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RESEARCH ARTICLE

COMPARATIVE ANALYSIS OF SUBFASCIAL ENDOSCOPIC PERFORATOR SURGERY (SEPS) AND OPEN LIGATION FOR TREATING LOWER LIMB VARICOSITIES

Kalesha Shaik and Nadigadda Mohammed Shukur Shaik
Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana 508254.

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Abstract

This study compares Subfascial Endoscopic Perforator Surgery (SEPS), a minimally invasive technique, with traditional Open Ligation for treating lower limb varicosities, a manifestation of chronic venous insufficiency (CVI) that affects quality of life through complications like ulcers, edema, and skin pigmentation. Conducted over one year at Kamineni Institute of Medical Sciences, Telangana, the study involved 50 patients divided equally between the two groups, assessing postoperative complications, hospital stay duration, symptom resolution, and varicosity recurrence. Results revealed that SEPS had significant advantages. It demonstrated superior symptom resolution, with 24% of patients achieving complete ulcer healing compared to none in the Open group. Additionally, 60% of SEPS patients experienced complete edema resolution, compared to only 20% in the Open group. SEPS also enabled faster recovery, with 88% of patients discharged within 10 days, whereas all Open group patients required stays of 11 days or longer. The complication rate was lower in SEPS (4%) compared to Open Ligation (8%), with no cases of deep vein thrombosis (DVT) or skin necrosis observed in either group. These findings align with global research, highlighting SEPS as a preferred treatment modality due to its minimally invasive nature, shorter hospital stays, and better clinical outcomes. The study underscores the need for further research, particularly in diverse populations and with long-term follow-up, to validate these findings and assess the cost-effectiveness of SEPS. Comparative studies with emerging minimally invasive techniques such as laser or radiofrequency ablation are also recommended to refine treatment protocols and enhance patient-centric care. SEPS holds promise as a standard of care for chronic venous insufficiency, offering improved recovery and reduced morbidity.

Introduction:-

Subfascial Endoscopic Perforator Surgery (SEPS) and Open Ligation are two widely employed surgical techniques for addressing lower limb varicosities, particularly in cases involving incompetent perforator veins. Lower limb varicosities, a common manifestation of chronic venous insufficiency (CVI), significantly impact patients' quality of life, leading to complications such as venous ulcers, edema, and skin pigmentation. Traditionally, open perforator ligation has been the standard approach to managing perforator incompetence associated with CVI. However,

Corresponding Author:- Kalesha Shaik
Address:- Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana 508254.

advancements in minimally invasive techniques have introduced SEPS, which utilizes endoscopic technology to access and treat incompetent perforator veins with minimal disruption to surrounding tissues. This contrasts with the more invasive open ligation technique, offering the potential for reduced morbidity, shorter hospital stays, and faster recovery.

Studies have consistently highlighted the advantages of SEPS over open ligation. For instance, Kishore and Jyothiswari (2022) reported that SEPS achieves superior outcomes, including shorter operative times, better ulcer healing, and a notably lower recurrence rate0% with SEPS compared to 30% with open ligation. Jain et al. (2022) further emphasized SEPS's efficacy in providing early symptom relief, including ulcer healing and reversal of skin changes, while also noting a decreased incidence of wound complications. A systematic review and meta-analysis by Ho et al. (2022) corroborated these findings, reporting high short-term efficacy of SEPS with a pooled wound healing estimate of 96.0% and a freedom-from-recurrence rate of 91.0%. Moreover, SEPS has demonstrated shorter hospital stays and fewer postoperative complications, such as pain and hematoma formation (Teja et al., 2020).

