

Comparison of Endovenous Laser Therapy and Traditional Surgical Techniques in The Management of Varicose Veins

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Abstract

Background: Varicose veins are a common chronic venous disorder characterized by tortuous, dilated superficial veins of the lower limbs, often resulting in pain, swelling, and ulceration. Conventional surgical treatment, such as high ligation and stripping, has been the traditional management method for decades. However, with advancements in minimally invasive techniques, Endovenous Laser Ablation (EVLA) has emerged as an effective alternative offering improved recovery and reduced morbidity. This study aimed to compare the outcomes of EVLA with conventional surgery in the treatment of varicose veins. **Material and Methods:** A prospective comparative study was conducted over a period of 10 months in the Department of General Surgery. A total of 80 patients diagnosed with primary varicose veins were included and randomly divided into two groups of 40 each. Group A underwent EVLA, while Group B received conventional surgery (high ligation and stripping of the long saphenous vein). Patients were evaluated preoperatively and postoperatively for operative time, hospital stay, postoperative pain (measured using Visual Analog Scale), complications, recurrence, and time to return to normal activity. **Results:** The mean operative time was significantly shorter in the EVLA group (52.6 ± 8.4 minutes) compared to the conventional group (70.3 ± 10.7 minutes). The mean postoperative pain score on day 1 was 3.2 ± 1.0 in Group A and 6.1 ± 1.3 in Group B ($p < 0.001$). Hospital stay duration was markedly reduced in the EVLA group (1.2 ± 0.4 days) compared to the conventional group (3.8 ± 0.7 days). Postoperative complications such as wound infection and bruising were less frequent in the EVLA group (10%) than in the conventional group (27.5%). Patients who underwent EVLA returned to normal daily activities within an average of 7.8 ± 2.3 days, whereas those who underwent conventional surgery took about 15.4 ± 3.1 days. **Conclusion:** EVLA offers a safe, effective, and minimally invasive alternative to conventional surgery for the treatment of varicose veins. It is associated with less postoperative pain, shorter hospital stay, fewer complications, and faster recovery, making it a preferred choice for most patients. However, long-term follow-up is necessary to evaluate recurrence rates and durability of the procedure compared to traditional surgery.

Keywords: Conventional surgery, Endovenous laser ablation, High ligation and stripping, Minimally invasive therapy, Varicose veins.

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INTRODUCTION

Varicose veins are common chronic vascular diseases, characterized by dilated, irregular shaped, superficial veins of the lower limbs and are more common in females than males and in those over 40 years of age.^[1-4]

Risk factors include prolonged standing or sitting, obesity, pregnancy, family history and previous history of DVT. The patient may have leg pain, heaviness, oedema, nocturnal cramps, itching, skin hyper pigmentation, eczema and, later on, venous ulcers that significant impact his or her quality of life and productivity.^[4]

Surgical procedures in particular, high ligation and stripping of the long saphenous vein have been the primary methods for treating varicose veins for decades. While this technique is highly effective in removing diseased veins and stopping the vein from getting worse, it also has its cons: discomfort after surgery, bruising, hematoma, nerve damage, longer hospital stay, postponing return to normal life and surgical scars.^[5] Recurrence rates of between 5% and 30% have been reported, mainly due to neovascularisation or incomplete removal of unsatisfactory incompetent veins.^[6]

The development of the new vascular surgeries and low

invasive techniques has made Endovenous Laser Ablation (EVLA) a safe and effective alternative to conventional surgery. EVLA utilizes laser energy that is sent into the vein through a catheter, causing thermal injury to the lining of the vein and ultimately causing vein occlusion.^[7]

The process is performed under local anesthesia and ultrasound guidance making it less invasive and more tolerable. Studies show EVLA to be associated with decreased postoperative pain, shorter hospitalizations, faster recovery, and better cosmetic outcomes. Further, the quick return to normal activities and work makes EVLA an attractive option for patients who wish to have the least disruptive treatment possible.^[8,9]

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Comparative studies to evaluate the short and long-term results of EVLA versus conventional surgery are important for use in evidence-based clinical decisions, especially in complex situations, if a technological advantage will not be investigated or if cost is a factor. Operational time, postoperative pain, complication rates, hospital stays, recurrence, and patient satisfaction are all factors that provide valuable data to compare the advantages of each technique. This study sought to analyze the results of EVLA versus surgery in the primary varicose veins patient population, focusing on the operative outcomes, post-operative recovery profile, comorbid conditions, and early outcomes of the procedures. The aim of this study is to critically review these parameters in a systematic manner and provide evidence to select the best treatment approach for varicose vein patients, to ensure efficacy, safety and patient-centered outcomes.

