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Endovenous Laser Treatment (EVLT) for Chronic Venous Disease of Lower Limbs at a Tertiary Care Center: A Descriptive Study

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ABSTRACT

Background: Chronic venous disease (CVD) in the lower limbs, mostly caused by reflux in the great saphenous vein, has typically been treated through surgical stripping. Recently, Endovenous Laser Treatment (EVLT) has come forward as a minimally invasive option, offering lower postoperative morbidity. This study aims to assess the short and midterm outcome of EVLT.

Methods: This cross-sectional descriptive research involved 64 adult patients suffering from CEAP C2–C6 chronic venous insufficiency who underwent EVLT at Nepal Police Hospital between March 2024 and February 2025. Patients were assessed using duplex Doppler ultrasound and treated with a 1470 nm diode laser alongside perivenular tumescent anesthesia. Outcomes were evaluated both clinically and sonographically one day, two weeks, and three months following the procedure.

Results: The average age of patients was 43.7 years, with a predominance of males (73.4%). The great saphenous vein was treated in 95.2% of limbs, while the small saphenous vein (14.5%) and incompetent perforators (30%) were treated less frequently. All patients reported pain and visible varicose veins; however, night cramps, bleeding, and skin discoloration were observed less often. Common complications included paresthesia (43.4%), superficial thrombophlebitis accompanied by bruising (10.8%), pain (6%), burns (3.6%), and recanalization (1.2%), with no incidents of deep vein thrombosis.

Conclusion: EVLT is a safe, effective, and minimally invasive option for addressing chronic venous insufficiency, demonstrating high success rates and few complications. Continuous follow-up is essential to detect any rare recanalization. It is advisable to conduct larger studies with extended follow-up to confirm these results.

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INTRODUCTION

Chronic Venous Disease (CVD) of the lower limbs is a progressive vascular disorder caused by venous hypertension, valvular dysfunction, and venous wall remodeling.[1] It manifests as varicose veins, edema, skin changes, and venous ulcers, significantly impacting the quality of life.[2] Conventionally, varicose veins due to SFJ incompetence along the GSV were treated with ligation of the GSV and stripping.[3] However, after the introduction of thermal ablation (Laser or RFA) of the vein, the procedure has become popular due to obvious reasons like reduced postoperative pain, shorter recovery time, and a lower complication rate.[4,5]

Endovenous Laser Treatment (EVLT) is a minimally invasive technique.[6] It delivers laser energy into the incompetent vein, causing controlled endothelial

damage and vein wall fibrosis, leading to vein closure.[7] This process reduces venous reflux, restores normal hemodynamics, and alleviates symptoms more effectively than traditional surgical interventions.[8] The evaluation of outcomes of EVLT is done through the examination for DVT, ablation of the veins or recanalization, disappearance of varicosity, skin color changes, or development of an ulcer.[9,10] This study assessed the effectiveness and patients' short- and mid-term outcomes of EVLT for chronic venous disease of the lower limbs.

METHODS

This is a cross-sectional descriptive study aimed at assessing the clinical outcomes of Endovenous Laser Treatment (EVLT) in patients diagnosed with chronic venous disease affecting the lower limbs. The study sought to assess treatment effectiveness, recognize complications, and monitor recurrence during the follow-up period at the Department of Radiodiagnosis at Nepal Police Hospital in Kathmandu from March 2024 to February 2025.All clinical evaluations, procedures, and follow-up assessments were performed at the hospital's specialized Varicose Vein Clinic.

The study population included adult patients aged 18 years and older with chronic venous disease of the lower limbs categorized as CEAP class C2 to C6. Patients who consented to undergo EVLT were eligible for participation. Those were excluded if they had acute deep vein thrombosis (DVT), significant peripheral arterial disease, were pregnant, or chose not to provide informed consent. A total of 64 patients participated in the study. The sample size was calculated based on feasibility and the anticipated patient flow during the one-year study period. This number was deemed adequate for conducting a meaningful descriptive analysis of treatment outcomes and procedural complications using a total sampling method. Every patient who met the inclusion criteria and sought treatment during the study timeframe was enrolled consecutively. This method ensured that all eligible patients were included, enhancing the accuracy and representativeness of the data.

Data were collected using a structured proforma. Information was obtained from clinical examinations, interviews with patients, and a review of hospital records. Preoperative assessment involved a duplex Doppler sonographic evaluation to check for deep vein thrombosis and to identify venous reflux at key anatomical locations such as the saphenofemoral junction (SFJ), saphenopopliteal junction (SPJ), and perforator veins. Individualized treatment plans were developed based on Doppler results. The day of the procedure, venous access was established under ultrasound guidance, and EVLT was executed utilizing a 1470 nm diode laser with either 400- or 600-micrometer fibers. Tumescent anesthesia with normal saline was administered around the vein. Energy settings were adjusted according to vein characteristics: 7–8 watts for the great saphenous vein (GSV) and 6 watts for the below-knee GSV, small saphenous vein (SSV), and perforators. Post-procedure care included application of compression with elastic bandages, intravenous antibiotics, analgesics, and subcutaneous enoxaparin. Compression stockings were placed starting from the second postoperative day. Follow-up assessments occurred the day after the procedure, at two weeks, and at three months utilizing Doppler sonography to assess treatment success, complications, and vein closure. For cases where local anesthesia was used, a tumescent solution containing lignocaine, sodium bicarbonate, and saline was employed for perivenular infiltration.

