



A PROSPECTIVE COMPARATIVE STUDY OF THE CONSERVATIVE AND SURGICAL MANAGEMENT OF LOWER LIMB VARICOSE VEINS BASED ON CEAP CLASSIFICATION IN A TERTIARY CARE CENTER

Surgery

**Dr. Chandhan
Prakash K***

MBBS, MS, Junior Resident, Department of General Surgery, Akash Institute of Medical Sciences and Research Centre, Prasannahalli Main Road, Near International Airport, Devanahalli, Bengaluru, Karnataka, 562110, India *Corresponding Author

**Surg Capt Dr. G K
Shreeram Retd**

MBBS, MS, Associate professor, Department of General Surgery, Akash Institute of Medical Sciences and Research Centre, Prasannahalli Main Road, Near International Airport, Devanahalli, Bengaluru, Karnataka, 562110, India

Dr. Sneha shree

MBBS, MS, Assistant professor, Department of General Surgery, Akash Institute of Medical Sciences and Research Centre, Prasannahalli Main Road, Near International Airport, Devanahalli, Bengaluru, Karnataka, 562110, India

ABSTRACT

Background: Lower limb varicose veins are a common manifestation of chronic venous disease, associated with significant morbidity including pain, edema, skin changes, and venous ulceration. The CEAP classification provides a standardized framework for assessing disease severity and guiding management. However, the comparative effectiveness of conservative versus surgical management across different CEAP classes remains an area of ongoing evaluation. **Objectives:** To compare conservative and surgical management of lower limb varicose veins based on CEAP classification and to evaluate their short-term clinical outcomes. **Methods:** A prospective comparative observational study was conducted at Akash Institute of Medical Sciences and Research Centre from March 2024 to September 2025. A total of 96 patients aged 18–70 years with primary lower limb varicose veins were included. Patients were classified according to CEAP classification. Those with CEAP $\leq$ C3 without significant reflux were managed conservatively (compression therapy, limb elevation, lifestyle modification, pharmacotherapy), while patients with CEAP C4–C6 or significant venous reflux underwent surgical management (Trendelenburg procedure, vein stripping, perforator ligation, phlebectomy). Outcomes were assessed based on symptomatic improvement and categorized as good, satisfactory, or poor. Statistical analysis was performed using Chi-square test with $p < 0.05$ considered significant. **Results:** The most common age group was 41–50 years (27.1%), with a female predominance (57.3%). Left limb involvement was most frequent (41.7%). Pain (55.2%), pigmentation (52.1%), edema (49%), and venous ulcers (41.7%) were common clinical features. In the conservative group, good outcomes were observed in 15 patients, satisfactory in 13, and poor in 20. In the surgical group, good outcomes were seen in 18 patients, satisfactory in 16, and poor in 14. There was no statistically significant association between treatment modality and outcome ($\chi^2 = 1.64$, $p = 0.440$). Although higher CEAP classes showed a trend toward poorer outcomes, this association was not statistically significant ($\chi^2 = 14.08$, $p = 0.0797$). **Conclusion:** Both conservative and surgical management provide satisfactory outcomes when appropriately selected based on disease severity. Conservative treatment is effective in early CEAP classes, whereas surgical intervention offers better symptomatic relief in advanced disease with significant venous reflux. Management should be individualized based on CEAP classification, clinical presentation, and Doppler findings to optimize patient outcomes.

KEYWORDS

Varicose Veins, Ceap Classification, Conservative Management, Surgical Management, Chronic Venous Disease, Venous Reflux, Treatment Outcomes.

INTRODUCTION

Varicose veins are one of the most common manifestations of chronic venous disease affecting the lower limbs, with a reported prevalence of 10–20% in the adult population worldwide. Although often considered a benign condition, varicose veins can lead to significant morbidity, including pain, edema, skin pigmentation, lipodermatosclerosis, and venous ulceration, thereby adversely affecting quality of life and daily functioning.

The pathophysiology of varicose veins is primarily related to venous valvular incompetence, resulting in reflux, venous hypertension, and progressive venous dilatation. The Clinical–Etiological–Anatomical–Pathophysiological (CEAP) classification system provides a standardized framework for assessing disease severity and guiding management decisions. Increasing CEAP class has been shown to correlate with worsening clinical features and a higher risk of complications.