Aims and Objectives

To compare the outcomes of EVLA with conventional surgery in the treatment of varicose veins.

MATERIALS AND METHODS

This was a prospective comparative study carried out in the Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam for 10 months. Patients with primary varicose veins of the LL, diagnosed clinically and confirmed by Duplex U/S, were studied. The study design was approved by the Institutional Ethics Committee and informed written consent was obtained from all the participants before enrolment in the study.

80 patients that met inclusion criteria were enrolled to be randomly divided into 2 groups of 40 patients. Group A received EVLA and Group B received conventional surgery, which included high ligation and stripping of long saphenous vein. To maintain uniformity and to minimize the confounding, patients with secondary varicose veins (from DVT, post-thrombotic syndrome, and venous malformations), patients with active leg ulcers, pregnant women, women with coagulopathy and those with significant comorbidities (such as uncontrolled diabetes, and cardiovascular instability) were excluded from the study.

Detailed history, physical examination, routine hematological, biochemical, and duplex ultrasonographic evaluation of the extent of venous reflux, vein diameters, and

involvement of the saphenofemoral junction were performed in all patients. The procedure, outcomes, potential complications, and follow up were explained to patients. Pre-op instructions comprised positioning the limbs in elevation, wearing compression stockings and using prophylactic antibiotics as needed.

The EVLA was performed under local anaesthetic guided by ultrasound. A laser fibre was inserted inside the affected vein and thermal energy was applied over the whole length of the vein, resulting in injury to the endothelial cells and closure of the vein. Patients were bandaged to promote compression or wore stockings after the procedure and were urged to move around to prevent deep vein thrombosis.

In conventional surgery, high ligation of saphenofemoral junction and stripping of the long saphenous vein through multiple incisions under spinal or general anesthesia were used. Hemostasis was performed, wounds were closed in layers and sterile dressings applied. Treatment involved the use of analgesics, early mobilization and compression stockings.

Operative time, blood loss, Visual Analog Scale (VAS) pain score, postoperative hematoma, wound infection, ecchymosis, and recurrence were studied as outcome parameters. Other data recorded included the length of hospitalization and return to normal activities. All patients were clinically examined and an ultrasound examination was performed to assess venous occlusion, symptom improvement and early recurrence at 1 week, 1 month, and 3 to 3 months after the procedure.

Data was gathered systematically and statistically analyzed using the appropriate methods. All continuous variables were reported as mean $\pm$ standard deviation, and categorical variables as percentiles. Comparative analysis between the two groups was done by the use of Student's t-test to analyse continuous variables and Chi-square test to analyse categorical variables, with the cut off set as a p-value <0.05 .

RESULTS

The age of patients ranged from 20 to 60 years, with a peak incidence between 31 and 50 years in both groups. The male-to-female ratio was almost equal, showing a slight male predominance. There was no statistically significant difference in age or gender distribution between the groups ($p > 0.05$), indicating that both groups were demographically comparable and thus suitable for comparison of surgical outcomes. [Table 1]

Table 1: Age and Sex Distribution of Study Population

Variable	Group A (n=40)	Group B (n=40)	Total (n=80)	p-value
Age Group (years)				
20–30	6 (15%)	5 (12.5%)	11 (13.8%)	0.76
31–40	12 (30%)	11 (27.5%)	23 (28.8%)	0.81
41–50	14 (35%)	15 (37.5%)	29 (36.3%)	0.84
51–60	8 (20%)	9 (22.5%)	17 (21.3%)	0.78
Sex				
Male	22 (55%)	20 (50%)	42 (52.5%)	0.63
Female	18 (45%)	20 (50%)	38 (47.5%)	0.63

