Prospective randomized trial comparing radiofrequency ablation and complete saphenous vein stripping in patients with mild to moderate chronic venous disease with a 3-year follow-up

Ensaio clínico randomizado prospectivo comparando a ablação por radiofrequência e a retirada completa de veia safena em pacientes com doença venosa crônica leve à moderada com seguimento de 3 anos


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ABSTRACT

Objective: To compare the use of the radiofrequency thermoablation of the saphenous vein with the ligation technique, and complete removal of the saphenous vein, from the saphenofemoral junction to the ankle. Methods: A total of 49 patients with chronic venous disease in the Comprehensive Classification System for Chronic Venous Disorders (CEAP) classes 2 to 4 for clinical signs, etiology, anatomic distribution and pathophysiology, were assessed at baseline, after 4 weeks, and after 1 year. The parameters assessed were complications, period of absence from activities, Venous Clinical Severity Score (VCSS) and quality of life scores according to Aberdeen Varicose Veins Questionnaire (AVVQ). They were re-examined 1 and 3 years after treatment to evaluate recurrence rates. Results: The success rate per limb (p=0.540), VCSS (p=0.636), AVVQ (p=0.163), and clinical complications were similar in the two treatment groups. Nevertheless, the radiofrequency thermoablation group had significant shorter length of hospital stay (0.69±0.47) and absence from activities (8.62±4.53), p<0.001. Conclusion: Patients submitted to radiofrequency thermoablation had an occlusion rate, clinical recurrence and improvement in quality of life comparable to removal of the saphenous vein. However, these patients spent less time hospitalized and away from their daily activities during recovering.

Keywords: Catheter ablation/methods; Saphenous vein/surgery; Radio waves; Quality of life

RESUMO

Objetivo: Comparar o uso da termoablação por radiofrequência da veia safena com a técnica de ligação e retirada completa da veia safena da junção safeno-femoral ao tornozelo. Métodos: Foram avaliados 49 pacientes com doença venosa crônica nas categorias 2 a 4 (Comprehensive Classification System for Chronic Venous Disorders (CEAP) classes 2 to 4) para sinais clínicos, etiologia, distribuição anatômica e patofisiologia. Os parâmetros avaliados foram complicações, período de ausência de atividades, score de severidade clínica de veias (VCSS) e escores de qualidade de vida de acordo com o Questionário de Veias Varicosas de Aberdeen (AVVQ). Eles foram reavaliados 1 e 3 anos após o tratamento para avaliar taxas de recorrência. Resultados: A taxa de sucesso por membro (p=0.540), VCSS (p=0.636), AVVQ (p=0.163) e complicações clínicas foram semelhantes nos dois grupos de tratamento. No entanto, o grupo de termoablação por radiofrequência teve um tempo hospitalar significativamente mais curto (0.69±0.47) e ausência de atividades (8.62±4.53), p<0.001. Conclusão: Os pacientes submetidos à termoablação por radiofrequência tiveram uma taxa de occlusão, recorrência clínica e melhora na qualidade de vida comparáveis à remoção da veia safena. No entanto, esses pacientes passaram menos tempo hospitalizados e afastados de suas atividades diárias durante o recuperação.

Keywords: Ablação por cateter/métodos; Veia safena/cirurgia; Radiofrequência; Qualidade de vida
Classification System for Chronic Venous Disorders — CEAP

INTRODUCTION

Chronic venous disease (CVD) affects approximately 23% of the population of the United States and 35% of Brazil, with a male:female ratio ranging from 1:2 to 1:4. (1) Up to 6% of cases are in the advanced stage of disease, with trophic changes in the skin and open or healed ulcers, which substantially impacts the patients' quality of life. (2,3)

Reflux in the great saphenous vein (GSV) is the most common cause for varicose veins and CVD. (4) However, this reflux may be segmental, especially in patients in the clinical category 2 (Comprehensive Classification System for Chronic Venous Disorders — CEAP), and is a reason for complaints regarding aesthetic aspects. (5,6)

