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ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

Comparison of Patients Undergoing Stripping, Endovenous Laser Ablation and Radiofrequency Ablation for Chronic Venous Insufficiency

Kronik Venöz Yetmezlikte Stripping, Endovenöz Lazer Ablasyon ve Radyofrekans Ablasyon Uygulanan Hastaların Karşılaştırılması

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ÖZET

Amaç: Alt ekstremitelerdeki kronik venöz yetmezlik (KVY) için çeşitli tedavi yöntemleri bulunmaktadır. Bu çalışmada, KVY tedavisi için uygulanan stripping, radyofrekans ablasyon (RFA) ve endovenöz lazer ablasyon (EVLA) yöntemlerini, postoperatif birinci yıldaki nüks, derin ven trombozu (DVT) ve flebit komplikasyonları açısından karşılaştırmayı amaçladık.

Gereç ve Yöntemler: Kliniğimize 2018 ile 2023 yılları arasında başvuran, vena saphena magna (VSM) çapı 5,5 mm üzerinde ve reflü süresi 0,5 sn üzerinde olan ve bu hastalara stripping, RFA veya EVLA uygulanan 442 hasta retrospektif olarak çalışmaya dahil edildi. Hastaların, postoperatif birinci yıldaki renkli doppler ultrasonografi (RDUSG) sonuçları incelendi. Daha önce KVY nedeniyle operasyon geçirmiş veya DVT öyküsü olan, 18 yaş altı, hamile ve/veya emziren hastalar ile periferik vasküler hastalık semptomları olan hastalar çalışmadan hariç tutuldu.

Bulgular: Çalışmaya dahil edilen hastaların ortalama yaşı 46±12.3 yıl olup, bunların 266'sı (%60.2) kadın ve 176'sı ise (%39.8) erkek cinsiyetteydi. Çalışmaya dahil edilen 143 hastaya stripping prosedürü, 179 hastaya RFA ve 120 hastaya EVLA işlemi uygulandı. Endovenöz lazer ablasyon uygulanan hastalarda flebit ve DVT insidansı daha yüksek bulunmasına rağmen, bu fark istatistiksel olarak anlamlı değildi (sırasıyla p=0.166, 0.252). Postoperatif 1. yılda operasyon tipine göre RDUSG'de saptanan nüks analizi yapıldığında, RFA ve EVLA arasında istatistiksel olarak anlamlı bir fark bulunmazken, stripping prosedüründe RFA ve EVLA'ya kıyasla istatistiksel olarak daha düşük nüks oranı gözlendi (sırasıyla p=0.035, 0.002).

Sonuç: Bu çalışma, prosedürler arasında DVT oranlarında anlamlı farklılıklar bulmamıştır, ancak sonuçlar, stripping işleminin bir yıl sonra RFA ve EVLA'ya kıyasla daha düşük flebit oranlarına ve önemli ölçüde daha az rekürrenslere sahip olduğunu ortaya koymaktadır.

Anahtar Kelimeler: Kronik venöz yetmezlik Stripping, Endovenöz lazer ablasyon, EVLA, Radyofrekans ablasyon, RFA

ABSTRACT

Objective: Chronic venous insufficiency (CVI) of the lower limbs is managed with various treatment options. This study aimed to compare the outcomes of stripping, radiofrequency ablation (RFA), and endovenous laser ablation (EVLA) regarding recurrence, deep vein thrombosis (DVT), and phlebitis within the first postoperative year.

Materials and Methods: We retrospectively analyzed 442 patients treated between 2018 and 2023, all presenting with a vena saphena magna (VSM) diameter exceeding 5.5 mm and reflux time over 0.5 seconds. Patients underwent either stripping, RFA, or EVLA. Postoperative outcomes were evaluated using color Doppler ultrasound (CDUSG).

