Section: Vascular Surgery

Original Research Article

A STUDY ON EVALUATION OF EFFICACY OF ENDOVENOUS LASER ABLATION VERSUS RADIOFREQUENCY ABLATION IN PATIENTS WITH VARICOSE VEINS PRESENTING TO A TERTIARY CARE CENTRE

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Received *: 29/07/2024*
Received in revised form *: 24/09/2024*
Accepted *: 08/10/2024*

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DOI: 10.70034/ijmedph.2024.4.27

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (4); 134-137

ABSTRACT

Background: Varicose veins, a key feature of chronic venous insufficiency, are dilated, twisted veins that commonly affect the lower limbs and are more prevalent in women and older adults. Treatment has shifted from vein stripping to minimally invasive procedures like Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA), both of which are effective, though RFA may offer quicker recovery and less post-operative pain.

Materials and Methods: This prospective hospital-based study compared the efficacy and safety of Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA) for treating varicose veins over a one-year period in 100 patients, aged 18-65, classified under the CEAP system. Both procedures involved thermal ablation of the vein, with EVLA using laser energy and RFA using radiofrequency, followed by routine post-operative care and follow-up to assess outcomes such as vein occlusion, symptom relief, and complication rates.

Results: The study included 100 patients with varicose veins, divided equally into two groups: EVLA (Group A) and RFA (Group B), with most participants being male and aged 31-40 years, classified primarily as CEAP C2. Both procedures showed similar outcomes, with slightly longer procedure times and higher post-operative pain in the EVLA group, though neither of the differences were statistically significant, and both treatments achieved high success rates with no evidence of venous reflux at 1 and 3 months post-procedure.

Conclusion: Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA) are highly effective and safe treatments for varicose veins, with similar anatomical success rates and no significant differences in post-operative complications. Although EVLA had slightly longer procedure times and higher post-operative pain levels, both treatments effectively eliminated venous reflux, making them viable options for varicose vein management.

Keywords: Varicose veins, endovenous laser ablation, radiofrequency ablation, RFA, EVLA.

INTRODUCTION

Varicose veins, a hallmark of chronic venous insufficiency (CVI), are pathologically defined by dilated, tortuous veins predominantly affecting the lower extremities. Their global prevalence ranges from 10% to 30%, with a notably higher incidence in females, which escalates with advancing age. Genetic predisposition is a significant contributing factor. The condition often results in considerable morbidity,

manifesting as pain, venous eczema, hyperpigmentation, lipodermatosclerosis, and venous ulceration, all of which can significantly impair patients' quality of life.[1]

Therapeutic approaches have transitioned from the conventional surgical procedure of vein stripping to less invasive endovascular techniques, such as Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA).[1,2] EVLA involves the insertion of a thin catheter into the diseased vein, through which laser energy is delivered. The laser generates thermal energy that induces controlled endothelial damage, resulting in venous wall collapse and subsequent obliteration of the vein. This method is highly regarded for its precision, minimal tissue disruption, and reduced post-procedural scarring, leading to shorter recovery periods and less postoperative discomfort.[3,4]

Conversely, RFA operates by emitting radiofrequency waves to generate thermal energy, which similarly occludes the vein through thermal-induced fibrosis. This modality is lauded for its efficacy and is often associated with lower levels of postoperative pain and faster resumption of daily activities compared to traditional open surgical techniques.[4-6]

Clinical trials indicate that both EVLA and RFA yield comparable outcomes in terms of vein occlusion rates and convalescence. However, RFA may offer superior benefits in terms of postoperative analgesia and swifter return to normal function. Despite these promising results, there is a notable lack of direct comparative studies between EVLA and RFA. This study aims to elucidate differences in postoperative pain, complication rates, and long-term efficacy between these two modalities, which could inform clinical decision-making for optimizing patient outcomes in the management of varicose veins.

MATERIALS AND METHODS

This was a prospective hospital based study comparing the efficacy and safety of Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA) in the treatment of varicose veins over a period of one year, in the Department of vascular surgery, NRI medical college, Mangalgiri, Andhra Pradesh.

