

Early-Term Results of Endovenous Saphenous Vein Radiofrequency Ablation Combination with Trans-sheath Ultrasound-Guided Foam Sclerotherapy

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ABSTRACT

Objective: To determine the early success rate in cases of great saphenous vein insufficiency treated with radiofrequency ablation (RFA) and combined transsheath ultrasonography-guided foam sclerotherapy (RFA+ST).

Study Design: Descriptive study.

Place and Duration of the Study: Department of Cardiovascular Surgery, Faculty of Medicine, Canakkale Onsekiz Mart University, Canakkale, Turkiye, from July 2022 to October 2024.

Methodology: Patients who underwent only RFA and combined RFA+ST between July 2022 and October 2024 were retrospectively scanned. Demographic data and complications were recorded. Differences between the demographic and collected data of the two groups were examined using the Mann-Whitney U test, Pearson's Chi-square or Fisher's exact test.

Results: In total, 235 patients were included in the study: 120 in the RFA group (Group A) and 115 in the RFA+ST group (Group B). The median age (IQR) of Groups A and B was 48 (24) and 50 (26) years, respectively. The gender distribution was 86 females (65.6%) and 45 males (34.4%) in Group A, 75 females (67%) and 37 males (33%) in Group B. The median GSV diameter was 6.7 (1.5) mm and 7 (1.7) mm, respectively. Recanalisation occurred in 8 (6.1%) patients in Group A and 1 (0.9%) patient in Group B ($p = 0.041$). Other complications in Groups A and B included tenderness [7 (5.3%) vs. 12 (10.7%)], phlebitis or cellulitis [4 (3.1%) vs. 2 (1.8%)], ecchymosis [1 (0.8%) vs. 2 (1.8%)], hyperpigmentation [5 (3.8%) vs. 2 (1.8%)], and phlebothrombosis [7 (5.3%) vs. 24 (21.4%); $p < 0.001$], respectively.

Conclusion: In Group B combined with foam sclerotherapy, recanalisation rate was found to be significantly lower, and phlebothrombosis was higher in the early period. Closure reactions may develop more strongly with phlebothrombosis; however, appropriate case selection and procedure should be performed very carefully due to possible adverse conditions such as deep vein thrombosis.

Key Words: Venous insufficiency, Radiofrequency ablation, Endovenous laser, Foam sclerotherapy.

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INTRODUCTION

Chronic venous insufficiency (CVI) is a progressive condition affecting the venous system.¹ Although it usually has a prevalence of 50% in population, it can reach up to 80%, which can significantly increase healthcare costs.^{2,3} Venous insufficiency can be treated using a variety of methods, including surgery and endovenous applications. These procedures include thermal and non-thermal endovenous laser or radiofrequency ablation, glue, foam sclerotherapy (ST), and surgical interventions.⁴⁻⁶ These methods demonstrate acceptable success rate; however, all carry a risk of recurrence.^{7,8} The effectiveness of ST and radiofrequency ablation in achieving saphenous vein closure has been shown in several studies.⁹⁻¹²

Both procedures trigger closure reactions in the saphenous vein through different pathways. Foam ST triggers closure reactions by chemical effects on the vein wall, while radiofrequency ablation triggers closure reactions by thermal effects.

Combined applications may be a better option to achieve a higher success rate.¹³ Hanna and Elkafas reported high success rates in their series in which they applied catheter-directed foam ST with endovenous radiofrequency ablation (RFA).¹⁴ These two methods, which can be applied to the saphenous vein at the same time, may be a suitable combination option. Similarly, based on the principle of combining two procedures at the same time, this study aimed to examine the results of RFA and RFA+ST cases with isolated great saphenous vein (GSV) insufficiency in two groups.

METHODOLOGY

Patients who underwent RFA and simultaneous RFA+ST for GSV insufficiency in the Department of Cardiovascular Surgery, Faculty of Medicine, Canakkale Onsekiz Mart University, Canakkale, Turkiye, from July 2022 to October 2024 were retro-

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spectively scanned. Ethical approval was obtained from the Local Ethics Committee of Canakkale Onsekiz Mart University, Canakkale, Türkiye (No. 2024-11/11-02; dated: 30.10.2024). Age, gender, great GSV diameters, recanalisation, phlebitis or cellulitis, phlebothrombosis, tenderness, ecchymosis, hyperpigmentation, and deep vein thrombosis were recorded. Differences between the two groups' demographic and collected data were examined.