The conventional techniques to treat chronic venous insufficiency (CVI) of the GSV and small saphenous vein (SSV) are the high ligation of the saphenofemoral junction (SFJ) or saphenopopliteal junction (SPJ), and the vein stripping. Recommendations to treat GSV are to strip the above-knee GSV due to saphenous nerve injury caused by complete GSV stripping. (2) However, in Brazil, the complete removal of the GSV is considered a standard treatment. (7) Theivacumar et al., (8) showed greater satisfaction of patients, and Gifford et al., (9) noted better long-term outcomes of patients undergoing complete stripping of the venous incompetence segment. Several authors recommend removing the entire GSV if a venous duplex evaluation confirms reflux to the ankle of over 1 second. (6,10-12) The SSV is usually removed from the SPJ to the mid-third of the leg, but it can be completely excised, especially in patients with severe disease. (12) This procedure usually requires hospitalization, has a high rate of recurrence and the patient may need at least 1 week to recover. (13)

Percutaneous techniques have significantly evolved, especially in the last decade, because they are safe, outpatient procedures. These techniques have medium-term outcomes similar to the conventional treatment, but cause less pain and postoperative discomfort, allow an earlier return to work and have a lower rate of recurrence. (14,15) However, most studies compare ablative techniques to the stripping of the GSV limited to the knee, even though, in several countries, including Brazil, the standard technique to treat GSV reflux is high ligation and stripping of the SFJ to the ankle. (1,7,16-18)

The aim of this study was to compare the treatment of saphenous vein reflux using radiofrequency ablation (RFA) to treatment using ligation and complete stripping of the saphenous vein (S&T), in patients with CVD CEAP classes 2-4.

OBJECTIVE

To compare the use of the radiofrequency thermoablation of the saphenous vein with the technique of ligation and complete stripping of the saphenous vein, from the saphenopopliteal junction to the ankle.

METHODS

Patients with CVD requiring treatment of the saphenous vein at Hospital Geral de Carapicuíba, of Organização Social de Saúde São Camilo, Carapicuíba (SP) Brazil, were recruited from February to September of 2013. All patients who met the inclusion criteria and were interested in volunteering were invited to participate in the study. The study was approved by the Research Ethics Committee of Hospital Geral de Carapicuíba (protocol number 021/12), and all procedures were performed in accordance with the Declaration of Helsinki and good practices in clinical research. All participants signed Informed Consent forms, and were free to leave the study at any moment, without interference in treatment.

The patients were examined in the vascular outpatient clinic. A detailed history was taken and a complete physical examination was made. All patients had an Ankle-Brachial Index (ABI) measured and underwent color-Doppler venous ultrasound of the superficial and deep veins in the lower limbs. Age, sex, weight, comorbidities and body mass index (BMI) were recorded. The same physician determined the score
for each patient by using the revised Venous Clinical Severity Score (R-VCSS). Furthermore, all patients filled in the Aberdeen Varicose Vein Questionnaire (AVVQ) for quality of life. Doppler venous ultrasound for reflux evaluation was performed by a vascular surgeon with experience in imaging examination of CVD patients, using a portable system (MySono 6 Samsung Medison Co., Seoul, Korea) with a 7 to 12MHz multi-frequency linear transducer. The examination was performed in the standing position with the body weight put on the contralateral limb. The deep venous system was evaluated for acute thrombophlebitis and post-thrombotic changes. The number and location of refluxing perforator veins were recorded. Reflux was induced by manual compression followed by sudden release. Retrograde flow lasting >0.5 second was used as cut-off for reflux in the saphenous vein. In this study, only patients with >1 second reflux (diffused throughout the entire GSV) were included to avoid treating minimal disease. GSV diameters were measured 3cm away from the SFJ, at mid-thigh and at the knee. Small saphenous vein diameter was measured at the popliteal fossa, and at 10cm below that level before beginning of treatment. The same measurements were taken 12 and 36 months after surgery. The ultrasound pattern of the treated saphenous vein flux was classified as with occlusion (or non-visualized); patent saphenous vein with reflux; and patent saphenous vein without reflux.

The inclusion criteria were as follows: age between 18 and 70 years; CEAP classes C2, C3 or C4 and presence of symptoms; ABI ≥0.9; GSV reflux of >1 second (diffused throughout the entire GSV), with a minimum diameter of 5mm and maximum diameter of 12mm; and SSV reflux of >1 second, with a minimum diameter of 3mm and maximum diameter of 12mm.