Despite these advantages, there are limitations to the existing evidence. Ho et al. (2022) pointed out that the overall quality of studies comparing SEPS and open ligation remains low to intermediate, necessitating further high-quality comparative research to solidify clinical decision-making. Additionally, while SEPS has gained acceptance globally, its comparative efficacy, safety, and outcomes in specific populations, such as the Indian demographic, remains underexplored. This study seeks to address these gaps by evaluating and comparing SEPS and open perforator ligation for treating lower limb varicosities. Key parameters under analysis include postoperative complications, hospital stay durations, symptom resolution, and patient recovery. By providing evidence-based insights into the benefits and limitations of these surgical techniques, this research aims to inform clinical practices and optimize treatment strategies for patients with chronic venous insufficiency.

Methodology:-

Study Design and Setting

This research was designed as a prospective comparative observational study. It was conducted in the Department of General Surgery at Kamineni Institute of Medical Sciences, Narketpally, Telangana, India, over a one-year period from October 2023 to September 2024. The study aimed to compare the outcomes of Subfascial Endoscopic Perforator Surgery (SEPS) and Open Perforator Ligation in the treatment of lower limb varicosities.

Sample Size and Population

A total of 50 patients diagnosed with lower limb varicosities were included in the study. The participants were randomly assigned to one of two groups: Group 1, which underwent SEPS, and Group 2, which underwent Open Perforator Ligation, with 25 patients in each group.

Inclusion and Exclusion Criteria

The study included patients aged between 15 and 70 years who presented with perforator incompetence, with or without saphenofemoral junction (SFJ) or saphenopopliteal junction (SPJ) incompetence. Individuals with skin changes such as venous ulcers were also included. Patients younger than 15 or older than 70, those diagnosed with deep venous thrombosis (DVT), individuals unfit or unwilling for surgical intervention, and those with bleeding disorders or associated arteriovenous malformations were excluded from the study.

Data Collection

Patients presenting to the General Surgery outpatient department with symptoms of lower limb varicosities were recruited for the study after obtaining written and verbal informed consent. Detailed medical histories were recorded, followed by comprehensive clinical and local examinations. To confirm the diagnosis and evaluate the extent of venous incompetence, specialized tests, including Venous Color Doppler imaging, were performed.

Surgical Techniques

For patients in the SEPS group, a minimally invasive two-port technique was utilized. Carbon dioxide insufflation created a subfascial space, allowing the identification and division of incompetent perforator veins using bipolar cautery and endoscopic scissors. The procedure was completed with minimal disruption to surrounding tissues, and the skin incisions were closed postoperatively. Patients in the Open Perforator Ligation group underwent traditional surgical ligation through direct incisions. This method involved exposing the incompetent perforator veins for

ligation, with stripping of the great saphenous vein and ligation at the saphenofemoral junction performed if necessary.

Postoperative Care
Postoperative care was standardized across both groups. Patients were encouraged to ambulate on the day of surgery. A single dose of prophylactic antibiotics was administered before surgery, with continued antibiotic coverage for 48 hours postoperatively. Compression bandages and regular ulcer dressings were maintained. Patients were advised to elevate the affected limb and follow specific postoperative care instructions to enhance recovery.

Follow-Up Assessments
Follow-up evaluations were conducted at 2 weeks, 1 month, 3 months, and 6 months post-surgery to assess the clinical outcomes and monitor for complications. Symptom resolution, including reduction in pain, edema, pigmentation, and ulcer size, was documented. Recurrence of varicosities and postoperative complications, such as wound infections and hematoma, were also assessed.

Outcome Measures
The primary outcomes measured included the duration of postoperative hospital stay, rates of symptom resolution (pain, edema, pigmentation, and ulcer healing), incidence of postoperative complications (wound infections, dehiscence, or hematoma), and recurrence of varicosities. These measures provided a comprehensive comparison of the efficacy and safety of SEPS versus Open Perforator Ligation.

Observations and Results:-

This study compares the outcomes of Subfascial Endoscopic Perforator Surgery (SEPS) and Open Perforator Ligation in treating lower limb varicosities. The key findings are presented below.