Patients who underwent RFA or RFA+ST for symptomatic lower extremity venous insufficiency, detected by Doppler ultrasound (DUS) showing a reflux time of more than 2 seconds in the GSV and a diameter greater than 5.5 mm at the knee region, were included in the study. Patients with additional venous pathologies (deep vein thrombosis, intra-abdominal venous pathology, or small saphenous vein insufficiency), as well as those with a history of previous venous surgery or procedures other than for GSV insufficiency, were excluded from the study.

Before the procedure, all patients' legs were examined and marked using DUS to identify and measure the pathological vein segments, the connection points of the accompanying superficial pathologies, the presence of a double saphenous vein, the relationship between the saphenofemoral junction and the accessory saphenous vein, and the presence of pathological perforating vein. General, spinal anaesthesia, or sedation was not required for any of the patients. After marking and mapping the patient's leg, Betadine was applied, and sterile conditions were provided. The ultrasound guidance (USG) probe was prepared in accordance with sterile conditions. A 7F sheath was placed into the GSV using the Seldinger technique, mostly from the knee area, under USG. The RFA catheter (ClosureFast®, Medtronic, Minneapolis, USA) was placed approximately 1 cm distal to the superior epigastric vein at the saphenofemoral junction through the sheath, under USG control. Tumescence anaesthesia was prepared by adding 2% prilocaine, 8.4% sodium bicarbonate, and 0.5 mg epinephrine into 500 mL isotonic solution at +4°C. Tumescence was applied to the GSV area with the help of USG. After all preparations were completed, the RFA procedure was started; it was applied at 120°C for 4 seconds in every 7 cm segment. After RFA was applied to the entire segment, it was checked that the GSV was closed with ablation. After all procedures were completed, elastic compression was applied. Patients were mobilised after surgery. After discharge, elastic compression was applied for 24 hours. Subsequently, 20-30 mmHg compression stockings were used for 1-month. Oral 2 x 500 mg calcium dobesilate was added to the medication.

In the Group B, in addition to the above, transsheath ultrasound-guided foam ST was applied (Figure 1).

After the RFA catheter was positioned appropriately, tumescence anaesthesia was initially applied only to the junction region. This created a barrier to prevent the sclerosant from entering the deep venous system by using spasm in the GSV through the effects of cold and adrenaline. Before the ablation procedure, 1% polidocanol (2cc) was foamed with 1/1 air using the Tessari

method. Its distribution and location inside were confirmed under USG guidance, and the foam was sent into the GSV via the sheath (Figure 2).

It was ensured that the sclerosant did not pass to the saphenofemoral junction region and other perforating veins to the deep venous system, and its distribution was ensured within the GSV. Then, the placed RFA catheter was activated, and ablation was initiated from the junction region. This provided a second protection against the passage of the sclerosant agent to the deep venous system by spasm of the vein segment. During these procedures, patients were additionally made to perform pedal movements to increase venous flow in the deep system. Tumescence anaesthesia was completed, and ablation was performed on the entire targeted vein segment. After all procedures, the GSV occlusion status and the presence of foam sclerosant or thrombus in the deep venous system were evaluated using DUSG.

Statistical analyses were performed using the SPSS software, version 26.0 (IBM, Chicago, IL). Categorical data (tenderness, phlebitis or cellulitis ecchymosis, phlebothrombosis, hyperpigmentation, deep vein thrombosis, recanalisation, and gender) were presented as numbers (n) and percentages (%). Continuous variables (age and diameter size) were expressed as median (IQR). The suitability of the variables for normal distribution was examined using the Shapiro-Wilk test and histogram analysis. Differences between groups were assessed using the Mann-Whitney U test for continuous variables, and Pearson's Chi-square or Fisher's exact tests for categorical variables. A p-value less than 0.05 was considered significant. Due to the retrospective design, randomisation or blinding could not be performed in the study.



Figure 1: Transsheath ultrasound-guided foam ST.