The exclusion criteria were patients unable to undergo Duplex ultrasound examination; presenting with acute thrombophlebitis or chronic obstruction of the saphenous vein detected in the duplex ultrasound exam; history of deep venous thrombosis; absence of clinical conditions for surgical treatment, even under local anesthesia; CEAP 0, 1.5 or 6; restricted mobility; pregnancy; peripheral arterial disease; saphenous vein diameter <5mm or >12mm; non-compliance with postoperative treatment protocol; and technical failure of the procedure.

Bilateral treatment was performed, and each limb received the same treatment. Both limbs were treated and in the same surgery. For the statistical analysis, each leg of the patients who underwent bilateral treatment was considered a distinct individual. Multiple treatments were allowed in the same procedure, such as thermoablation of GSV and anterior saphenous vein.

Randomization

Patients were randomized using the website sealedenvelope.com (https://www.sealedenvelope.com/). Two groups were generated: the first one received saphenous thermoablation (RFA Group) and the second group was treated with conventional stripping (S&T Group).

Analyzed outcomes

The outcomes were assessed at baseline, 4 weeks, 1 year, and 3 years after treatment. Criteria for technical success were closed or absent saphenous vein with no flow. A recanalized saphenous vein or treatment failure were defined as an open part of the treated vein segment with more than 10cm in length; or a residual SFJ and SPJ with reflux. The primary outcome measured was recanalization rate for RFA Group, and saphenous vein neovascularization or surgical failure for the S&T Group, which were analyzed only at the 1- and 3-year follow-up. Secondary outcomes measured were length of hospital stay, period of absence from work or domestic activities, clinical recurrence rate, and R-VCSS and AVVQ, which were both analyzed at baseline (14 to 30 days after the procedure), and in the 1-year follow-up. AVVQ is a change-responsive tool, which has been internationally validated to assess quality of life in varicose vein patients.

Furthermore, we evaluated demographic indices, comorbidities, BMI and adverse events associated to the methods used, such as infection, phlebitis, deep venous thrombosis, pulmonary embolism, or need for hospitalization.

Surgical procedure and operative technique

All patients from both groups were treated in the operating room. For the S&T Group, all procedures were performed under spinal block, through exposure of the SFJ in the groin, dissection and ligation of all tributaries, and ligation of the GSV next to the common femoral vein. Later, the GSV was dissected through a 1-cm incision at the ankle level, and the phleboextractor was inserted in the cephalad direction. Saphenous stripping was performed from proximal to distal and hemostasis was obtained by compression for 10 minutes. The SSV was surgically treated through ligation of the SFJ and stripping of the segment with reflux up to the origin of the Achilles tendon. We avoided complete
stripping of the SSV due the risk of sural nerve injury.\(^{(17)}\) The suture of incisions and phlebectomy healing were followed by extrinsic compression through a compressive tubular gauze bandage. Analgesics and non-steroid anti-inflammatory drugs were prescribed for 3 to 5 days.

The RFA Group was mostly treated under local anesthesia – only four patients, who did not agree to tumescent anesthesia, were given spinal blockage. With the patient in supine position, the GSV was punctured under echography, preferably in the middle third of the leg. A 7F-sheath was inserted, and the Closure FAST\(^{TM}\) 100 cm (Medtronic\(^{TM}\), USA) catheter was placed 2 to 3 cm away from the terminal valve of the SFJ. Tumescent anesthesia was applied under ultrasound-guidance in the saphenous compartment and in the perivenous tissues. The tumescent solution was composed of 1,000mL of saline and 120mg of methylprednisolone. For those who chose for local anesthesia, the tumescent solution was composed of 1,000mL of saline, 40mL of lidocaine with epinephrine at 1%, 20mL of sodium bicarbonate at 8.4%, and 120mg of methylprednisolone. On average, 400mL of the solution were used in each limb, never exceeding the maximum dose of 7mg/kg of lidocaine. The patients were maintained in the Trendelenburg position for the ablation. Pressure over the treated area during ablation was made both by the ultrasound transducer and by hand. Small saphenous vein ablation was similar to that of the GSV. Varicose tributaries were treated during the same surgery using micro-incisions in both groups. Adjuvant procedures on varices and perforator vessels were limited to anesthesia sites.

