



## General Surgery

## A COMPARISON OF TRENDLENBURG OPERATION, ENDOVENOUS LASER ABLATION AND RADIOFREQUENCY ABLATION IN MANAGEMENT OF VARICOSE VEINS

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| <b>Dr Navjot Singh</b>           | Junior Resident, Dept. of Surgery, Rajindra hospital, Patiala.                                    |
| <b>Dr Manpreet Kaur Walia*</b>   | Associate Professor, Dept. of Ophthalmology, Rajindra hospital, Patiala.<br>*Corresponding Author |
| <b>Dr Darshanjit Singh Walia</b> | Professor, Dept. of Surgery, Rajindra hospital, Patiala.                                          |
| <b>Dr Anand Singla</b>           | Assistant Professor, Dept. Of Surgery, Rajindra hospital, Patiala.                                |
| <b>Dr Sakini Langtang</b>        | Junior Resident, Dept. of Surgery, Rajindra hospital, Patiala.                                    |

**ABSTRACT**

**Introduction And Aim:** Varicose veins are dilated, tortuous and elongated veins & have been recognised as a chronic disorder since ancient times. It is a progressive disease, though not fatal but the morbidity is more. Present study aimed to evaluate the comparative efficacy of Trendelenburg Operation, Endovenous Laser Ablation, and Radiofrequency Ablation in Varicose Vein Management. **Material And Method:** This was a comparative study conducted in the Department of General Surgery, Rajindra Hospital, Patiala, including 60 patients presenting to the surgery OPD from January 2023 to May 2024. These patients were divided randomly into 3 groups: Trendelenburg Operation, Endovenous Laser Ablation, and Radiofrequency Ablation. A structured proforma was used to enter the detailed clinical history, mode of management received, and post-op follow up at short interval of 2 months, after obtaining consent at the time of admission. **Observation:** In this comparative study, mean age was 42.72 years, with 78.3% male preponderance. Majority of the patients belonged to C4 group with 31.7% out of the study group. Post-op pain was more for T.O group, as compared to the minimally invasive procedures. Estimated cost for the T.O, EVLA and RFA is 12,178, 53,500 and 38,815 respectively. The p-value was calculated to be 0.001 which is highly significant. **Conclusion:** All the three modalities are effective for treating varicose veins. RFA and EVLA have fewer complication rates as compared to Trendelenburg operation, but recurrence rate is more for minimally invasive techniques.

**KEYWORDS :** Varicose veins, Trendelenburg, RFA, EVLA.**INTRODUCTION**

The word varicose vein was first proposed by Hippocrates in 460 B.C. and means "grape like".<sup>(1)</sup> Varicose vein is a "subcutaneous dilated vein, 3 mm or larger in diameter, measured in upright position with demonstrable reflux. Lower limb varicose veins, the commonest of all vascular disorders affect 25% of the western population<sup>(2)</sup>, and approximately one-third of the adult population.<sup>(3)</sup>

They often lead to symptoms such as pain, swelling, and discomfort, significantly impacting patients' quality of life. Complications can include bleeding or superficial thrombophlebitis, eczema, lipodermatosclerosis and venous ulcer. They can be diagnosed clinically or by radiological investigations. The CEAP (Clinical-Etiology-Anatomy-Pathophysiology) classification is an internationally accepted standard used for describing patients with chronic venous disorders based on clinical manifestations of chronic venous disorders.<sup>(4)</sup>

C - Clinical signs (grade0-6), supplemented by A for asymptomatic and S for symptomatic presentation

E - Classification by cause (etiology)—congenital, primary, secondary

A - Anatomic distribution—superficial, deep, or perforator, alone or in combination

P - Pathophysiologic dysfunction—reflux or obstruction, alone or in combination

Surgical treatment of varicose veins has evolved from a simple phlebectomy to the stripping of entire diseased vessel. High ligation and stripping is considered the standard treatment of varicose veins, as it has highest initial rate of success and lowest rate of recurrence.<sup>(5)</sup>

Over the last 15 years, various minimally invasive techniques have been developed to treat saphenous vein incompetence with ongoing innovations to improve efficacy and patient comfort<sup>(6)</sup> These alternate procedures have been developed to tide over the complications and increased morbidity associated with Trendelenburg operation, to provide better cosmetic results, to facilitate early recovery and better outcome.