Results: The average age of participants was 46 ± 12.3 years, with 266 (60.2%) females and 176 (39.8%) males. The number of patients per procedure was as follows: 143 for stripping, 179 for RFA, and 120 for EVLA. While phlebitis and DVT were more frequent in the EVLA group, the differences were not statistically significant (p=0.166 for phlebitis, p=0.252 for DVT). However, recurrence rates at one year showed that stripping resulted in significantly fewer recurrences than RFA and EVLA (p=0.035 and p=0.002, respectively).

Conclusion: This study did not find significant differences in DVT rates among the procedures, but the results reveal that stripping had lower phlebitis rates and significantly fewer recurrences compared to RFA and EVLA after one year.

Keywords: Chronic venous insufficiency, Stripping, Endovenous laser ablation, EVLA, Radiofrequency ablation RFA

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INTRODUCTION

Chronic venous insufficiency (CVI) primarily affects the veins in the lower extremities, manifesting through a range of clinical symptoms. These symptoms can either present as cosmetic concerns or progress into serious conditions like venous ulceration (1). Varicose veins, a common sign of CVI, increase with age and are found in approximately 9% of men and 6% of women (2). Vena saphena magna (VSM) insufficiency is the most frequent venous reflux, affecting about 70% of CVI patients (3). CVI prevalence varies widely, ranging from 1% to 40% in women and 1% to 27% in men (4). This variance often stems from inadequate detection and assessment of venous insufficiency signs (5).

Several risk factors contribute to CVI, including age, family history of venous insufficiency, pregnancy, obesity, smoking, and prior history of deep vein thrombosis (DVT) (6, 7). The Clinical Etiological Anatomical Pathophysiological (CEAP) classification system is widely used for the standardized assessment and classification of CVI (8).

Treatment options for CVI include conservative approaches, along with more traditional methods like ligation and stripping, which have been extensively used over time. However, recent technological advancements have introduced catheter-based treatments such as radiofrequency ablation (RFA) and endovenous laser ablation (EVLA), which offer quicker recovery times, improved cosmetic results, and increased patient comfort. Despite these benefits, each treatment should be evaluated in terms of its potential complications and outcomes in clinical practice. For instance, a 2019 study reported a case where a guidewire migrated within the saphenous vein following an RFA procedure, necessitating a hybrid treatment (9). Given these advantages and risks, this study aims to compare the effectiveness of stripping, EVLA, and RFA treatments, along with their associated complications and VSM-related recurrences, evaluated through color Doppler ultrasonography (CDUSG) after one year.

MATERIALS AND METHODS

Patients treated at Necmettin Erbakan University Cardiovascular Surgery Clinic from 2018 to 2023, diagnosed with chronic venous insufficiency and presenting with a vena saphena magna (VSM) diameter greater than 5.5 mm and a reflux time over 0.5 seconds, were included if they underwent elective surgery and were assessed using lower extremity color Doppler ultrasonography (CDUSG) within the first postoperative year. Exclusion criteria included pregnancy, breastfeeding, age under 18, insufficient follow-up data, or a history of symptomatic peripheral artery disease, deep vein thrombosis (DVT), or pulmonary embolism.

Data from 442 patients were retrospectively analyzed and divided into three groups based on the procedure: RFA (n=179), EVLA (n=120), and stripping (n=143). Demographic information, preoperative CEAP classification (Table 1), VSM diameter, reflux duration, and recurrence of VSM-related varices were assessed at the first postoperative year using CDUSG. Additionally, DVT status on the treated limb was recorded.

The study received ethical approval from the Ethics Committee (Approval Date: 05.07.2024, No: 2024/5061), and informed consent was obtained from all patients in accordance with the Declaration of Helsinki.

Procedures

For RFA and EVLA, tumescent anesthesia was prepared with 1 liter of isotonic NaCl solution, mixed with 2% lidocaine (50 ml), 10 mEq $NaHCO_3$, and 1 ml of 1:1000 adrenaline, cooled to +4ºC.

Stripping: Under general anesthesia, the VSM was located and exposed via a 2 cm incision near the ankle. A 3 cm incision was made in the inguinal region, and the VSM branches were ligated. Stripping was then performed using a stripper.