The gathered data were initially inputted into Microsoft Excel and subsequently analyzed with SPSS version 21.0. Descriptive statistical methods were employed to interpret clinical outcomes, success of the procedure, complications, and rates of recurrence. Ethical approval for the study was obtained from the Institutional Review Committee of Nepal Police Hospital (Reference No. 57). All participants provided written informed consent following a comprehensive explanation of the study's objectives, procedures, risks, and benefits. Participation was voluntary, and patient data confidentiality was maintained throughout the research.

RESULTS

Patient demographics

Among the 64 patients included in the study, ages ranged from 18 to 69 years, demonstrating that chronic venous insufficiency affects a broad adult population. Of these, 47 were male and 17 were female, indicating a higher prevalence of the condition among males in this cohort. The demographic characteristics of the patients, along with the number of affected limbs. (Table:1)

Table 1. Patient demographics

Variables		Number (Percentage)
Mean age		43.7 ±11.8 years
Gender	Male	47(73.4%)
	Female	17(26.6%)
Lower limbs involved	Right	23 (35.9%)
	Left	22 (34.4%)
	Bilateral	19 (29.7%)

CEAP classification

Before undergoing Endovenous Laser Therapy (EVLT), all patients were classified according to the CEAP system. Every individual with primary (Ep) etiology and venous

reflux (Pr) as the underlying pathophysiology was treated. Only those limbs exhibiting clinical symptoms (C2) were selected to receive EVLT. **(Table:2)**

Table 2. Clinical classification of the studied participants

Clinical category	No of affected limbs (Percentage)
C0 No visible or palpable signs of venous disease	0 (0 %)
C1 Telangiectasias (spider veins) or reticular veins	0 (0 %)
C2 Varicose veins (diameter ≥ 3 mm)	55 (66.3 %)
C3 Edema (swelling) without skin changes	4 (4.8 %)
C4 Skin changes – pigmentation or eczema lipodermatosclerosis or atrophie blanche	16 (19.3 %)
C5 Healed venous ulcer	3 (36%)
C6 Active venous ulcer	5 (6.0 %)

Anatomical classification

Anatomically, the great saphenous vein (GSV) was the most frequently treated, involved in 79 limbs (95.2 %), while the anterior accessory GSV (A-GSV) was treated in just 2 limbs (2.4 %). The small saphenous vein (SSV) accounted for treatments in 12 limbs (14.5 %). Of the 25 limbs with incompetent perforators, only 11 underwent direct ablation. The remaining 14 perforators were not treated individually, as they communicated with saphenous segments (GSV or SSV) that had already been ablated. **(Table:3)**

Table 3. Anatomical classification of the studied patients.

Veins	Number of affected limbs (Percentage)
GSV	79 (95.1 %)
A. GSV	2 (2.41)
SSV	12 (14.4%)
Perf	25 (30 %)

GSV- Great saphenous vein, aGSV-Accessory great saphenous vein, SSV-Small saphenous vein, Perf-Incompetent perforators

Symptomatology of the patients

In our study of 83 ablated limbs, all patients (100 %) presented with pain and visible varicose veins, underscoring these as universal clinical symptoms in symptomatic varicose vein cases. Night cramps were reported in 5 limbs (6.0 %), bleeding occurred in 3 limbs (3.6 %), and skin discoloration was present in 24 limbs (28.9 %), illustrating the typical range of moderate to mild venous manifestations alongside the primary symptoms. **(Table:4)**

Table 4. Patient's main presenting symptoms

Symptoms	Number of affected limbs (Percentage)
Pain	83 (100 %)
Visible varicose veins	83 (100 %)
Night cramps	5 (6%)
Bleeding	3 (3.6 %)
Skin discoloration	24 (28.9 %)

Post-operative complications

Patients were scheduled for follow-up visits at one day, two weeks, and three months post-EVLT. At three months post-procedure, sensory changes were the most frequently observed complications, with paresthesia affecting 36 limbs (43.4 %)**.** This was followed by superficial thrombophlebitis with bruising in 9 limbs (10.8 %)**.** Less common complications included post-procedural pain in 5 limbs (6.0 %)**,** skin burns in 3 limbs (3.6 %)**,** and recanalization in 1 limb (1.2 %)**.** Notably, no cases of deep vein thrombosis (DVT) were recorded. **(Table:5)**