The present study was conducted to evaluate the comparative efficacy between the Trendelenburg operation, Endovenous laser ablation, and Radiofrequency ablation and determine the outcome among patients with varicose veins.

**MATERIALS AND METHOD**

The present study was conducted in the Department of General Surgery, Rajindra Hospital, Patiala, amongst 60 cases of varicose veins presenting to the OPD, from January 2023 to May 2024. A structured proforma was used to enter the detailed clinical history and patients were evaluated by radiological investigation i.e., Colour Doppler USG. All the patients who were 18 and above, and had given the written consent were included; whereas, patients with recurrences or deep vein thrombosis were excluded from the study. These patients were divided randomly into 3 groups consisting of Trendelenburg Operation (Group A), Endovenous Laser Ablation (Group B), and Radiofrequency Ablation (Group C), and follow up was done for a short period of 2 months.

In group A, patients were managed by standard Trendelenburg surgery. The patient was placed in a supine position with the knee slightly flexed and externally rotated. Sapheno-femoral high ligation and great saphenous vein stripping was done at the knee level. Spinal anesthesia was administered to all the patients and they were managed as in-patients.

In group B, patients were managed by EVLA for the varicose veins. All the cases were done under spinal anesthesia. GSV was cannulated with the EVLA laser fibre Biolitech. A 1470 nm diode laser was used to ablate the GSV, with short bursts of 70 J energy, withdrawing the fibre to the markings 1cm apart.

In group C, patients were managed by RFA for the varicose veins. The patient was placed in supine position, after the administration of spinal anesthesia. The GSV was cannulated below the knee level, with the introducer RFA sheath. ClosureFast RFA catheter was placed just 2-3 cm below the sapheno-femoral junction. RFA is fired for 20 seconds to ablate the 7cm segment. Compression bandaging is done in all the groups.

In all the groups, perforator incompetence was managed by perforation ligation.

**OBSERVATION****Table No. 1: Age-wise Comparison Of T.O., EVLA, And RFA Group.**

| Age          | Group A (Trendelenburg operation) |            | Group B (EVLA) |            | Group C (RFA) |            |
|--------------|-----------------------------------|------------|----------------|------------|---------------|------------|
|              | Number                            | Percentage | Number         | Percentage | Number        | Percentage |
| 20 – 29      | 1                                 | 5.0        | 2              | 10.0       | 2             | 10.0       |
| 30 – 39      | 5                                 | 25.0       | 7              | 35.0       | 5             | 25.0       |
| 40 – 49      | 7                                 | 35.0       | 6              | 30.0       | 9             | 45.0       |
| 50 – 59      | 4                                 | 20.0       | 3              | 15.0       | 3             | 15.0       |
| 60 – 69      | 3                                 | 15.0       | 1              | 5.0        | 1             | 5.0        |
| 70 – 79      | 0                                 | 0.0        | 1              | 5.0        | 0             | 0.0        |
| Total        | 20                                | 100.0      | 20             | 100.0      | 20            | 100.0      |
| P value      | 0.943                             |            |                |            |               |            |
| Significance | NS                                |            |                |            |               |            |

**Table No. 2: Gender-wise Comparison Of T.O., EVLA, And RFA Group.**

| Sex          | Group A (TO) |            | Group B (EVLA) |            | Group C (RFA) |            |
|--------------|--------------|------------|----------------|------------|---------------|------------|
|              | Number       | Percentage | Number         | Percentage | Number        | Percentage |
| Male         | 13           | 65.0       | 16             | 80.0       | 18            | 90.0       |
| Female       | 7            | 35.0       | 4              | 20.0       | 2             | 10.0       |
| Total        | 20           | 100.0      | 20             | 100.0      | 20            | 100.0      |
| P value      | 0.190        |            |                |            |               |            |
| Significance | NS           |            |                |            |               |            |