Radiofrequency Ablation (RFA): With Doppler guidance, VSM was punctured medial to the knee, and a 7F sheath was inserted (ClosureFast [Medtronic Inc, Minneapolis, MN]). A fiber catheter was advanced to 1 cm from the sapheno-femoral junction, and tumescent anesthesia was applied around the VSM. Ablation was done by delivering 10-40 watts of power at 120°C for 10 seconds, with 7 cm between treated segments.

Endovenous Laser Ablation (EVLA): Under Doppler guidance, VSM was punctured medial to the knee, and the fiber catheter was positioned 1 cm from the sapheno-femoral junction. Following tumescent anesthesia, 1470 nm wavelength, energy was applied at 12 watts (8 sec/cm) per vascular segment, with a mean energy of 100 joules.

For all procedures, prominent varicose veins were marked and excised. Parva ligation was performed via a 3 cm incision in the popliteal fossa, with the vena saphena parva located 1.5-2 cm distal to the junction and double ligated. Post-procedurally, VSM closure, deep femoral vein, and sapheno-femoral junction patency were confirmed with CDUSG. Compression therapy with 20-30 mmHg stockings was recommended for 90 days.

Statistical Analysis

Statistical evaluations were carried out using SPSS software (version 26.0, SPSS Inc., Chicago, IL, USA). Continuous data were expressed as means with standard deviations (SD), while categorical variables were presented as frequencies and percentages. To compare qualitative data, Pearson's chi-square test and Fisher's exact test were applied. A p-value of less than 0.05 was considered statistically significant. Fisher's exact post-hoc test was used to further analyze significant group differences.

RESULTS

The average age of the 442 patients in the study was 46±12.3 years. Among them, 266 (60.2%) were female and 176 (39.8%) were male. In terms of treatment distribution, 143 patients underwent stripping, 179 had RFA, and 120 received EVLA. Most patients in the stripping, RFA, and EVLA groups were classified as stage C3 according to the CEAP clinical system (42.65%, 42.50%, and 40.23%, respectively) (Table 2).

Patient characteristics by procedure type, including limb treated and additional pane/parva ligation (Table 3). One-year recurrence rates for DVT, phlebitis, and VSM-associated varicose

Table 1. CEAP clinical classification (8)

Clinical stage		Clinical Status
C0		No visible or palpable signs of venous disease
C1		Telangiectasia or reticular veins
C2		Varicose veins
	C2r	Recurrent varicose veins
C3		Edema
C4		Changes in skin and subcutaneous tissue due to CVI
	C4a	Pigmentation or eczema
	C4b	Lipodermatosclerosis or white atrophy
	C4c	Corona filebectatica
C5		Healed ulcer
C6		Active venous ulcer
	C6r	Recurrent venous ulcer

CVI= Chronic Venous Insufficiency

Table 2. CEAP classification and preoperative VSM diameters of the patients

	RFA, n (%)	EVLA, n (%)	Stripping n (%)
C2	62 (34,64)	28 (23,34)	29 (20,29)
C3	72 (40,23)	51 (42,50)	61 (42,65)
C4	41 (22,90)	33 (27,50)	41 (28,67)
C5	4 (2,23)	8 (6,66)	12 (8,39)
Total Number of Patients	179	120	143
VSM mean diameter, SD(mm)	9,12±3,16	8,96±2,76	8,73±2,54

n=Number of patients, SD=standard deviation, RFA=Radiofrequency Ablation, EVLA=Endovenous Laser Ablation, VSM=Vena Saphena Magna

Table 3. Descriptive data by patient groups

		RFA, n (%)	EVLA, n (%)	Stripping, n (%)
Processed Party	Right	64 (%35,8)	31 (%25,8)	54 (%37,8)
	Left	57 (%31,8)	48 (%40,0)	48 (%33,6)
	Bilateral	58 (%32,4)	41 (%34,2)	41 (%28,7)
Pache Excision Status	Positive	133 (%74,3)	73 (%60,8)	130 (%90,9)
	Negative	46 (%25,7)	47 (39,2)	13 (%9,1)
Parva Ligation Status	Positive	12 (%6,7)	5 (%4,2)	10 (%7)
	Negative	167 (%93,3)	115 (%95,8)	133 (%93)

n=Number of patients, RFA=Radiofrequency Ablation, EVLA=Endovenous Laser Ablation

