



Original Article

## A Study About Comparing Outcomes of Endoscopic Versus Open Subfascial Interruption of Below Knee Perforators for Management of Varicose Veins

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### ABSTRACT

**Background:** Varicose veins are dilated, tortuous, elongated superficial veins. Severity of the disease may vary from telangiectatic veins to venous ulceration, chronic venous insufficiency, and they need ligation either by open surgery or by subfascial endoscopic perforator surgery (SEPS).

**Methodology:** A comparative study conducted at department of general surgery, King George Medical University, Lucknow for a period of 12 months.

**Results:** Mean hospital stays & wound complications were less in SEPS as compare to open approach

**Conclusion:** SEPS is feasible, safe effective and superior to conventional open ligation of perforating veins.

**Keywords:** SEPS, CEAP, VCSS, GSV.

### INTRODUCTION

Varicose veins are dilated, tortuous, elongated superficial veins. Severity of the disease may vary from telangiectatic veins to venous ulceration. Perforating veins perform a normal function in transporting superficial venous blood inward to the deep veins for further transit to the heart. If perforating veins become incompetent and transmit outward flow, it may lead to chronic venous insufficiency<sup>1</sup>. Deep venous reflux accompanies superficial venous reflux in 20% of limbs with varicose veins. The usual starting point of this retrograde circuit is the saphenofemoral junction, but it may start from one of the perforators like mid-thigh Hunterian or the anteromedial Boyd perforator or a calf perforator<sup>2</sup>. This circuit must be broken by removing the superficial part of the circuit and by ligating the incompetent perforators. Hence, incompetent perforators which are sometimes very big in size have a definite role in the pathophysiology of chronic venous insufficiency, and they need ligation either by open surgery or by subfascial endoscopic perforator surgery (SEPS). The prevalence of venous ulceration due to chronic venous insufficiency has been estimated to be approximately 0.1 to 0.3%<sup>1</sup>. Minimally invasive approaches have been developed that permit subfascial endoscopic interruption of incompetent perforating veins in patients with promising results concerning ulcer healing and postoperative morbidity<sup>3</sup>.

### OBJECTIVES

The objective of the study was to compare outcomes among SEPS with modified Linton's technique in respect to following parameters-1. Duration of surgery, 2. Ulcer healing, 3. Mean hospital stay, 4. Total number of perforators ligated, 5. Complications of surgery in terms of haemorrhage, surgical site infection like paraesthesia, recurrence, deep vein thrombosis, 6. Mean time for resumption of daily activities

### METHODOLOGY

A comparative study conducted at department of general surgery, King George Medical University, Lucknow for a period of 12 months. A total number of 33 patients were taken up for study out of whom 16 underwent SEPS (group A) and 17 underwent modified Linton's operation (Group B). After taking a detailed history, a thorough clinical examination was done. Patients were randomly allocated to either open or endoscopic surgery by sealed envelopes. All patients will be

classified according to CEAP & VCSS. All patients will undergo investigations of their venous status by physical examination and duplex ultrasound scan before surgery, 6 weeks after surgery and 6 months after surgery. Open subfascial exploration was performed by modified Linton approach<sup>4-11</sup>. Localization of incompetent perforators was done prior to surgery with the help of colour Doppler. Small skin incision was given over the marked perforator site and it was ligated. Endoscopic subfascial exploration was performed by use of a conventional laparoscopic instruments using 2 port method. All perforating veins on the medial and dorsal side of the lower leg that could be found were interrupted by the use of either Liga clips, bipolar cautery or by harmonic scalpel. The time taken for each operation will be recorded as the time between the first incision and skin closure and it excluded time taken for Trendelenburg procedure. Patient will be mobilized on first postoperative day and were treated by ambulant compression therapy. The length of hospital stay was registered. Each patient will return to the outpatient clinic at 1 week, 6 week and 6 months after operation. Post operative wound complications after open and endoscopic division of perforating veins were recorded under- wound infection, par aesthesia, subfascial haematoma, DVT. Fischer exact test was used to calculate the statistical significance in respect to different variables among the two groups<sup>7</sup>.

### Preoperative evaluation

Preoperative evaluation is performed by duplex scanning of the superficial, deep and perforator venous systems to diagnose both valvular incompetence and obstruction. Colour doppler ultrasonography guided perforator sites were marked by skin marker.

### Operative technique for SEPS

#### Position

Patient was placed in Trendelenburg's position. Knee of that site (diseased side) was flexed and slightly elevated by placement of a pillow. Surgeon stands on same side of leg. Camera man stands on opposite side. SEPS was done by conventional laparoscopic instruments through two ports.

#### First Port

A transverse incision was made four to six cm posteromedial to tibial tuberosity through the subcutaneous tissue. The deep fascia was incised and calf muscle visualized. Subfascial space was created by blunt gauze dissection or by balloon inflation (Finger gloves were tied on tip of endoscopic suction cannula and inflated in subfascial space by normal saline) The laparoscopic port (10 mm or 5mm) was then inserted beneath the fascia and carbon dioxide was insufflated (15-18 mm Hg). Usually, this port was used for working channel.