1. Age Distribution
The study revealed that varicose veins are more prevalent among older individuals. In the SEPS group, 40% of patients were above 60 years of age, compared to 28% in the Open Perforator Ligation group. This trend aligns with established research linking aging to venous wall degeneration and valve dysfunction, making older individuals more susceptible to venous insufficiency. Younger adults (21–30 years) represented a smaller percentage, with 16% in the SEPS group and 24% in the Open group. This indicates that while varicose veins primarily affect older adults, younger individuals are not entirely exempt, particularly those with occupational or genetic predispositions.

Table 1:- Age Distribution of Patients in SEPS and Open Perforator Ligation Groups.

Age (Years)	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
21–30	4	6	10
31–40	1	2	3
41–50	6	3	9
51–60	4	7	11
>60	10	7	17
Total	25	25	50

2. Gender Distribution
The study showed a higher prevalence of varicose veins in males, with males constituting 76% of the SEPS group and 64% of the Open group. Female representation was 24% and 36% in the respective groups. This male predominance may be attributed to occupational factors, such as prolonged standing or heavy physical work, and physiological differences, including hormonal influences and venous pressure dynamics. These findings align with global studies on chronic venous insufficiency.

Table 2:- Gender Distribution of Patients in SEPS and Open Perforator Ligation Groups.

Gender	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
Male	19	16	35
Female	6	9	15
Total	25	25	50

3. Symptoms at Presentation

Patients in both groups universally presented with dilated veins and pain (100%). However, the SEPS group showed a lower incidence of other symptoms compared to the Open group. For example, edema was observed in 40% of SEPS patients versus 80% in the Open group. Skin pigmentation was present in 36% of SEPS patients compared to 80% in the Open group, and ulceration occurred in only 4% of SEPS cases compared to 24% in the Open group. These findings suggest that SEPS may provide better preoperative management or attract patients with less advanced disease.

Table 3:- Symptoms at Presentation in SEPS and Open Perforator Ligation Groups.

Symptom	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
Dilated veins	23	27	50
Pain/discomfort	21	29	50
Itching	20	24	44
Skin pigmentation	9	20	29
Edema	10	31	41
Ulceration	1	6	7

4. Postoperative Hospital Stay

SEPS demonstrated a significant advantage in reducing hospital stay durations. In the SEPS group, 88% of patients were discharged within 10 days, whereas none in the Open group met this threshold. Conversely, 80% of Open group patients required stays of 11–20 days, and 20% had hospitalizations extending beyond 20 days. These results underscore the minimally invasive nature of SEPS, allowing for quicker recovery and reduced inpatient care requirements, which can significantly impact healthcare costs and patient quality of life.

Table 4:- Postoperative Hospital Stay Duration in SEPS and Open Perforator Ligation Groups.

Duration (Days)	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
5–10 Days	22	0	22
11–20 Days	3	20	23
>20 Days	0	5	5
Total	25	25	50

5. Postoperative Complications

The SEPS group had fewer complications, with only one case of wound dehiscence or hematoma (4%) reported, while the Open group experienced two cases of wound infections (8%). No cases of skin necrosis or deep vein thrombosis (DVT) were observed in either group. The lower complication rate in SEPS can be attributed to its minimally invasive technique, smaller incisions, and reduced tissue trauma compared to the more invasive Open Perforator Ligation.

Table 5:- Postoperative Complications in SEPS and Open Perforator Ligation Groups.

Complication	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
Wound dehiscence/hematoma	1	0	1
Wound infections	0	2	2
Skin necrosis	0	0	0
Deep vein thrombosis	0	0	0
Total	1	2	3

6. Persistence of Clinical Symptoms

Postoperative symptom resolution was more favorable in the SEPS group. Persistent pain or discomfort was reported in only 4% of SEPS patients compared to 8% in the Open group. Notably, complete healing of venous ulcers was achieved in 24% of SEPS patients, while none in the Open group experienced complete ulcer resolution. This highlights SEPS's effectiveness in addressing advanced symptoms of venous insufficiency, including skin changes and ulceration.

Table 6:- Persistence of Clinical Symptoms Post-Surgery in SEPS and Open Perforator Ligation Groups.