Pain and leg swelling were the most frequently reported symptoms in both groups. Approximately one-third of patients presented with skin changes, and a small proportion

had venous ulceration. The clinical presentation was similar in both groups, confirming that the baseline disease severity was evenly matched. [Table 2]

Table 2: Clinical Presentation of Patients

Symptom	Group A (n=40)	Group B (n=40)	p-value
Pain	35 (87.5%)	36 (90%)	0.72
Swelling	28 (70%)	30 (75%)	0.61
Heaviness	26 (65%)	27 (67.5%)	0.82
Skin Changes	10 (25%)	12 (30%)	0.62
Ulceration	4 (10%)	5 (12.5%)	0.72

EVLA required significantly less operative time and resulted in minimal intraoperative blood loss compared to conventional surgery ($p < 0.001$). The average hospital stay was considerably shorter in the EVLA group, allowing most

patients to be discharged within 24 hours. This reflects the minimally invasive nature and faster recovery associated with endovenous laser therapy. [Table 3]

Table 3: Operative and Perioperative Parameters

Parameter	Group A (EVLA)	Group B (Conventional)	p-value
Mean Operative Time (min)	52.6 $\pm$ 8.4	70.3 $\pm$ 10.7	<0.001*
Mean Blood Loss (mL)	32.4 $\pm$ 12.8	78.6 $\pm$ 18.5	<0.001*
Hospital Stay (days)	1.2 $\pm$ 0.4	3.8 $\pm$ 0.7	<0.001*

Pain scores were consistently and significantly lower in the EVLA group at all postoperative intervals. By day 7, most EVLA patients reported minimal discomfort, whereas

conventional surgery patients continued to experience moderate pain. [Table 4]

Table 4: Postoperative Pain (VAS Scores)

Time Interval	Group A (Mean $\pm$ SD)	Group B (Mean $\pm$ SD)	p-value
Day 1	3.2 $\pm$ 1.0	6.1 $\pm$ 1.3	<0.001*
Day 3	2.4 $\pm$ 0.8	5.0 $\pm$ 1.2	<0.001*
Day 7	1.5 $\pm$ 0.7	3.8 $\pm$ 1.1	<0.001*

Patients who underwent EVLA were able to resume their daily activities almost twice as fast as those treated with

conventional surgery. [Table 5]

Table 5: Postoperative Pain (VAS Scores)

Parameter	Group A (EVLA)	Group B (Conventional)	p-value
Days to return to Routine Work	7.8 $\pm$ 2.3	15.4 $\pm$ 3.1	<0.001*

Though not statistically significant, the EVLA group showed a lower incidence of postoperative complications, including

hematoma, infection, and ecchymosis. [Table 6]

Table 6: Early Postoperative Complications

Complication	Group A (n=40)	Group B (n=40)	p-value
Bruising / Ecchymosis	4 (10%)	9 (22.5%)	0.14
Hematoma	2 (5%)	5 (12.5%)	0.23
Wound Infection	1 (2.5%)	4 (10%)	0.17
Nerve Injury	0 (0%)	2 (5%)	0.15
Superficial Thrombophlebitis	1 (2.5%)	3 (7.5%)	0.30

DISCUSSION

The age of the patients in this study varied from 20 to 60 years, with the majority of patients being in the age range of 31-50 years. 55% of Group A were male and 50% of Group B were male. The mean ages of the two groups were similar and there was no significant difference between the margin of the distribution of sex in the two groups ($p > 0.05$). The clinical profiles were also similar among groups. The most frequent presenting symptom was pain, which affected 87.5% of EVLA patients and 90% of the conventional surgery patients, and it was leg swelling, present in 70% of EVLA patients and 75% of conventional surgery patients. The majority of patients (66%) complained of limb heaviness, and one-fourth experienced skin changes. With

regard to ulceration, a small group of 10% (Group A) and 12.5% (Group B) had ulcers. These similar baseline characteristics ($p > 0.05$) provided a common baseline to evaluate outcomes.