Management of varicose veins includes both conservative and surgical approaches. Conservative treatment—comprising compression therapy, limb elevation, lifestyle modification, and pharmacotherapy—is generally recommended in the early stages of disease (CEAP C1–C3) or in patients who are unfit for surgery. Surgical management, including procedures such as saphenofemoral ligation, vein stripping, perforator ligation, and phlebectomy, aims to eliminate venous reflux and is typically indicated in advanced disease (CEAP C4–C6) or in the presence of significant venous incompetence. Despite the availability of multiple treatment modalities, the choice between conservative and surgical management remains variable and depends on disease severity, anatomical involvement, and patient-related factors. Furthermore, there is limited data correlating CEAP classification with treatment outcomes, particularly in the Indian population.

The present study aims to compare the outcomes of conservative and surgical management of lower limb varicose veins based on CEAP classification and to evaluate their effectiveness in improving clinical outcomes.

METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of General Surgery at Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, from March 2024 to September 2025.

Study Population

A total of 96 patients aged 18–70 years with primary lower limb varicose veins were included in the study. Written informed consent was obtained from all participants prior to enrolment.

Inclusion Criteria

- Age between 18 and 70 years
- Diagnosis of primary lower limb varicose veins
- Willingness to participate in the study

Exclusion Criteria

- Secondary varicose veins (post-thrombotic)
- Deep vein thrombosis
- Pregnancy-related varicosities
- Recurrent varicose veins
- Peripheral arterial disease

Clinical Evaluation and Classification

All patients underwent detailed clinical evaluation, and disease severity was classified according to the CEAP classification system.

Clinical features such as pain, edema, skin pigmentation, and ulceration were recorded.

Investigations

Duplex Doppler ultrasonography was performed in all patients to assess:

- Venous reflux
- Saphenofemoral junction incompetence
- Saphenopopliteal junction incompetence
- Perforator vein involvement
- Deep venous system status

Treatment Allocation

Patients were allocated into two groups based on CEAP classification and Doppler findings:

Conservative Management Group:

Patients with CEAP class ≤C3 and without significant venous reflux were managed with compression therapy, limb elevation, lifestyle modification, and pharmacotherapy.

Surgical Management Group:

Patients with CEAP class C4–C6 or those with significant venous reflux were managed surgically with:

- Trendelenburg procedure (high ligation)
- Great saphenous vein stripping
- Perforator ligation
- Multiple phlebectomies

Outcome Assessment

Patients were followed up to assess clinical outcomes, which were categorized as:

- Good
- Satisfactory
- Poor

Outcome assessment was based on symptomatic improvement, ulcer healing, and overall clinical status.

Data Collection

The following data were recorded:

- Demographic details (age, sex)
- Limb involvement (right, left, bilateral)
- Clinical presentation
- CEAP classification
- Treatment modality
- Clinical outcomes

Statistical Analysis

A total of **96 patients** were included in this prospective observational study based on eligibility criteria during the study period. Data were analyzed using **SPSS statistical software**. Continuous variables were expressed as **mean ± standard deviation**, and categorical variables were presented as **frequency and percentage distributions**.

The **Chi-square test** was applied to assess the association between treatment modality and clinical outcomes, as well as between CEAP classification and outcome variables. A **p-value of less than 0.05** was considered statistically significant.

RESULTS

A total of 96 patients were included in the study. The majority of patients belonged to the middle-aged group, with a female predominance.

AGE DISTRIBUTION

AGE GROUP (YEARS)	FREQUENCY	PERCENT
<= 30	21	21.9
21-40	14	15.0
41-50	26	27.1
51-60	15	15.2
>60	20	20.8
TOTAL	96	100.0

Interpretation

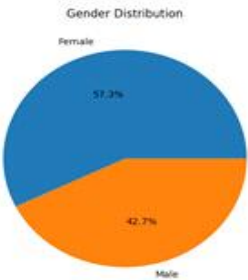
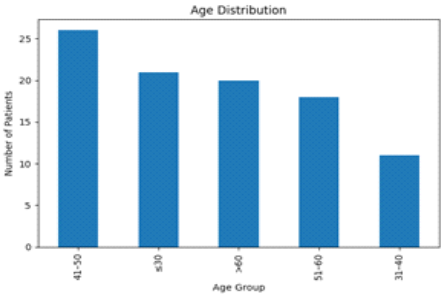
The majority of patients were in the 41–50 years age group, indicating peak incidence in the middle-aged population.