#### Second Port

A second transverse incision was made 6 cm posteroinferior from the first one, and the second 10 mm laparoscopic port was inserted under visual control or guided by first port. This port was used for zero-degree telescope.

### Subfascial Dissection and perforators interruption

Under videos Copic control, all connective tissue bridging between muscles and fascia was dissected with Maryland forceps and endoscopic scissors. Perforating veins bridging in the Subfascial space visualised easily, isolated and coagulated by ultrasonic scalpel / bipolar diathermy or clipped and divided. Complete visualization of all perforating veins down up to the medial malleolus, posteriorly to the midline of leg & anteriorly to the tibial edge was performed. Finally, the instruments and all ports were removed.

The wound was sutured with 2/0 absorbable sutures for the subcutaneous tissues and 3/0 non-absorbable sutures for the skin. After completing SEPS if patient has incompetent SFJ, Flush ligation and stripping of GSV at level of first port was done concurrently. First port incision site was used for stripping of GSV.

### Post operative Management

Once the effect of anaesthetic wears off, the patients were encouraged to ambulate and are discharged few days after surgery. In Post operative instruction, stress on the need for active ambulation, elevation of operated limb and maintenance of elastic bandage advised. Enoxaprin sodium (40mg/0.4ml) was administered subcutaneously in all for 3 days. Patients were seen for removal of skin sutures in the outpatient's department.

## RESULTS

| Operative procedure performed  | Total number of patients (=33) |
|--|--------------------------------|
| SEPS with stripping of GSV and ligation of incompetent sapheno popliteal junction                      | 5                              |
| Modified Linton procedure with stripping of GSV and ligation of incompetent sapheno popliteal junction | 7                              |
| SEPS with stripping of GSV   | 8                              |

|   |   |
|---|---|
| Modified Linton procedure with stripping of GSV | 8 |
| Only SEPS                                       | 3 |
| Only Modified Linton procedure                  | 2 |

#### Clinical results comparing open & endoscopic approach

| Parameter   | Open approach<br>(n=17) | Endoscopic approach<br>(n= 16) | Statistical significance<br>(p value) |
|---|-------------------------|--------------------------------|---------------------------------------|
| Mean operating time<br>(in minutes)                           | 32.7 (16-48)            | 38.4 (22-64)                   | 0.123                                 |
| Mean number of<br>perforators ligated                         | 3.64 (2-5)              | 5.06 (2-12)                    | 0.036                                 |
| Mean hospital stays<br>(in days)                              | 2.6(1-5)                | 1.7 (1-4)                      | 0.023                                 |
| <b>Complications</b>  |                         |                                |                                       |
| Wound infection   | 10 (59%)                | 2(13%)                         | 0.004                                 |
| Subfascial hematoma   | 3(18%)                  | 1(6.3%)                        | 0.103                                 |
| Paresthesia   | 2(12%)                  | 0(0%)                          | 0.227                                 |
| DVT   | 1(6%)                   | 0(0%)                          | 0.485                                 |
| Recurrence  | 3(18%)                  | 0(0%)                          | 0.103                                 |
| Mean time for<br>resumptions of daily<br>activities (in days) | 6.2n (3-8)              | 5.6 (2-5)                      | 0.166                                 |

SEPS Was performed in 33 patients. In a follow up period of 12 months, the venous ulceration of all patients healed in five months. - Number of perforators ligated in SEPS group (2-12) were higher as compared to the open group (2-5). Possibly some perforators may be missed on Doppler localization and ligation, which may be a cause of future recurrence in varicose veins in the open ligation group. SEPS has the advantage of exploration of the entire subfascial space so that majority of the incompetent perforators can be identified and ligated. Mean hospital stay was significantly reduced in SEPS group (1.7) as compared to open one as SEPS (2.6). -Wound complications were more in open group as compared to SEPS because incisions are given in already compromised skin. Ulcer healing rates were increased in group undergoing SEPS. Though ulcer healed in both the groups but it was faster in SEPS group. The subfascial hematoma was 6.3% (01 patient) .13% (02 patients) developed wound infection managed conservatively. None of patients developed DVT or CO2 embolization & paraesthesia. . Average duration for SEPS was about 39 minutes. Hypertrophic scar was found in one patient at trocar site. No death or serious complication occurred in any patient.