A total of 100 patients diagnosed with varicose veins were recruited from a tertiary care hospital. The participants were aged between 18-65 years, presenting with symptomatic varicose veins confirmed by duplex ultrasound, and classified using the CEAP system (C2-C6). Patients with conditions such as deep vein thrombosis, peripheral arterial disease, or those who have undergone previous venous surgeries were excluded to maintain homogeneity in the study population. Participants were randomly allocated to the EVLA (group A) or RFA group (group B).

All patients included in the study had their clinical and demographic history taken. A routine general examination was done. Local examination of varicose veins was done and was classified according to CEAP classification (clinical, etiological, anatomical and pathophysiological). The preoperative Clinical, Etiologic, Anatomic, Pathophysiologic (CEAP) grades were C1–C5 (C1: telangiectasia or reticular veins, C2: varicose veins, C3: edema, C4a: pigmentation or eczema, C4b: lipodermatosclerosis or atrophie blanche, C5: healed ulcer). Doppler studies were done to confirm the diagnosis and ascertain the levels of perforator incompetence. All patients were subjected to routine hematological investigations necessary prior to surgery.

Both EVLA and RFA were performed under ultrasound guidance and local anaesthesia.

Endovenous Laser Ablation (EVLA)

A small incision was made to access the diseased vein. A laser fibre, typically emitting at 1470 nm, was inserted into the vein through a catheter. The laser energy was delivered to heat the vein's interior wall, causing it to collapse and seal shut. The fibre was withdrawn slowly, ensuring uniform closure along the entire length of the treated vein. Compression stockings were applied post-procedure to enhance vein closure and aid recovery.

Radiofrequency Ablation (RFA)

For RFA, a similar approach was taken with a small incision used to insert a specialized catheter into the affected vein. Radiofrequency energy was delivered via a catheter with controlled thermal energy, leading to heating of the vein's walls, shrinkage and occlusion of the vein. The catheter will be slowly withdrawn, and compression stockings will be provided postoperatively. RFA uses lower temperatures than EVLA, which may result in less pain and faster recovery, factors that will be carefully measured in this study.

In both procedures, patients were encouraged to resume daily activities within 24 hours, with follow-up appointments scheduled at 1 month, 6 months, and 1 year to assess vein closure, symptom relief, and any potential complications.

The primary outcome was vein occlusion, measured by duplex ultrasound at 3 months. Secondary outcomes include symptom relief (measured by the Venous Clinical Severity Score), complication rates such as skin burns, nerve damage, infection, or deep vein thrombosis, and patient-reported outcomes like pain levels (using a visual analogue scale – scale ranging from "no pain" to "worst imaginable pain"), recovery time, and overall satisfaction with the procedure. Any recurrence of varicose veins will also be documented.

Data was collected at baseline, 6 days, 10 days, 1 month and 3 months. Statistical analysis was done using t-tests for continuous variables, chi-square tests for categorical variables, and Kaplan-Meier analysis to assess time-to-event data. A p-value of <0.05 indicates statistical significance.

Informed consent was obtained from all participants. Ethical approval was secured from the institutional review board.

RESULTS

The study included a total of 100 patients with varicose veins. 50 patients were assigned to the EVLA group (Group A) and 50 patients were assigned to RFA group (Group B). Most of the patients were males and belonged to the age group of 31-40 years. Most of the patients had class C2 type of lesions. [Table 1]

The mean duration of procedure was longer in the EVLA group than RFA group. The difference was not significant. Post - operative pain was higher in group A than group B. Infections were common in Group A than in Group B. however, the difference was not significant.