Table 5. Post-operative complications

Complications	Number of affected limbs (Percentage)
Paresthesia	36 (43.4%)
Thrombophlebitis with bruising.	9 (10.8%)
Recanalization	1 (1.2 %)
Pain	5 (6 %)
Burn	3 (3.6 %)
DVT	0

DISCUSSION

This study evaluated the effectiveness and safety of Endovenous Laser Treatment (EVLT) for chronic venous insufficiency (CVI) of the lower limbs involving 64 participants, with an average age of 43.7 years (ranging from 18 to 69), predominantly comprising males (73.4%). The affected limbs were predominantly right (35.9%), left (34.4%), and bilateral (29.7%). The majority of limbs were categorized as CEAP C2

(66.3%), with fewer instances in C4 (19.3%), C6 (6.0%), C5 (3.6%), and C3 (4.8%). The great saphenous vein was treated in 95.2% of cases, followed by the small saphenous vein at 14.5% and incompetent perforators at 30%. All participants experienced pain and visible varicose veins, while night cramps, skin discoloration, and bleeding were reported less frequently. Post-surgical complications included paresthesia (43.4%), superficial thrombophlebitis accompanied by bruising (10.8%), pain (6%), burns (3.6%), and recanalization (1.2%). There were no recorded instances of deep vein thrombosis following EVLT.

Most interventions in this study focused on the great saphenous vein (GSV), which is well-recognized as the main vessel involved in venous reflux and chronic venous insufficiency (CVI).[11,12] The GSV frequently serves as the primary source of reflux due to valve failure, making it the key target for endovenous procedures. Alongside treatment for the GSV, certain patients also needed ablation of the small saphenous vein (SSV), incompetent perforators, and accessory veins, highlighting the intricate and varied nature of venous issues. These results underscore the critical role of thorough preoperative duplex Doppler ultrasonography in accurately assessing venous structure and reflux patterns, enabling personalized treatment strategies to enhance clinical results.[13,14] Correctly identifying all refluxing segments is vital to achieving complete ablation and minimizing the chances of recurrence.[15]

The application of perivenular tumescent anesthesia, commonly made up of a blend of normal saline and lignocaine, effectively safeguarded surrounding tissues throughout the endovenous laser treatment (EVLT) procedure. Tumescent anesthesia not only shields nerves and skin from heat damage but also compresses the vein, which promotes efficient laser energy application and lessens postoperative discomfort.[16,17] Patients in this group typically left the hospital within two days after the procedure, reflecting the minimally invasive characteristics and swift recovery associated with EVLT. Complications were mostly minor and temporary, with the most frequently reported issues being paresthesia, ecchymosis, superficial thrombophlebitis, and rare minor burns .[18,19] Notably, there were no instances of deep vein thrombosis (DVT) reported, aligning with the low rate of thromboembolic occurrences noted in similar EVLT studies.[20] However, one patient did experience recanalization that necessitated repeat ablation, highlighting the importance of attentive postoperative monitoring to identify and address treatment failures promptly.[15]

After two-weeks of EVLT, 11 limbs exhibited remaining varicosities—9 in the GSV area and 2 in the SSV area—all of which were effectively addressed with ultrasound-guided foam sclerotherapy utilizing 2% sodium tetradecyl sulfate. This method is in line with published findings indicating approximately 93% primary occlusion at two weeks after foam sclerotherapy, with residual varices frequently managed as a secondary intervention.[18,19] By the three-month follow-up, all limbs with CEAP C6 active venous ulcers (n=6) had fully healed, whereas those with skin discoloration showed over 50% improvement—consistent with research indicating more than 65% ulcer healing within six weeks after foam therapy.[13,20]

These findings are consistent with an expanding collection of international studies supporting EVLT as a secure, efficient, and minimally invasive option for treating CVI.[11,18] EVLT presents several benefits compared to conventional surgical stripping, including decreased postoperative discomfort, shorter recovery times, and improved cosmetic results.[12,17] Nonetheless, the limitations of the study comprise a relatively small sample size and a brief follow-up period, which limits the evaluation of the long-term effectiveness and durability of the procedure. Future investigations involving larger patient cohorts and lengthened observation durations are necessary to better understand the sustainability of EVLT outcomes and to identify factors that may predict recurrence.[14,20]

Limitations of this study include the small sample size and relatively short follow-up period, which may limit the assessment of long-term efficacy and recurrence rates. Additionally, the single-center design may affect the generalizability of the findings to broader populations. In summary, EVLT has demonstrated itself as a successful and well-accepted treatment alternative for chronic venous insufficiency in this tertiary care environment, illustrating its effectiveness in enhancing patient outcomes and quality of life.

CONCLUSION

Endovenous Laser Treatment (EVLT) is a secure, efficient, and minimally invasive approach for treating chronic venous insufficiency in the lower extremities with enhanced outcomes, lower morbidity, and shorter hospital stay than conventional surgery. However, long-term follow-ups are crucial to identify and address uncommon cases of recanalization.

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CONFLICT OF INTEREST

None

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