Operative parameters demonstrated a distinct advantage for EVLA. The mean operative time was significantly shorter at 52.6 $\pm$ 8.4 minutes compared to 70.3 $\pm$ 10.7 minutes for conventional surgery ($p < 0.001$). Similarly, intraoperative blood loss was considerably lower in the EVLA group (32.4 $\pm$ 12.8 mL) than in the conventional surgery group (78.6 $\pm$ 18.5 mL; $p < 0.001$). The mean duration of hospital stay was also significantly reduced in the EVLA group (1.2 $\pm$ 0.4 days) compared to 3.8 $\pm$ 0.7 days in the conventional group ($p < 0.001$). Li Q et al,^[11] reported similar findings, where ELVT was associated with shorter operation times and hospital stays compared to conventional surgery.

Postoperative pain assessment using the Visual Analogue Scale (VAS) further reinforced the superiority of EVLA. Mean VAS scores were 3.2 versus 6.1 on day 1, 2.4 versus 5.0 on day 3, and 1.5 versus 3.8 on day 7 ($p < 0.001$), indicating significantly less pain, faster recovery, and greater patient comfort with the minimally invasive laser technique. Nakashima M et al,^[12] similarly observed a substantial improvement in postoperative VAS scores—from a preoperative mean of 82.1 ± 12.1 to 31.3 ± 17.9 at 7 days, 2.8 ± 3.6 at 1 month, and 1.2 ± 1.8 at 3 months ($p < 0.0001$).

Viswateja M et al,^[13] found that also the operative time was reduced by 37%, which reduces anesthetic exposure. Pain scores [postoperative mean (SD)] in Group A (EVLA) and B (conventional surgery) were 1.94 (0.8) and 4.48 (1.6), respectively, giving a 53% reduction in pain in the EVLA group.

The early postoperative complications were less in the EVLA group but not significant. The bruising, hematoma, wound infection and thrombophlebitis rates were fewer in the EVLA group, and importantly, no incidents of nerve injury occurred in the EVLA patients compared to the conventional surgery group. The results demonstrate the efficacy and accuracy of the minimally invasive EVLA procedure.

The EVLA group also had a decreased incidence of bruising, hematoma, sensory disturbance, infection, and phlebitis, as reported by Shrestha O et al,^[14] which confirmed the favorable postoperative profile of EVLA.

Recovery outcomes also strongly favored EVLA. Patients resumed normal daily activities in an average of 7.8 ± 2.3 days, compared with 15.4 ± 3.1 days for those undergoing conventional surgery ($p < 0.001$). The accelerated recovery, minimal postoperative discomfort, and reduced hospital dependence highlight the superior rehabilitation and patient satisfaction associated with EVLA.

Ali AM et al,^[15] also found that the operative time was significantly shorter in the laser group compared to the surgical group (41.3 ± 5.8 vs. 71.8 ± 11.5 minutes, respectively). Moreover, patients in the laser group had shorter hospital stays and returned to normal activities earlier. Pain was notably lower in the laser group (45%) than in the surgery group (75%).

Desouki AA et al.¹⁶ further reported that the Venous Clinical Severity Score (VCSS) at one month was significantly better in the EVLA group (median 1 [0–2]) than in the surgery group (4 [3–5]; $p < 0.0001$). EVLA patients experienced less postoperative pain ($p < 0.00163$) and resumed normal work and daily activities much sooner ($p < 0.0001$). There were no significant differences between the groups in terms of overall satisfaction or complication rates, except for a higher incidence of hematoma in the surgery group.

Sharma A et al,^[17] concluded that EVLA offers excellent efficacy and safety in the treatment of varicose veins, with consistent vein closure, progressive symptom resolution, and minimal complications, reaffirming its advantage over conventional surgery.

CONCLUSION

EVLA proved to be a safe, effective, and minimally invasive

alternative to conventional surgery for the treatment of primary varicose veins. Both groups were equally demographically and clinically matched giving an equitable assessment of results. EVLA proved to be highly beneficial, with benefits such as reduced blood loss, postoperative pain, complications, hospital stay, and ability to return to normal activities. There was no significant difference in complication rates, but generally, EVLA was preferable. The results indicate that the EVLA can provide better postoperative recovery, patient comfort, and rehabilitation rate, and is the preferred approach for treating primary varicose veins.

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Conflicts of interest

There are no conflicts of interest.

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