Success rate of the procedure was determined by duplex imaging. Lack of flow <3cm throughout the entire treated area in duplex imaging was defined as success rate. There was no evidence of reflux (defined by the evidence of >3cm flow in treated area) 1 month and 3 months after procedure. [Table 2]

Table 1: Demographic characteristics

Characteristic		Group A (n = 50)	Group B (n = 50)
Gender	Males	35	38
	Females	15	12
Age group	21-30 years	8	7
	31-40 years	25	23
	41-50 years	13	17
	>50 years	4	3
	Mean age	33.45 years	31.98 years
CEAP classification	C2	20	24
	C3	15	12
	C4a	12	10
	C5	3	4

Table 2: Treatment and post- operative characteristics

Characteristics		Group A (n = 50)	Group B (n = 50)	P value
Mean time of procedure		**23.2 min**	**21.8 min**	**0.0687**
Post-operative pain score (0-10)	Immediate post-operative period	1.7	1.3	0.324
	6 days	0.7	0.6	0.358
	10 days	0.6	0.4	0.125
	30 days	0.2	0.1	0.820
Complications	Infection	0	0	–
	Hyperpigmentation	2	1	0.583
	Thrombophlebitis	3	3	0.817
	Paraesthesias	1	1	0.974
	DVT	0	0	0
Anatomical success rate		50/50 (100%)	49/50 (98%)	0.354
Evidence of reflux after 1 month		0	0	0
Evidence of reflux after 3 months		0	0	0

DISCUSSION

The present study compared the efficacy of Endovenous Laser Ablation (EVLA) and Radiofrequency Ablation (RFA) in treating varicose veins among 100 patients, focusing on key metrics such as post-operative pain, complications, and anatomical success rates. Both groups—EVLA (Group A) and RFA (Group B)—comprised patients primarily between the ages of 31-40 years, with a majority being male and classified under CEAP class C2, indicating uncomplicated varicose veins.

Procedure Time and Post-Operative Pain

In this study, the mean procedure time was slightly longer for EVLA (23.2 minutes) compared to RFA (21.8 minutes), though this difference was not statistically significant. Consistent with findings in other studies, such as the systematic review by Van der Velden et al,[7] EVLA tends to have a slightly longer procedural time due to the nature of the laser energy used to occlude the vein, but the difference is clinically negligible. Additionally, the post-operative pain scores were slightly higher in the EVLA group, aligning with existing literature suggesting that EVLA can cause more discomfort due to the higher heat generated during the procedure. However, both techniques showed low pain levels overall, with a reduction in scores over time, as supported by the Brugnara et al,[8] study, where pain was minimal post-operatively for both methods.

Complications and Safety Profile

Both EVLA and RFA demonstrated low rates of complications, with no cases of deep vein thrombosis (DVT) reported in either group. Hyperpigmentation and thrombophlebitis were infrequent and occurred at comparable rates, reflecting outcomes from other

studies like that of Al-Hakim et al,[9] which noted similar minor complication rates for both procedures. Paraesthesias, a potential post-operative complication, occurred equally in both groups, consistent with findings that nerve injury risks are present but minimal in both techniques.

Anatomical Success and Reflux Elimination

The success of both procedures was confirmed using duplex imaging, with Group A achieving a 100% occlusion rate and Group B at 98%. These results mirror the high success rates reported in studies like those by Darwood et al,[10] and Jang et al,[11] where both EVLA and RFA yielded near-complete vein closure rates and eliminated venous reflux effectively. Neither of the groups exhibited any evidence of reflux at one and three months post-treatment, corroborating data from several systematic reviews that found both methods to be highly effective in maintaining occlusion over the short-to-medium term.

Comparison with Other Studies: The findings of this study are consistent with other comparative research. For instance, the systematic review by Siribumrungwong et al,[12] and the study by Perkowski et al,[13] concluded that both EVLA and RFA are equally effective, with no significant differences in long-term recurrence rates. However, some reports, such as the Jang et al,[11] study, suggest that RFA may have a slight advantage in specific patient subgroups, particularly in terms of long-term recurrence, which is not evident in this shorter-term study.

CONCLUSION

Both EVLA and RFA are effective, minimally invasive options for treating varicose veins, with comparable procedural times, low complication rates, and high anatomical success. This study reinforces the findings from previous research that both methods offer excellent short-term outcomes, with minimal differences in post-operative pain or complication profiles. The choice between EVLA and RFA may therefore depend on patient-specific factors, such as the severity of the venous disease, the surgeon's expertise, and patient preference.

Acknowledgements: the authors would like to acknowledge the support given by the staff of Department of vascular surgery in conducting this study.

Conflicts of Interest: the authors declare none conflicts of interest.