All patients were encouraged to use compression stockings and return to their routine physical activity as soon as possible.

### Statistical analysis

Numerical variables were expressed as mean and standard deviation, or median and interquartile range, and minimum and maximum values. Categorical variables were described as absolute and relative frequencies. Both groups were compared in relation to demographic data, comorbidities and outcomes using Fisher’s exact test or \(\chi^2\) test for categorical variables, and the Student’s \(t\)-test or Mann-Whitney’s test for numerical variables.

Models of generalized estimating equations were adjusted considering the relation between the two evaluations performed in the same patient, and the results were presented by estimated means and a 95% confidence interval. The models were adjusted by the Poisson distribution in the case of the R-VCSS, and by normal distribution for the quality of life score. For the CEAP classification, the adjustment was performed with multinomial distribution, and binomial distribution was used for the recanalization of treated saphenous vein in all patients analyzed.

The analyses were conducted using the IBM Statistical Package for the Social Sciences (SPSS) for Windows, version 19.0 (IBM Corp., Armonk, NY, USA), and significance level was set at 0.05.

### RESULTS

A total of 186 patients were referred to primary outpatient care and, of those, 70 (37.6%) met the eligibility criteria and 53 (28.6%) consented to participate. Four patients were excluded after randomization. The final analysis included 49 patients with primary CVD of the saphenous vein. A total of 26 patients were randomly assigned to the RFA Group and 23 to the S&T Group (Figure 1). After 4 weeks of treatment, all patients underwent clinical evaluation and duplex scan to identify any complications. There was no statistical difference in demographic data and clinical characteristics between the groups, as indicated in table 1.

The incidence of complications was similar between the groups (Table 2). They included thrombophlebitis in a thigh tributary and popliteal vein thrombosis in the
Table 1. Comparison of epidemiological data between both groups

<table>
<thead>
<tr>
<th></th>
<th>Total (n=49)</th>
<th>Groups</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RFA (n=26)</td>
<td>S&amp;T (n=23)</td>
<td></td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>39 (79.6)</td>
<td>20 (76.9)</td>
<td>19 (82.6)</td>
</tr>
<tr>
<td>Male</td>
<td>10 (20.4)</td>
<td>6 (23.1)</td>
<td>4 (17.4)</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>46.6±11.9</td>
<td>44.1±11.7</td>
<td>49.3±11.7</td>
</tr>
<tr>
<td>Minimum-maximum</td>
<td>21-70</td>
<td>21-68</td>
<td>23-70</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean±SD</td>
<td>26.6±3.6</td>
<td>26.4±3.5</td>
<td>26.7±3.7</td>
</tr>
<tr>
<td>Minimum-maximum</td>
<td>19.6-36.7</td>
<td>19.6-32.0</td>
<td>20.8-36.7</td>
</tr>
<tr>
<td>Unilateral involvement, n (%)</td>
<td>31</td>
<td>17 (65.4)</td>
<td>14 (60.9)</td>
</tr>
<tr>
<td>Saphenous-vein involvement, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great saphenous vein</td>
<td>63</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>Small saphenous vein</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CEAP classification, n (%)</td>
<td></td>
<td></td>
<td>0.286*</td>
</tr>
<tr>
<td>C2, varicose veins &gt;3mm</td>
<td>19 (38.8)</td>
<td>9 (34.6)</td>
<td>10 (43.5)</td>
</tr>
<tr>
<td>C3, edema</td>
<td>19 (38.8)</td>
<td>11 (42.3)</td>
<td>8 (34.8)</td>
</tr>
<tr>
<td>C4, skin or subcutaneous change</td>
<td>11 (22.4)</td>
<td>6 (23.1)</td>
<td>5 (21.7)</td>
</tr>
<tr>
<td>Comorbidities, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAH</td>
<td>13 (26.5)</td>
<td>7 (26.9)</td>
<td>6 (26.1)</td>
</tr>
<tr>
<td>DM</td>
<td>5 (10.2)</td>
<td>1 (3.8)</td>
<td>4 (17.4)</td>
</tr>
<tr>
<td>Smoking</td>
<td>8 (16.3)</td>
<td>6 (23.1)</td>
<td>2 (8.7)</td>
</tr>
<tr>
<td>OAC</td>
<td>4 (8.2)</td>
<td>2 (7.7)</td>
<td>2 (8.7)</td>
</tr>
<tr>
<td>Recurrence of varicose veins within 3 years, n (%)</td>
<td>37 (88.1)</td>
<td>21 (91.3)</td>
<td>16 (64.2)</td>
</tr>
</tbody>
</table>