**Table No. 3: Limb Side Comparison Of T.O , EVLA, and RFA Group.**

| Side         | Group A (Trendelenburg) |            | Group B (EVLA) |            | Group C (RFA) |            |
|--------------|-------------------------|------------|----------------|------------|---------------|------------|
|              | Number                  | Percentage | Number         | Percentage | Number        | Percentage |
| Left         | 7                       | 35.0       | 9              | 45.0       | 8             | 40.0       |
| Right        | 13                      | 65.0       | 11             | 55.0       | 12            | 60.0       |
| Total        | 20                      | 100.0      | 20             | 100.0      | 20            | 100.0      |
| P value      | 0.945                   |            |                |            |               |            |
| Significance | NS                      |            |                |            |               |            |

**Table No. 4: Clinical Component Of CEAP**

|    |     | Group A (TO) |      | Group B (EVLA) |       | Group C (RFA) |       | P value | Sig. |
|----|-----|--------------|------|----------------|-------|---------------|-------|---------|------|
|    |     | Num ber      | %    | Num ber        | %     | Num ber       | %     |         |      |
| C2 | Yes | 6            | 30.0 | 1              | 5.0   | 8             | 40.0  | 0.027   | S    |
|    | No  | 14           | 70.0 | 19             | 95.0  | 12            | 60.0  |         |      |
| C3 | Yes | 3            | 15.0 | 8              | 40.0  | 5             | 25.0  | 0.027   | NS   |
|    | No  | 17           | 85.0 | 12             | 60.0  | 15            | 75.0  | 0.237   |      |
| C4 | Yes | 5            | 25.0 | 11             | 55.0  | 3             | 15.0  | 0.237   | S    |
|    | No  | 15           | 75.0 | 9              | 45.0  | 17            | 85.0  | 0.027   |      |
| C5 | Yes | 2            | 10.0 | 0              | 0.0   | 0             | 0.0   | 0.027   | NS   |
|    | No  | 18           | 90.0 | 20             | 100.0 | 20            | 100.0 | 0.322   |      |
| C6 | Yes | 4            | 20.0 | 0              | 0.0   | 4             | 20.0  | 0.322   | NS   |
|    | No  | 16           | 80.0 | 20             | 100.0 | 16            | 80.0  | 0.108   |      |

**Table No. 5: Cost Comparison In The TO, EVLA, and RFA Group.**

|                         | Mean     | S.D     | P value | Significance |
|-------------------------|----------|---------|---------|--------------|
| Group A (Trendelenburg) | 12178.00 | 1362.79 | <0.001  | HS           |
| Group B (EVLA)          | 53500.00 | 2295.76 |         |              |
| Group C (RFA)           | 38815.00 | 1764.02 |         |              |

**Table No. 6: Procedure-related Parameters Of All The 3 Groups.**

| S. no. | Procedure related Parameters     | Trendelenburg operation (T.O) | EVLA             | RFA              |
|--------|----------------------------------|-------------------------------|------------------|------------------|
| 1.     | Duration of Surgery (in minutes) | 78.15 ± 10.69                 | 47.70 ± 8.88     | 67.50 ± 12.98    |
| 2.     | Duration of hospital stay        | 2.55 ± 0.82 days              | 1.20 ± 0.41 days | 2.20 ± 0.52 days |
| 3.     | Time to resume normal activity   | 6.90 ± 1.25 days              | 3.05 ± 0.69 days | 3.25 ± 0.72 days |

**Table No. 7: Comparison Of The Complications In The T.O, EVLA, and RFA Group.**

| S. no. | Complications           | T.O group   | EVLA group  | RFA group   |
|--------|-------------------------|-------------|-------------|-------------|
| 1.     | Post-operative hematoma | 5 (25%)     | 2 (10%)     | 0 (0%)      |
| 2.     | Post-op Swelling        | 3 (15%)     | 1 (5%)      | 1 (5%)      |
| 3.     | Post op Pain            | 5.90 ± 1.33 | 4.55 ± 0.76 | 5.30 ± 1.03 |
| 4.     | Surgical site infection | 4 (20%)     | 0 (0%)      | 1 (5%)      |
| 5.     | Recurrence              | 0 (0%)      | 1 (5%)      | 2 (10%)     |

**DISCUSSION**

It was observed that in our study as per the Age-wise distribution analysis, mean age was 42.72 years ± 11.27 years. Maximum patients were between the age group of 40-49 years (n=22, 36.7%) followed by the 30-39 years age group (n= 17, 28.3%). Our results were corroborated by other studies like **Baram A et al<sup>(7)</sup>** where the mean age is 37.32 years, and **Joseph N et al<sup>(8)</sup>** whose mean age is 46.71 years.