Symptom	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
Persistent dilated veins	1	1	2
Persistent pain/discomfort	1	2	3
Ulceration (healed)	6	0	6
Ulceration (persistent)	0	0	0

7. Edema

Edema resolution was significantly higher in the SEPS group, with 60% of patients achieving complete resolution compared to only 20% in the Open group. Persistent edema was observed in just 12% of SEPS patients, whereas 64% of the Open group continued to experience this condition postoperatively. This finding underscores SEPS's superior efficacy in alleviating one of the most debilitating symptoms of chronic venous insufficiency.

Table 7:- Edema Resolution in SEPS and Open Perforator Ligation Groups.

Edema	SEPS Group (n=25)	Open Perforator Ligation Group (n=25)	Total (n=50)
Resolved	15	5	20
Persistent	3	16	19
Total	18	21	39

The detailed analysis of observations and results highlights the clear advantages of SEPS over Open Perforator Ligation. SEPS is associated with shorter hospital stays, fewer complications, better symptom resolution, and greater efficacy in managing advanced symptoms such as edema and ulceration. These findings support the use of SEPS as a preferred treatment for lower limb varicosities, particularly in patients seeking minimally invasive options with faster recovery and improved outcomes.

Figure 1:- Marked perforators

Figure 2:- Venous ulcer over lower leg.

Figure 3:- Venous ulcer over gaiter's area.

Figure 4:- Lipodermatosclerosis of both limbs.

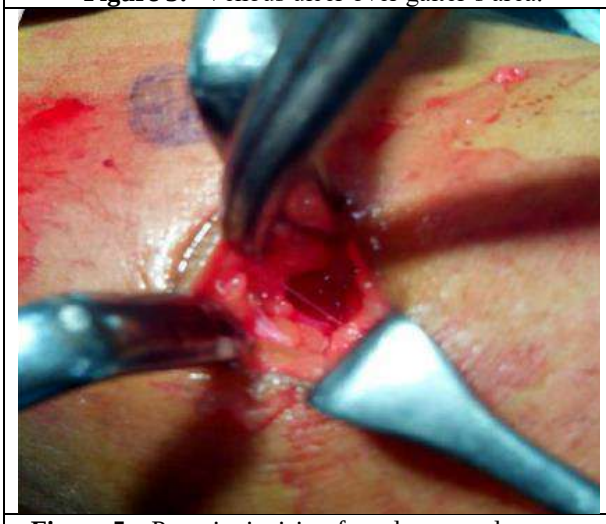

Figure 5:- Port site incision for telescope placement.

Figure 6:- Perforator identification.

Figure 7:-Telescope and working port site over the limb with dissection upto just above medial malleolus.

Discussion:-

1. Age and Gender Trends

The findings of this study align with established literature indicating that chronic venous insufficiency predominantly affects older adults, as aging contributes to venous wall degeneration and valve dysfunction (Puggioni et al., 2005; Ortega et al., 2021). In the SEPS group, a higher proportion of patients (40%) were above 60 years, demonstrating a marked prevalence among the elderly. This observation is consistent with global data linking aging with compromised venous function.Additionally, the study showed a male predominance (76% in SEPS and 64% in the Open group), which correlates with previous findings that attribute this trend to occupational factors (e.g., prolonged standing and heavy physical work) and lifestyle differences. Hormonal factors also influence venous pressure dynamics, further explaining this disparity (Robertson et al., 2008; O'Donnell et al., 2014). These gender and age trends reinforce the need for tailored treatment strategies that address patient-specific risk factors, especially in elderly and male populations.

2. Symptom Control

SEPS demonstrated superior preoperative and postoperative symptom management compared to Open Perforator Ligation. The lower incidence of preoperative symptoms such as edema (40% vs. 80%) and skin pigmentation (36% vs. 80%) in the SEPS group suggests its potential to attract patients with less advanced disease. Furthermore, SEPS's efficacy in resolving advanced symptoms, such as ulceration, is notable, with 24% of patients achieving complete healing compared to none in the Open group. These findings align with studies by Gloviczki et al. (1997) and O'Donnell et al. (2014), which highlighted SEPS's role in effective symptom management, especially for pigmentation and ulceration.