SEX DISTRIBUTION

Gender	FREQUENCY	PERCENT
Male	41	42.7
Female	55	57.3
Total	96	100.0

Interpretation

There was a female predominance, suggesting possible hormonal and lifestyle influences.

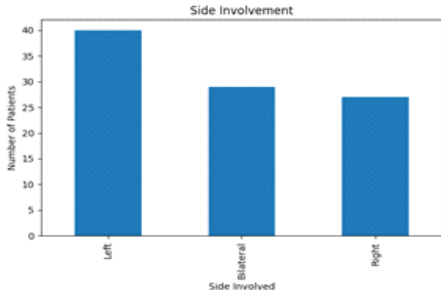


LIMB INVOLVEMENT

LIMB INVOLVED	FREQUENCY	PERCENT
LEFT	40	41.7
RIGHT	27	28.1
BILATERAL	29	30.2
TOTAL	96	100.0

Interpretation

Left limb involvement was most common, followed by bilateral disease.

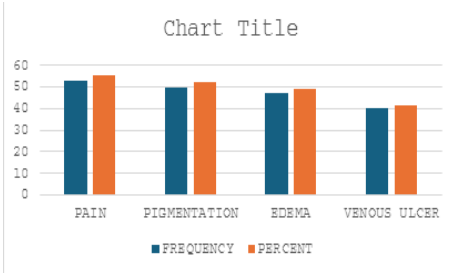


CLINICAL FEATURES

CLINICAL FEATURE	FREQUENCY	PERCENT
PAIN	53	55.2
PIGMENTATION	50	52.1
EDEMA	47	49.0
VENOUS ULCER	40	41.7

Interpretation

Pain was the most common symptom. A significant number of patients presented with ulcers, indicating advanced disease at presentation.

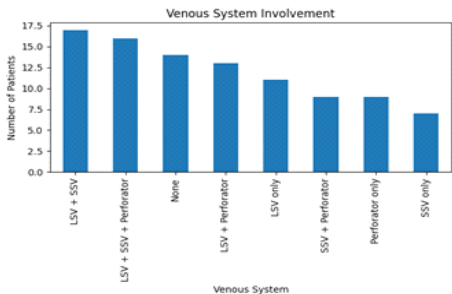


DUPLEX FINDINGS

VENOUS SYSTEM INVOLVED	FREQUENCY	PERCENT (%)
LSV + PERFORATOR	13.0	13.5
LSV + SSV	17.0	17.7
LSV + SSV +PERFORATOR	16.0	16.7
LSV ONLY	11.0	11.5
NONE	14.0	14.6
PERFORATOR ONLY	9.0	9.4
SSV + PERFORATOR	9.0	9.4
SSV ONLY	7.0	7.3

Interpretation:

In the above table, it is shown that combined venous system involvement patterns such as LSV + SSV (17.7%) and LSV + SSV + perforator involvement (16.7%) were more common than isolated system involvement. The association between venous system involvement and clinical outcome was not statistically significant

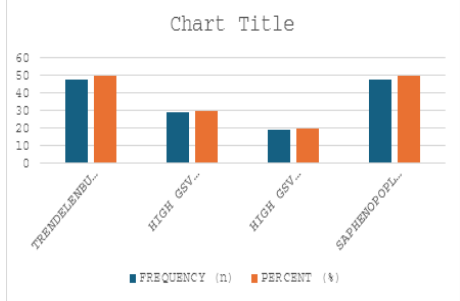


PROCEDURE PERFORMED:

PROCEDURE	FREQUENCY (n)	PERCENT (%)
TRENDELENBURG OPERATION	48	50
HIGH GSV LIGATION WITH STRIPPING	29	30.2
HIGH GSV LIGATION WITHOIT STRIPPING	19	19.8
SAPHENOPOPLITEAL JUNCTION LIGATION	48	50
MULTIPLE PHLEBECTOMY	48	50
TOTAL PATIENTS (SURGICAL GROUP)	48	100.0

Multiple procedures were performed in the same patient depending on the extent of venous reflux; hence, the percentages are not mutually exclusive.

