessment, including evaluation of deep venous patency and accessory vein anatomy. The slightly higher than expected thrombotic complication rate underscores the need for standardized thromboprophylaxis protocols and routine postoperative duplex surveillance. The absence of CEAP classification in this study highlights the importance of standardized classification in clinical practice to facilitate meaningful comparisons and guide treatment decisions.

Conclusion:

The present study demonstrates that radiofrequency ablation is an effective and well-tolerated intervention for symptomatic chronic venous disease, achieving high early closure rates and significant improvement in both pain and venous symptoms. The observed closure rate is consistent with established evidence from clinical guidelines, systematic reviews, and randomized controlled trials. The clinical improvement observed, particularly in pain reduction, reinforces the value of

RFA as a preferred thermal ablation modality. The recurrence and thrombotic complication rates observed highlight the importance of comprehensive patient assessment, standardized procedural protocols, and systematic postoperative surveillance. While short-term outcomes are encouraging, long-term follow-up studies are needed to assess durability and identify predictors of recurrence. These findings support the continued use of RFA as a primary treatment modality for symptomatic chronic venous disease, with attention to optimization of patient selection, procedural technique, and post-procedural care to further improve outcomes and minimize complications.

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