* Fisher’s exact test; † two sample t-test; ‡ generalized estimating equations; ‡ Pearson χ².

RFA: radiofrequency ablation; S&T: complete stripping of the saphenous vein; SD: standard deviation; BMI: body mass index; CEAP: Comprehensive Classification System for Chronic Venous Disorders; SAH: systemic arterial hypertension; DM: diabetes mellitus; OAC: oral anticoagulants.

Table 2. Surgery outcomes according to treatment

<table>
<thead>
<tr>
<th></th>
<th>Total (n=49)</th>
<th>Groups</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RFA (n=26)</td>
<td>S&amp;T (n=23)</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>45 (91.8)</td>
<td>24 (92.3)</td>
<td>21 (91.3)</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (8.2)</td>
<td>2 (7.7)</td>
<td>2 (8.7)</td>
</tr>
<tr>
<td>Length of hospital stay, days</td>
<td>0.69±0.47</td>
<td>1.48±1.67</td>
<td>0.001†</td>
</tr>
<tr>
<td>Absence from work, days</td>
<td>8.62±4.53</td>
<td>20.13±18.76</td>
<td>&lt;0.001†</td>
</tr>
</tbody>
</table>

Results expressed as n (%) or mean±standard deviation. * Fisher’s exact test; † Mann-Whitney test.

RFA: radiofrequency ablation; S&T: complete stripping of the saphenous vein.

RFA Group, while one patient developed cellulitis and another developed deep venous thrombosis in the S&T Group (Table 2).

Patients in the S&T Group reported a longer time of absence from work or from house activities (20.13±18.76) than those in the RFA Group (8.62±4.53).

Length of hospital stay was also significantly longer for the S&T Group (1.48±1.67) than for the RFA Group (0.69±0.47). Moreover, the RFA Group stayed at the hospital for a maximum of 1 day, whereas hospitalization ranged from 1 to 9 days for patients in the S&T Group. In the S&T Group, one patient had a secondary infection (cellulitis) and required hospitalization for antibiotic therapy.

Both R-VCSS and AVVQ significantly improved (p<0.001) between pre- and postoperative evaluations for all patients (Table 3), but there was no difference in R-VCSS (p=0.636) or AVVQ scores (p=0.163) between the RFA and S&T Groups (Tables 3 and 4). Both procedures significantly improved CEAP classification (p<0.001) of all participants, but there was no difference (p=0.268) in CEAP classifications between the groups.

Twelve months after treatment, on average, 67 limbs of 49 patients (35 from the RFA Group and 32 from the S&T Group) were evaluated by ultrasound (Table 5). Overall technical failure rate was 5.2%,
with one recanalization in the RFA Group (2.9%) and three surgical failures in the S&T Group (9.4%). In the latter, there were two cases of reflux in residual segments of GSV, and one case of incomplete ligation of SSV, maintaining venous reflux to gastrocnemial and superficial varicose veins.

In the next follow-up session (37.1 months, on average), in which 42 study participants returned for ultrasound and medical evaluation, a total of 58 limbs were analyzed (31 from the RFA Group and 27 from the S&T Group), resulting in the identification of one new technical failure (saphenous recanalization) in the RFA Group. Thus, the success rate per limb was 93.4% for the RFA Group and 88.8% to the S&T Group (p=0.540).

The clinical recurrence of varicose veins in 3 years was not significantly different in the two groups (p=0.638), with only two cases in RFA Group (8.7%) and three cases in the S&T Group (15.8%).