#### DISCUSSION

2016 Linton proposed that those patients with perforator incompetence could be treated by directly dividing the offending perforators<sup>9</sup>. Unfortunately, in order to achieve this goal, a long incision through the medial skin from knee to the medial malleolus was necessary. Perforators could then be identified below the fascia and divided. On average, 85% of patients enjoyed ulcer-free recurrence in the long term. However, wound related complications such as infection, flap necrosis, and delayed healing occurred in 17% of patients and caused the procedure to fall into disfavor<sup>9-11</sup>. Although several modifications of the Linton procedure have been developed to minimize wound morbidity such as the posterior stocking seam incision<sup>13</sup> and parallel oblique incisions<sup>14</sup> it was not until the development of minimally invasive procedures, which permitted small remote incisions to be created, that the procedure began to be re-evaluated. The Society for Vascular Surgery (SVS) and the American Venous Forum (AVF) have developed clinical practice guidelines for the care of patients with varicose veins of the lower limbs and pelvis. He recommends against selective treatment of perforating vein incompetence in patients with simple varicose veins (CEAP class C (2); GRADE 1B), but we suggest treatment of pathologic perforating veins (outward flow duration  $\geq 500$  ms, vein diameter  $\geq 3.5$  mm) located underneath healed or active ulcers (CEAP class C (5)-C (6); GRADE 2B)<sup>17</sup>.

However, SEPS has not been widely adopted because of the technical difficulty and burdensome apparatus involved in its performance. In Japan, the two-port system utilizing screw-type ports (EndoTIP®, Karl Storz, Tuttlingen, Germany) was introduced by Haruta in the beginning of the 21st century, which made the performance of SEPS simpler and easier<sup>18-19</sup>. Results of the Mayo Clinic experience, which included 57 consecutive SEPS procedures, were reported.<sup>8-14</sup> Some 22 patients had active and 20 had healed ulcerations. A total of 20 limbs had post-thrombotic syndrome and 37 had primary valvular incompetence without any evidence of previous deep vein thrombosis. Concomitant ablation of saphenous reflux was performed in 41 limbs. The number of perforating veins divided averaged  $4.9 \pm 0.2$  (range: 1-11) per limb. Minor wound complications occurred in 5% and one patient with known inferior vena cava occlusion had recurrent deep venous thrombosis within 30 days.

Clinical scores were calculated based on the recommendations of the Committee of Reporting Standards of the Joint Vascular Societies,<sup>20</sup> and significant improvement was found with scores decreasing from 6.42 ± 0.41 preoperatively to 2.70 ± 0.32 after surgery (p 0.0001). Calculating outcome with the scoring system of Porter et al,<sup>17</sup> clinical outcome averaged 2.11 ± 0.12 (range -1 to 3; the scale is from -3 to 3). Within a median of 36 days after surgery all the ulcers present at operation on 22 limbs healed (mean: 99 ± 37 days, range: 11–670 days). However, eight limbs had poor ulcer healing (40 days) and one ulcer healed only by 670 days after surgery. No ulcers recurred in patients with primary valvular incompetence without any evidence of previous deep vein thrombosis. Concomitant ablation of saphenous reflux was performed in 41 limbs. The number of perforating veins divided averaged 4.9 ± 0.2 (range: 1–11) per limb. Minor wound complications occurred in 5% and one patient with known inferior vena cava occlusion had recurrent deep venous thrombosis within 30 days.

In a Meta analysis of 3 study (two RCT and one retrospective comparative study) by Luebke T, Brunkwall J between SEPS and Linton groups, there was a significant lower rate of wound infections for SEPS (odds ratio [OR] 0.06 [95% confidence interval (CI) 0.02 to 0.25]) and a significantly reduced hospital stay for SEPS (OR 8.96 [95% CI -11.62 to -6.30]). In addition, SEPS was associated with a significant reduced rate of recurrent ulcers (mean follow-up 21 months) (OR 0.15 [95% CI 0.04-0.62]). There was no significant difference between the groups in the following dimensions: rate of hospital re admission (OR 0.21 [95% CI 0.03-1.31]), death at six months (OR 3.00 [95% CI 0.11-78.27]), ulcer healing rate at four months (OR 0.44 [95% CI 0.09-2.12]), and the rate of deep vein thrombosis (DVT) (OR 0.35 [95% CI 0.01-8.85])<sup>21</sup>. Most venous ulcers treated with SEPS with ablation of superficial venous reflux heal rapidly and remain healed during medium-term follow-up<sup>22</sup>In one RCT, SEPS is found as an adjunct to standard varicose vein surgery reduces the number of incompetent perforating veins at 1 year but has no effect on quality of life or varicose vein recurrence at 1 year<sup>26</sup>. In long term follow up , three and five year recurrence rates were 8% and 18% respectively among survivors. In a multivariate Cox regression analysis previous vein surgery was the only factor significantly associated with recurrent ulceration (p=.004)<sup>26</sup>.

## CONCLUSION

SEPS is feasible, safe effective and superior to conventional open ligation of perforating veins. It has been found that SEPS is a promising technique for treatment of incompetent perforators. Favourable ulcer healing rate and improvement in clinical symptoms suggests that SEPS plays a considerable role in correcting the underlying pathology in chronic venous insufficiency caused by below knee perforating veins.

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