In our study, out of the 60 patients, 47 (78.3%) were male and 13 (21.7%) patients were female. Similar results were seen in studies conducted by **Swenil S et al<sup>(9)</sup>** in which 86% were males. The right lower limb was more affected (60%). Similar findings were noticed in the study of **Baram A et al<sup>(7)</sup>**.

The majority of the patients in our study i.e., 31.7% (19) belonged in the C4 class followed by 26.7% (16) in C3, 25% (15) in C2, 3.3% (2) in C5 and 13.3% (8) in C6. However, C2 and C3 were more common in studies conducted by **Rasmussen LH et al<sup>(10)</sup>** which was a study based in Denmark, a well developed country. The cause of the increased incidence of patients in C4 group can be attributed to delay in seeking professional medical advice and the abundance of quacks in developing countries.

The mean duration of surgery for the TO group was 78.15 minutes ± 10.69 minutes, 47.70 minutes ± 8.88 minutes for the EVLA Group, and 67.50 minutes ± 12.98 minutes for the RFA group. This difference in the duration of surgery for open TO and minimally invasive EVLA and RFA is due to more elaborate tissue dissection required in Trendelenburg operation. **EVOLVEs<sup>(11)</sup>** study reported similar findings to our study with 89 minutes required for Trendelenburg, and 74 minutes for RFA procedure.

The Duration of Hospital stay was more for the conventional method with mean of 2.55 days, and least for EVLA with mean of 1.20 days. The findings in our study were corroborated by **Thulasikumar R et al<sup>(12)</sup>** with increased hospital stay required in TO group as compared to RFA group. In most of the studies conducted like **Pronk et al<sup>(13)</sup>** and **Darwood et al<sup>(14)</sup>** EVLA was performed under local anesthesia with perivenous tumescent anesthesia and surgery was done under General anesthesia as day care procedure, patients were discharged on same day of the procedure.

Post-op pain was less for patients in the minimally invasive groups i.e., RFA and EVLA. It was measured as per the visual analogue scale. It came out to be 5.9 for the T.O group, 4.5 for the EVLA, and 5.3 for the RFA group. The findings in our study are corroborated by **Carradice D et al<sup>(15)</sup>** and **Baram et al<sup>(7)</sup>**. All the patients treated with minimally invasive procedures achieved early ambulation on POD 1, whereas, the patients in TO group were ambulated on POD 2, therefore patients in RFA and EVLA group resumed normal activities after 3.25 and 3.05 days respectively; whereas, patients in T.O group resumed normal activities after average of 6.9 days.

Other complications like post-op hematoma formation and post-op swelling were more commonly seen in the T.O group with 25% and 15% each, in the EVLA group, it was 10% and 5% respectively.

In the TO group, 20% (n = 4) of patients had **surgical site infection** in the form of serous discharge (Southampton grade 3). This increase in SSI's in TO group can be due to the incision given close to the genital area, which harbours many infective pathogens, and increased perspiration in the thigh skin fold. In RFA group, only 5% (n = 1) patients had developed surgical site infection. None of the patients in the EVLA group had any type of infection.

Cost of the surgery can be a major drawback for the minimally invasive procedures, as they have their advantages like early return to work, less hospital stay, reduced morbidity, but, the RFA catheter and EVLA laser fibre account for major proportion of the cost. Estimated cost for the

T.O, EVLA and RFA is ₹12,178, ₹53,500 and ₹38,815 respectively.

**Recurrence** in our study was noticed in 5% patients (n = 3) out of all the patients enrolled. 2 patients with recurrence belonged to RFA group and 1 patient belonged to EVLA group; whereas, no recurrence was seen among the patients treated with Trendelenburg surgery. All the 3 treatment modalities were comparable in safety and efficacy to eradicate the GSV reflux with a primary occlusion rate of 95%.

## CONCLUSION

In our study, the overall complication rate is less in RFA and EVLA, leading to early ambulation, discharge and fast return to normal activities. EVLA was superior to RFA in terms of reduced hospital stay, post-op pain, Surgical Site Infection, and recurrence. Overall in our study, RFA and EVLA were found to be better than conventional Trendelenburg surgery.

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