3. Postoperative Stay

SEPS significantly reduced hospital stays, with 88% of patients discharged within 10 days compared to none in the Open group. This stark contrast underscores the minimally invasive nature of SEPS, which facilitates faster recovery and minimizes the burden on healthcare resources. These findings align with the advantages of minimally invasive surgery (MIS), as outlined by Goldberg (2006), emphasizing reduced trauma and shorter postoperative recovery times.

4. Complications

The complication rates were lower in the SEPS group, with only 4% of patients experiencing wound dehiscence or hematoma, compared to 8% in the Open group. Both groups reported no cases of skin necrosis or deep vein thrombosis (DVT). The smaller incisions and reduced tissue trauma inherent to SEPS are significant factors contributing to these lower rates of complications. Similar trends have been observed in other MIS approaches, such as single-incision laparoscopic surgery, which also report fewer postoperative complications and improved patient outcomes (Murthy et al., 2020; Johal et al., 2012).

5. Edema Resolution

The resolution of edema was significantly better in the SEPS group, with 60% of patients achieving complete resolution compared to only 20% in the Open group. Persistent edema was also notably lower in the SEPS group (12% vs. 64%). These outcomes highlight SEPS's superior efficacy in managing one of the most debilitating symptoms of chronic venous insufficiency. The findings echo the benefits of MIS techniques in addressing venous disorders with reduced trauma and enhanced symptom resolution (Goldberg, 2006).

6. Comparison with Global Studies

The study's findings corroborate global research emphasizing the superiority of SEPS. A meta-analysis by Myers et al. and studies by Gloviczki et al. (1997) demonstrated improved postoperative recovery and quality of life in patients undergoing SEPS. This study's results shorter hospital stays, fewer complications, and superior symptom resolution further validate these conclusions, positioning SEPS as the preferred treatment for lower limb varicosities.

Summary and Conclusion:-

This study highlights the significant advantages of Subfascial Endoscopic Perforator Surgery (SEPS) over Open Perforator Ligation in the treatment of lower limb varicosities. SEPS demonstrated superior efficacy in managing advanced symptoms such as edema and ulceration, with a notably higher rate of complete ulcer healing (24% in SEPS vs. 0% in the Open group). The minimally invasive nature of SEPS also translated into shorter hospital stays,

with 88% of patients discharged within 10 days, compared to none in the Open group. Additionally, SEPS reported lower complication rates (4% vs. 8%), attributed to reduced tissue trauma and smaller incisions. These findings underscore the ability of SEPS to deliver better clinical outcomes, faster recovery, and improved patient experiences. Moreover, the study strongly supports the adoption of SEPS as a preferred treatment modality for patients with chronic venous insufficiency, particularly those seeking minimally invasive solutions.

Future Scope of the Study:-

Future research can expand on these findings by involving a larger and more diverse patient cohort to confirm the results across various populations and geographic regions. Long-term follow-up studies are essential to assess the durability of SEPS outcomes, particularly in terms of symptom recurrence and sustained clinical improvement. Additionally, a detailed cost-effectiveness analysis could provide further evidence of SEPS's economic viability, considering its shorter hospital stays and reduced complications. The integration of advanced imaging techniques and robotic-assisted SEPS could enhance procedural precision and reduce learning curves for surgeons, potentially improving patient outcomes. Incorporating patient-reported outcomes and quality-of-life assessments would offer a more holistic evaluation of SEPS's benefits. Finally, comparative studies between SEPS and emerging minimally invasive techniques, such as laser or radiofrequency ablation, could refine treatment protocols and guide the development of advanced therapies for chronic venous insufficiency. These efforts will not only validate the current findings but also contribute to the evolution of patient-centric venous treatment approaches.

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