Table 4. Recurrence percentages of patients according to the type of surgery

		RFA, n (%)	EVLA, n (%)	Stripping, n (%)	p*
Recurrence	Positive	15 (%8,4)	15 (%12,5)	4 (%2,8)	0,012
	Negative	164 (%91,6)	105 (87,5)	139 (%97,2)	
Phlebitis	Positive	1 (%0,6)	4 (%3,3)	2 (%1,4)	0,166
	Negative	178 (%99,4)	116 (%96,7)	141 (%98,6)	
DVT	Positive	1 (%0,6)	2 (%1,7)	0 (%0)	0,252
	Negative	178 (%99,4)	118 (%98,3)	143 (%100)	

*=Chi Square, RFA= Radiofrequency Ablation, EVLA=Endovenous Laser Ablation, DVT=Deep Vein Thrombosis

Table 5. Pairwise comparisons according to the procedures performed on the patients

	Recurrence Positive	Recurrence Negative	Total Recurrence Positive	Total Recurrence Negative	p*
RFA vs	15 (%8,4)	164 (%91,6)			
EVLA	15 (%12,5)	105 (87,5)	30 (%10)	269 (%90)	0,245
EVLA vs	15 (%12,5)	105 (87,5)			
Stripping	4 (%2,8)	139 (%97,2)	19 (%7,2)	244 (%92,8)	0,002
RFA vs	15 (%8,4)	164 (%91,6)			
Stripping	4 (%2,8)	139 (%97,2)	19 (%5,9)	303 (%94,1)	0,035

*=Chi Square post-hoc, RFA= Radiofrequency Ablation, EVLA=Endovenous Laser Ablation

veins, as evaluated by CDUSG (Table 4). Although phlebitis and DVT rates were higher in the EVLA group, the differences were not statistically significant (p=0.166 and p=0.252, respectively).

Cross-tab analyses revealed no significant recurrence rate differences between RFA and EVLA, while the stripping method showed statistically lower recurrence rates (Table 5).

DISCUSSION

There are several treatment options for CVI, and both patient preferences and disease severity play crucial roles in choosing the appropriate method. Among these options, catheter-based treatments and surgical stripping are widely used today. Recent trends have shown a shift towards catheter-based procedures in CVI treatment. In our study, we compared catheter-based treatments (RFA, EVLA) with surgical stripping.

Dermody et al. (10) conducted a meta-analysis of 17 randomized control trials involving approximately 2,300 participants. The average age was 47.5 years, and around 70% of the cohort were female. No significant differences were found in DVT incidence between patients who underwent stripping, RFA, or EVLA, with rates of 0.4%, 0.5%, and 0.7%, respectively. Phlebitis rates were significantly lower in the stripping group compared to RFA and EVLA (3%, 5.5%, and 5.6%, respectively, p=0.003). Similarly, in our study, the mean age was 46 years, with around 60% female participants. Our results also showed no significant differences in postoperative DVT rates among the three groups. Although our postoperative phlebitis rates for stripping, RFA, and EVLA were lower than those in Dermody's study (1.4%, 0.6%, and 3.3%, p=0.166), these differences were not statistically significant. We believe this discrepancy may be due to the smaller patient population in our study.

Rajendran, S. et al. (11) found that 55% of patients had preoperative CEAP clinical stage scores of C2 and C3, while 11% were classified as C4. Helmy ElKaffas, K et al. (12) found that C2 and C3 patients made up 83%, while 15% were C4. In our study, around 75% of patients fell into the C2 and C3 classifications, while 25% were classified as C4. The higher proportion of C4 patients in our study likely reflects the tendency of patients to delay seeking treatment, possibly due to low awareness or viewing venous disease as purely cosmetic.