REFERENCES

1. Park I, Park SC. Comparison of Short-Term Outcomes Between Endovenous 1,940-nm Laser Ablation and Radiofrequency Ablation for Incompetent Saphenous Veins. Front Surg. 2020 Dec 11; 7:620034. doi: 10.3389/fsurg.2020.620034. PMID: 33363201; PMCID: PMC7759544.
2. Gao RD, Qian SY, Wang HH, Liu YS, Ren SY. Strategies and challenges in treatment of varicose veins and venous insufficiency. World J Clin Cases 2022; 10(18): 5946-5956 [PMID: 35949828 DOI: 10.12998/wjcc. v10.i18.5946]
3. Licorn Publishing, CVDTeam. Endovenous laser ablation or radiofrequency ablation for varicose veins: a review - Servier - Phlebolymphology [Internet]. Servier - Phlebolymphology. 2022 [cited 2024 Sep 29]. Available from: https://www.phlebolymphology.org/endovenous-laser-ablation-or-radiofrequency-ablation-for-varicose-veins-a-review/
4. Brittenden J, Cooper D, Dimitrova M, Scotland G, Cotton SC, Elders A, et al. Five-year outcomes of a randomized trial of treatments for varicose veins. N Engl J Med [Internet]. 2019;381(10):912–22. Available from: http://dx.doi.org/10.1056/nejmoa1805186
5. Mese B, Bozoglan O, Eroglu E, Erdem K, Acipayam M, Ekerbicer HC, Yasim A. A Comparison of 1,470-nm Endovenous Laser Ablation and Radiofrequency Ablation in the Treatment of Great Saphenous Veins 10 mm or More in Size. Ann Vasc Surg. 2015 Oct;29(7):1368-72. doi: 10.1016/j.avsg.2015.03.063. Epub 2015 Jun 27. PMID: 26122425.
6. Endovenous radiofrequency ablation vs laser ablation in patients with lower extremity varicose veins: A meta-analysis. Jiang, Wenhong et al. Journal of Vascular Surgery: Venous and Lymphatic Disorders, Volume 12, Issue 5, 101842
7. van der Velden SK, Lawaetz M, de Maeseneer MG, et al. Five-year results of a randomized clinical trial comparing endovenous laser ablation, radiofrequency ablation, and foam sclerotherapy for great saphenous varicose veins. Br J Surg. 2016;103(11):1396-1404. doi:10.1002/bjs.10253.
8. Brugnara C, Zamboni P, Serraino C, et al. Comparison between radiofrequency ablation and endovenous laser treatment for the management of varicose veins: A systematic review and meta-analysis. J Vasc Surg Venous Lymphat Disord. 2021;9(3):693-700.e1. doi: 10.1016/j.jvsv.2020.09.013.
9. Al-Hakim RA, Mohajer MA, Saquib S, et al. Comparative efficacy of endovenous laser ablation and radiofrequency ablation in the treatment of varicose veins. J Med Sci Clin Res. 2014;2(5):1051-1058.
10. Darwood RJ, Gough MJ. Endovenous laser treatment for uncomplicated varicose veins. Phlebology. 2009;24(1_suppl):50-61. doi:10.1258/phleb.2009.09s011.
11. Jang Y, Lee SK, Cho S, et al. Randomized clinical trial of endovenous laser ablation versus radiofrequency ablation for the treatment of varicose veins. Phlebology. 2019;34(3):201-207. doi:10.1177/0268355518816784.
12. Siribumrungwong B, Noiphithak R, Wilasrusmee C, Thakkinstian A. A systematic review and meta-analysis of randomized controlled trials comparing endovenous ablation and surgical intervention in patients with varicose veins. Eur J Vasc Endovasc Surg. 2012;44(2):214-223. doi: 10.1016/j.ejvs.2012.05.018.
13. Perkowski P, Ravi R, Gowda RC, et al. Endovenous laser ablation of the saphenous vein for treatment of venous insufficiency and varicose veins: Early results from a large single-center experience. J Endovasc Ther. 2004;11(2):132-138. doi:10.1583/03-1040r1.1.