Trendelenburg operation, sapheno-popliteal junction ligation, and multiple phlebectomies were the most commonly performed procedures. A significant proportion of patients underwent combined procedures, reflecting the presence of multilevel venous incompetence. High ligation with stripping was performed in selected patients with significant axial reflux, while ligation without stripping was done in cases where stripping was not indicated.

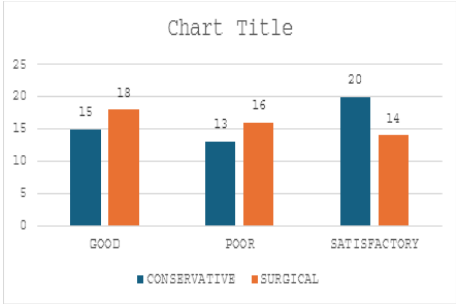


TREATMENT OUTCOMES

OUTCOME	CONSERVATIVE	SURGICAL	TOTAL
GOOD	15	18	33
SATISFACTORY	13	16	29
POOR	20	14	34
TOTAL	48	48	96

Interpretation

Surgical management showed better good and satisfactory outcomes, whereas conservative management had a higher proportion of poor outcomes.

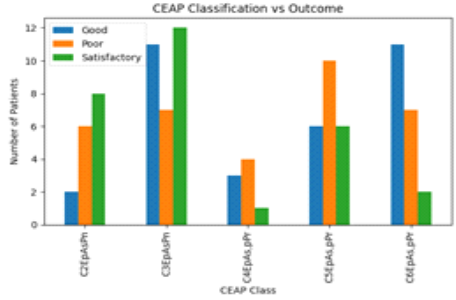


OUTCOME BASED ON CEAP CLASSIFICATION

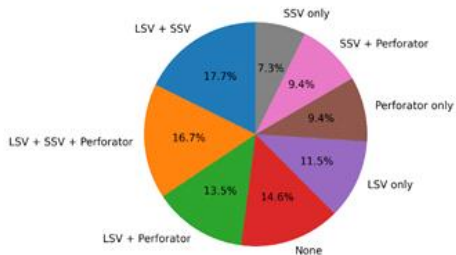
CEAP CLASS	GOOD	POOR	STAISFACTORY
C2EPAsPn	2	6	8
C3EPASPn	11	7	12
C4EPAsPr	3	4	1
C5EPAsPr	6	10	6
C6EPAsPr	11	7	2

INTERPRETATION

In the above table, it is shown that higher CEAP classes demonstrated a greater proportion of poor outcomes; however, satisfactory and good outcomes were observed across all classes. The association between CEAP classification and clinical outcome was not statistically significant



Pie Chart: Type of Venous System Involvement



Statistical Analysis

There was no statistically significant association between treatment modality and clinical outcome:

- $\chi^2 = 1.64$
- $p = 0.440$

Similarly, although higher CEAP classes showed a trend toward poorer outcomes, the association was not statistically significant:

- $\chi^2 = 14.08$
- $p = 0.0797$

The present study shows that lower limb varicose veins predominantly affect middle-aged individuals, with a female preponderance, and most commonly involve the left lower limb. Patients frequently presented with symptoms such as pain, pigmentation, and oedema, with a considerable proportion exhibiting venous ulcers, indicating advanced disease at presentation. Duplex Doppler findings revealed that combined venous system involvement was more common than isolated disease, suggesting multilevel venous reflux. Surgical management demonstrated a higher proportion of good and

satisfactory outcomes compared to conservative treatment, while conservative management was associated with a greater proportion of poor outcomes. Although the association between treatment modality and clinical outcome was not statistically significant ($p = 0.440$), a consistent clinical trend favouring surgical intervention was observed. Similarly, higher CEAP classes showed a tendency toward poorer outcomes, though this did not reach statistical significance ($p = 0.0797$). The frequent use of combined surgical procedures reflects the complex, multisegmental nature of venous insufficiency. Overall, these findings highlight the importance of CEAP classification and Doppler assessment in guiding management decisions, with surgical intervention offering better clinical improvement in patients with advanced disease.