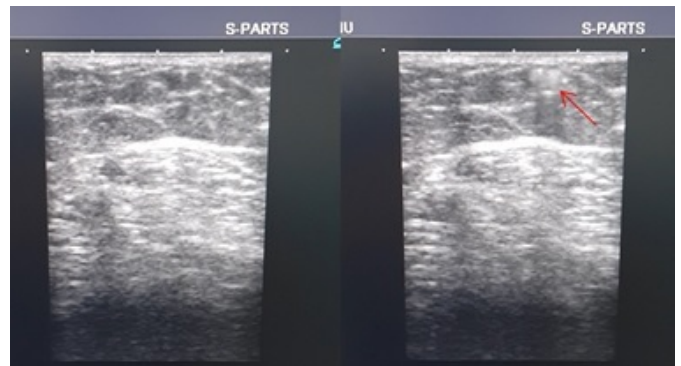


Figure 2: Follow-up of foam sclerosis under USG guidance (marked with red arrow)

Table I: Distribution of variables among the groups.

Variables	Group A (n = 120)	Group B (n = 115)	p-values
Age years median(IQR)	48 (24)	50 (26)	0.253*
Gender F/M n(%)	86 (65.6) / 45 (34.4)	75 (67) / 37 (33)	0.829#
GSV diameter median (IQR)	6.7 (1.5)	7.0 (1.7)	0.142*
Phlebitis/cellulitis	4 (3.1)	2 (1.8)	0.689+
Tenderness	7 (5.3)	12 (10.7)	0.120#
Ecchymosis	1 (0.8)	2 (1.8)	0.596+
Hyperpigmentation	5 (3.8)	2 (1.8)	0.457+
Recanalisation	8 (6.1)	1 (0.9)	0.041+
Phlebothrombosis	7 (5.3)	24 (21.4)	<0.001#
Deep venous thrombosis	0	0	-

p-values *Mann-Whitney U test. #Pearson's Chi-square. +Fisher's exact test.
GSV: Great saphenous vein; F: Females; M: Males.

RESULTS

In total, 235 patients were included in the study: 120 in the RFA group (Group A) and 115 in the RFA+ST group (Group B). The median age (IQR) of Groups A and B was 48 (24) and 50 (26) years, respectively. The gender distribution was 86 females (65.6%) and 45 males (34.4%) in Group A, 75 females (67%) and 37 males (33%) in Group B. The median GSV diameter was 6.7 (1.5) mm and 7 (1.7) mm, respectively. Recanalisation occurred in 8 (6.1%) patients in Group A, and 1 (0.9%) patient in Group B ($p = 0.041$). Other complications in Groups A and B included tenderness [7 (5.3%) vs. 12 (10.7%)], phlebitis or cellulitis [4 (3.1%) vs. 2 (1.8%)], ecchymosis [1 (0.8%) vs. 2 (1.8%)], hyperpigmentation [5 (3.8%) vs. 2 (1.8%)], and phlebothrombosis [7 (5.3%) vs. 24 (21.4%); $p < 0.001$], respectively. No significant difference was detected except for phlebothrombosis and recanalisation (Table I).

DISCUSSION

CVI remains a common disease today and can be treated using various approaches, including endovenous and surgical interventions.¹ Endovenous applications have surpassed surgical ones due to their low side effects and acceptable success rates. However, recurrence and recanalisation can still occur.^{7,14} Due to recurrences, patients are negatively affected, and labor loss and treatment costs may increase further. Recurrence rates have been reported as 13–65%,¹⁵ and GSV recanalisation is one of the most important reasons.¹⁶ It can be affected by many factors. The closure of the saphenous vein is an important factor in the case of recurrence. Combining it with other methods to increase the successful closure of the saphenous vein may yield better results. Foam ST is among the methods applicable to saphenous vein pathologies.^{17–19} The success of the RFA procedure can be increased when combined with GSV foam ST.

Hanna and Elkafas reported high success rates in their series in which they applied catheter-directed foam ST with endovenous RFA.¹⁴ Cavezzi *et al.* reported positive short- and medium-term results regarding the safety and efficacy of the combined application of GSV transcatheter foam ST with tumescent anaesthesia, perivenous infiltration, intrasaphe-

nous irrigation with normal saline, and phlebectomy of varicose tributaries.²⁰

This study aimed to compare outcomes in order to examine the significance of this combined approach. A retrospective review was conducted to compare both the procedural success of the (GSV closure rate) and complications (tenderness, phlebitis or cellulitis, ecchymosis, hyperpigmentation, phlebothrombosis, and deep vein thrombosis) among patients who underwent GSV transsheath foam ST concomitant with RFA and those who underwent RFA alone, at the 1-month follow-up.