Studies have reported varying postoperative recurrence rates for patients undergoing vena saphena parva ligation and/or stripping. Rashid HI et al. (13) reported a recurrence rate of approximately 30% one year after parva ligation or stripping, while Hong KP et al. (14) found this rate to be around 4%. In our study, parva ligation was performed on 27 patients, and no recurrence or neovascularization was detected at the one-year follow-up with CDUSG. We attribute this difference to preoperative marking of the popliteoparval junction with CDUSG and performing ligation 2 cm distal to the junction, as well as the small number of patients who underwent parva ligation in our study.

Postoperative recurrence rates vary across studies. In a randomized controlled trial by Biemans, A.A. et al. (15), the recurrence rates for EVLA and stripping after one year were 11.5% and 11.8%, respectively, with no statistically significant differences between the methods. Another study involving 180 patients found 5.5% recurrence for both RFA and stripping after two years (12). In another study, the recurrence rate after RFA applied to 1273 extremities was reported as 3.69% (16). Furthermore, in a systematic review published in 2023, it was observed that the average follow-up period ranged between 112 days and 5 years and recurrence, defined as the development of new varicose veins, ranged from 29.8-91% in stripping, 40-81.6% in EVLA and 67.0% in RFA (17). A ten-year follow-up randomized controlled study found recurrence rates of 27% for stripping and 56% for EVLA, a statistically significant difference (p=0.002) (18). In our study, recurrence rates for stripping, RFA, and EVLA were 2.8%, 8.4%, and 12.5%, respectively, with statistically significant differences (p=0.012). Subgroup analysis showed no significant difference between RFA and EVLA in terms of recurrence, while stripping had significantly lower recurrence rates than both (p=0.245, 0.035, 0.002, respectively). Recurrences following catheter-based procedures may be due to recanalization or reflux into an overlooked accessory saphenous vein (19), while stripping-related recurrences are often attributed to technical errors or neovascularization during long-term follow-up (20). We believe that the lower recurrence rates with stripping in our study reflect the technical success of the procedure.

Our study has several limitations. Firstly, the retrospective design introduces the potential for bias during data collection. Additionally, the one-year follow-up period limits our ability to assess long-term outcomes, and further studies with longer follow-up are needed to better understand the lasting effects of these treatments. Another limitation is the lack of clinical benefit analysis, which prevents a full assessment of the impact on patient quality of life. Finally, the smaller number of patients, especially in the EVLA group, limits the generalizability of our results. Future large-scale, prospective studies are essential for validating our findings.

CONCLUSION

In this study, we observed no significant difference in the incidence of deep vein thrombosis (DVT) between RFA, EVLA and stripping procedures. However, the development of phlebitis was significantly less frequent in the stripping group, which may indicate that stripping is relatively safer in terms of inflammatory complications.

The most significant finding was that stripping was associated with lower recurrence rates. Assessment using colour doppler ultrasonography (CDUSG) at one year postoperative follow-up showed that stripping was associated with lower recurrence rates than RFA and EVLA. This finding is in agreement with other studies indicating that stripping is still an effective treatment modality for the long-term resolution of venous insufficiency. Although RFA and EVLA are more popular due to their minimally invasive properties, our results suggest that stripping, although more invasive, provides a more durable outcome in terms of recurrence.

From a clinical point of view, factors such as patient preferences, severity of disease, cosmetic concerns and long-

term recurrence risks should be taken into consideration when choosing between these treatment options. Although catheter-based treatments, RFA and EVLA, continue to be widely used, stripping should not be ignored as an effective treatment alternative, especially in patients at high risk of recurrence.

The findings of our study emphasise the importance of careful evaluation of patient characteristics when choosing treatment. However, considering its limitations such as limited sample size and retrospective design, further studies with larger patient groups and long-term follow-up are required to fully evaluate the long-term efficacy of these treatments.

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