DISCUSSION

Varicose veins are a common manifestation of chronic venous disease and represent a significant source of morbidity, particularly in the middle-aged population. In the present study, the majority of patients belonged to the 41–50 years age group, with a female predominance (57.3%). This finding is consistent with previous studies, which have attributed the higher prevalence in females to hormonal influences, pregnancy, and occupational factors. The predominance of disease in the economically productive age group highlights its impact on quality of life and daily functioning.

Clinically, pain was the most common presenting symptom (55.2%), followed by skin pigmentation and edema. Notably, a substantial proportion of patients presented with venous ulcers (41.7%), indicating advanced disease at the time of presentation. This observation is in agreement with studies from developing countries, where delayed healthcare access and lack of awareness often result in late presentation. The high incidence of advanced CEAP classes in our study underscores the need for early diagnosis and timely intervention. Duplex Doppler evaluation revealed that combined venous system involvement, particularly involving the long saphenous vein, short saphenous vein, and perforators, was more common than isolated involvement. This finding reflects the multisegmental nature of venous reflux and is consistent with previous literature emphasizing that varicose veins rarely involve a single venous segment in advanced disease. The presence of multilevel incompetence has important implications for management, as incomplete treatment may lead to persistent symptoms or recurrence.

In the present study, surgical management demonstrated a higher proportion of good and satisfactory outcomes compared to conservative treatment, whereas conservative management was associated with a greater number of poor outcomes. Although the difference was not statistically significant ($\chi^2 = 1.64$, $p = 0.440$), a clear clinical trend favoring surgical intervention was observed. Similar findings have been reported in previous studies, which have shown that surgical or endovenous interventions provide superior symptomatic relief and improved quality of life, particularly in patients with advanced disease. Conservative management, while useful in early stages or in patients unfit for surgery, primarily offers symptomatic relief and does not address the underlying venous reflux.

Analysis of outcomes based on CEAP classification demonstrated that higher CEAP classes were associated with poorer outcomes, although this relationship did not reach statistical significance ($\chi^2 = 14.08$, $p = 0.0797$). This trend is biologically plausible, as advanced disease is associated with chronic venous hypertension, skin changes, and ulceration, which are more difficult to treat and have a higher risk of recurrence. The lack of statistical significance in our study may be attributed to the relatively small sample size and heterogeneity of patients across different CEAP classes.

The distribution of surgical procedures in this study showed that Trendelenburg operation, saphenopopliteal junction ligation, and multiple phlebectomies were the most commonly performed interventions, with many patients undergoing combined procedures. This reflects the need to address multiple incompetent venous segments to achieve optimal outcomes. Previous studies have also emphasized that combined procedures targeting both axial and perforator reflux are associated with better clinical results and lower recurrence rates.

Overall, the findings of this study reinforce the importance of individualized management of varicose veins based on disease

severity, anatomical involvement, and patient factors. CEAP classification and Duplex Doppler assessment play a crucial role in guiding treatment decisions. While conservative management remains appropriate for early-stage disease, surgical intervention provides better clinical improvement in patients with advanced disease and significant venous reflux.

However, this study has certain limitations. It was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings and the ability to detect statistically significant associations. Additionally, long-term follow-up was not performed, and therefore recurrence rates and long-term outcomes could not be assessed. Future studies with larger sample sizes and extended follow-up are required to validate these findings and further refine management strategies.

CONCLUSION

Lower limb varicose veins are a common chronic venous disorder affecting predominantly middle-aged individuals, with a female preponderance, and are often associated with significant morbidity due to delayed presentation. The present study demonstrates that both conservative and surgical management provide satisfactory outcomes when appropriately selected based on disease severity. However, surgical intervention offers comparatively better clinical improvement, particularly in patients with advanced CEAP classes and significant venous reflux.

Although statistical analysis did not show a significant association between treatment modality or CEAP classification and outcomes, clear clinical trends were observed, with higher CEAP classes associated with poorer outcomes and surgical management yielding better symptomatic relief. The frequent requirement for combined surgical procedures reflects the multisegmental nature of venous incompetence.

Therefore, management of varicose veins should be individualized, taking into consideration CEAP classification, Duplex Doppler findings, symptom severity, and patient factors. Early diagnosis and timely intervention are essential to prevent disease progression and improve patient quality of life.

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