There was no significant difference between the groups in demographic data of patients' age, gender, GSV diameter and tenderness, phlebitis or cellulitis, ecchymosis, and hyperpigmentation at the 1-month follow-up (Table I). Recanalisation, one of the most important criteria, was significantly lower in Group B ($p = 0.041$). This indicated a higher success rate in GSV closure. Additionally, phlebothrombosis was also found to be significantly higher in Group B ($p < 0.001$). During these procedures, it was observed that, in some cases, thrombotic reactions were more prominent along the GSV line, its branches, and associated varicosities, all of which subsequently closed together. In addition to the effect of the sclerosant agent distributed within the vascular lumen, high inflammation and thrombogenic activity may have occurred due to the superimposed thermal effects of the RFA procedure. These combined effects may also have increased closing rates. After the procedure, one of the worst complications observed was deep vein thrombosis (DVT). However, in this study, no case of DVT developed in either group. Although this represents a favourable outcome, it should be noted that high thrombogenic activity is also associated with the risk of DVT. Considering this potential risk, in cases where ST was applied, the presence of an incompetent GSV line and perforators that may be related to the deep venous system—especially in the thigh region—the relationship of vascular segments, varicosities and the deep system, as well as any accompanying pathologies below the knee, were examined using DUSG before the procedure to ensure appropriate case selection.

Higher success rates can be achieved with different sclerosant ratios and concentrations. However, increased thrombogenic activity should not be ignored, and a combined procedure should be performed with appropriate case selection and high sensitivity.

The study's limitations include a retrospective design, single-centred setting, and additional procedures applied to some patients who underwent varicose vein excision and perforating ligation. In order to avoid excessive data and result confusion, the results were analysed by ignoring these additional procedures in the study.

CONCLUSION

RFA+ST appears to be a feasible combination with a higher success rate according to the early results. However, case selection and application should be performed carefully, considering that thrombogenic activity may be high. In order to make more

detailed comments, studies with long-term results and larger caseseries are needed.

ETHICAL APPROVAL:

Ethical approval was obtained from the Local Ethics Committee of Canakkale Onsekiz Mart University, Canakkale, Türkiye (No. 2024-11/11-02; dated: 30.10.2024). This study was conducted in compliance with the ethical principles according to the Declaration of Helsinki.

PATIENTS' CONSENT:

Since the study is a retrospective screening, no patient consent was required.

COMPETING INTEREST:

The author declared no conflict of interest.

AUTHOR'S CONTRIBUTION:

SO: Conception and design of the work; acquisition, analysis, and interpretation of data; drafting and revision of the manuscript.

The author approved the final version of the manuscript to be published.