### DISCUSSION

This study shows that RFA allows for a shorter period of hospitalization and absence from work when compared to the S&T Group, as previously demonstrated by Lurie et al.,(13) and other studies.(23,24) Furthermore, the data presented here confirm the good clinical results of RFA regarding venous occlusion rates and impact on quality of life of patients treated, during the medium-term follow-up. We found a 93.4% occlusion rate per limb in the RFA group after 3 years, similar to the results described by Proebstle et al.,(25) who reported a 95% reflux-free rate, 5 years after RFA. We identified two cases of saphenous vein recanalization after RFA: one partial recanalization at knee level, and one neovascularization of the saphenous vein trunk at mid-thigh. However, one of the patients had no complaints about venous insufficiency, corroborating the recent publications that have demonstrated ablation of the saphenous vein improves VCSS, despite failing to close it completely.(26) Recently, the results of the original VNUS closure device to eliminate truncal venous reflux at 15 years were reported, demonstrating excellent long-term technical success in truncal veins with the first-generation device.(27)

In the S&T Group, we believe most recurrences are due to the current standard technique, with no intraoperative ultrasound assessment. Additionally, there was no permanent clinical nerve injury detected in any of the groups, even in those patients who underwent stripping from the SFJ to the ankle. Although we did not perform a specific protocol for nerve injury evaluation, our results are similar to those described by Morrison et al.(10) The authors suggest that saphenous nerve deficits after stripping of the GSV to the ankle have little clinical significance. In contrast, other reports found in the literature showed a risk of nerve injury after stripping below the knee as high as 39%.(17)
Furthermore, clinical dynamics such as surgical time, perioperative and temporary post-operative care, and antibiotic therapy were similar between the RFA and S&T Groups.

In the first two decades of the this century, there were significant advances in techniques used to treat saphenous trunk reflex, especially in the ultrasound-guided minimally invasive techniques.\(^{(26)}\) There are numerous studies demonstrating encouraging results with these techniques.\(^{(24,29)}\) The earlier return to daily activities and the decrease in postoperative pain, in comparison to the conventional technique, have been well established since the use of the first radiofrequency catheters.\(^{(13)}\) After technological advances in the ablation device, radiofrequency started to present even better results.\(^{(30)}\) This led the American Venous Forum guidelines to recommend endovenous thermoablation instead of the conventional technique.\(^{(2)}\) Since then, several publications recommending the same treatment to vascular specialist have been published, especially in developed countries.\(^{(31)}\) A recent survey with surgeons, who are members of the American Venous Forum (mostly US residents), identified that 47% of them favor radiofrequency ablation and 40% prefer laser ablation of the GSV.\(^{(32)}\) However, this paradigm change in CVD treatment through endovenous thermoablation is not yet globally disseminated.

Our main objective was to compare the standard of care in Brazil (complete stripping) to the standard of care in developed countries (thermoablation).\(^{(2)}\) We focused on the most prevalent group of CVD (CEAP classes 2, 3 and 4) for a better data analysis, and our results were corroborated by most data previously published.\(^{(22,25,33)}\)

This is the first randomized Brazilian trial with mid-term follow-up (3 years) that compared the complete stripping of saphenous vein for CVD treatment with a minimally invasive technique. This study reproduced the good results reported in the literature in the last 20 years, opening a new perspective for the treatment of axial saphenous reflux in developing countries. Since this technology requires additional equipment and supplies, it is necessary to perform a detailed economic analysis of the financial impact of the endovenous technique on the public health system. Lower hospitalization rates and shorter work absence periods must be considered when assessing the cost of implementing the new techniques, since they may be beneficial to society.

**CONCLUSION**

Patients submitted to radiofrequency thermoablation had an occlusion rate, clinical recurrence and improvement in quality of life that were comparable to those of patients who underwent complete stripping of the saphenous vein. However, the patients who underwent radiofrequency thermoablation showed an improvement in quality of life, spent significantly less time at the hospital and were absent from work for a shorter period of time in comparison to those who underwent the traditional technique. Further studies should evaluate the cost-benefit ratio of these minimally invasive techniques.

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