REFERENCES

- De Maeseneer MG, Kakkos SK, Aherne T, Baekgaard N, Black S, Blomgren L, et al. Editor's choice - European Society for Vascular Surgery (ESVS) 2022 clinical practice guidelines on the management of chronic venous disease of the lower limbs. *Eur J Vasc Endovasc Surg* 2022; **63(2)**: 184-267. doi: 10.1016/j.ejvs.2021.12.024.
- Ortega MA, Fraile-Martinez O, Garcia-Montero C, Alvarez-Mon MA, Chaowen C, Ruiz-Grande F, et al. Understanding chronic venous disease: A critical overview of its pathophysiology and medical management. *J Clin Med* 2021; **10(15)**:3239. doi: 10.3390/jcm10153239.
- Salim S, Machin M, Patterson BO, Onida S, Davies AH. Global epidemiology of chronic venous disease: A systematic review with pooled prevalence analysis. *Ann Surg* 2021; **274(6)**: 971-6. doi: 10.1097/SLA.0000000000004631.
- Pannier F, Noppeney T, Alm J, Breu FX, Bruning G, Flessenkamper I, et al. S2k guidelines: Diagnosis and treatment of varicose veins. *Hautarzt* 2022; **73(Suppl 1)**: 1-44. doi: 10.1007/s00105-022-04977-8.
- Santler B, Goerge T. Chronic venous insufficiency - a review of pathophysiology, diagnosis, and treatment. *J Dtsch Dermatol Ges* 2017; **15(5)**:538-56. doi: 10.1111/ddg.13242.
- Orhurhu V, Chu R, Xie K, Kamanyi GN, Salisu B, Salisu-Orhurhu M, et al. Management of lower extremity pain from chronic venous insufficiency: A comprehensive review. *Cardiol Ther* 2021; **10(1)**:111-40. doi: 10.1007/s40119-021-00213-x.
- Gloviczki P, Comerota AJ, Dalsing MC, Eklof BG, Gillespie DL, Gloviczki ML, et al. The care of patients with varicose veins and associated chronic venous diseases: Clinical practice guidelines of the Society for Vascular Surgery and the American Venous Forum. *J Vasc Surg* 2011; **53(5)**: 2S48S. doi: 10.1016/j.jvs.2011.01.079.
- Mariani F, Carbone L, Sozio G, Massaroni R, Andreucci E, Bianchi V, et al. Ultrasound-guided foam sclerotherapy of the saphenous trunks is associated with a low 5-year recurrence rate and improved quality of life in patients with chronic venous disease: A multicenter study. *J Vasc Surg Venous Lymphat Disord* 2025; **13(4)**:102212. doi: 10.1016/j.jvsv.2025.102212.
- Umar M, Col L, Saleem I, Aneeza Sikandar, Farooqi B, Shahzad S. Comparison of efficacy of foam sclerotherapy with and without ultrasound guided for the treatment of varicose veins. *Pak J Med Health Sci* 2025; **18(3)**:40-2. doi: 10.53350/pjmhs0202418312.
- Hauzer W, Gnus J, Rosinczuk J. Endovenous laser therapy with echosclerotherapy as a hybrid method for chronic venous insufficiency: Experience in 200 patients and literature review. *Eur Rev Med Pharmacol Sci* 2021; **25(24)**:7777-86. doi: 10.26355/eurrev_202112_27624.
- Li N, Li J, Huang M, Zhang X. Efficacy and safety of polidocanol in the treatment of varicose veins of lower extremities: A protocol for systematic review and meta-analysis. *Medicine (Baltimore)* 2021; **100(8)**:e24500. doi: 10.1097/MD.00000000000024500.
- Khan FU, Imtiaz N, Khan I, Huma G, Ahmad U, Mirza TI. A retrospective follow-up study to show the effectiveness of booster dose of foam sclerotherapy session at 3rd and 6th months in preventing the recurrence of varicose veins. *J Ayub Med Coll Abbottabad* 2023; **35(3)**:380-3. doi: 10.55519/JAMC-03-11972.
- Nesbitt C, Bedenis R, Bhattacharya V, Stansby G. Endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus open surgery for great saphenous vein varices. *Cochrane Database Syst Rev* 2014; **(7)**: CD005624. doi: 10.1002/14651858.CD005624.pub3.
- Hanna INA, Elkafas K. Radiofrequency endogenous ablation and concomitant sclerotherapy. *J Med Scient Res* 2020; **3(4)**:8. doi: 10.4103/JMSR.JMSR_88_20.
- Brake M, Lim CS, Shepherd AC, Shalhoub J, Davies AH. Pathogenesis and etiology of recurrent varicose veins. *J Vasc Surg* 2013; **57(3)**:860-8. doi: 10.1016/j.jvs.2012.10.102.
- Perrin MR, Labropoulos N, Leon LR Jr. Presentation of the patient with recurrent varices after surgery (REVAS). *J Vasc Surg* 2006; **43(2)**:327-34; discussion 334. doi: 10.1016/j.jvs.2005.10.053.
- Georgakarakos E, Dimitriadis K, Tasopoulou KM, Doukas D, Argyriou C, Georgiadis GS. Customizing foam sclerotherapy of the great saphenous vein: A proposed algorithm to enhance technical efficacy. *Vascular* 2024; **32(4)**:900-8. doi: 10.1177/17085381231161856.
- Dimitrios K. Foam Sclerotherapy for Chronic Venous Disease. In: Mastering Endovascular Techniques: Tips and Tricks in Endovascular Surgery. Cham: Springer International Publishing; 2024. pp.777-87. doi: 10.1007/978-3-031-42735-0_75.

19. Anis A, Yasmeen I, Sidra A, Syed Aamer H, Tariq J. Early adverse effects of foam sclerotherapy for varicose veins: An experience of 50 sclerotherapy sessions. *Pak J Med Health Sci* 2022; **16(10)**:994. doi: 10.53350/pjmhs221610994.
20. Cavezzi A, Mosti G, Campana F, Tessari L, Bastiani L, Urso SU. Catheter foam sclerotherapy of the great saphenous vein, with perisaphenous tumescence infiltration and saphenous irrigation. *Eur J Vasc Endovasc Surg* 2017; **54(5)**:629-35. doi: 10.1016/j.ejvs.2017.08.004.

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