

Assessment of Risk Factors, Causes, and Anatomical Patterns of Varicose Veins recurrence Following Surgical and Endovenous Interventions: A Prospective Single-Centre Cohort Study

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ABSTRACT

Background:

Recurrence rates appear to be rising with time in patients who underwent surgery for varicose veins. Following a follow-up period of three to eleven years, clinical recurrence rates ranging from 26% to 62% have been reported. Recurrences are due to variations in the initial therapy, recurrence measurement technique, and follow-up period.

Aims and objectives:

To identify the risk factors, possible causes and patterns of recurrence following all modalities of varicose veins surgery.

Methods:

This observational study was conducted in Department of General Surgery in Narayana Medical College Hospital to identify the risk factors, possible causes and patterns of recurrence following varicose veins surgery. A total of 40 Patients with recurrent varicose veins after surgery were recruited in to the study between October 2023 to August 2025.

Results:

Recurrent varicose vein after surgery was noted among 17.5% of the cases who underwent Endo venous laser ablation (EVLA) and 82.5% who underwent Trendelenburg procedure (TP). Probable causes for recurrence were found to be in surgeries of Double long saphenous vein (27.5%), Double short saphenous vein (15%), involvement of Neovascularization (37.5%), Inadequate pre-operative- evaluation (17.5%) and incomplete surgery (2.5%) the patients. Areas of body where Recurrence occurred included inguinal (2.5%), thigh (12.5%), popliteal fossa (15%), legs (20%) and both thigh and leg (50%) of the patients.

Conclusions: This study concluded that patients who underwent TP had more recurrences when compared to EVLA procedure. Among cause for recurrence, neovascularisation being the most common and body areas of recurrence being both thighs and legs.

Key-words: Causes, Endo venous laser ablation, Patterns, Recurrent varicose veins, Trendelenburg procedure.

[GJMEDPH 2026; Vol. 15, issue 4 | OPEN ACCESS](#)

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Conflict of Interest—none | Funding—none

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INTRODUCTION

varicose veins are a common condition and can cause anything from mild leg discomfort to a persistent, incapacitating venous ulceration.^[1] Fifty percent of adults have mild venous insufficiency, whereas thirty-five percent of women and fifteen percent of men have noticeable varicose veins.^[2] One reason for the bulk of varicose veins (70%) is an incompetent Great Saphenous Vein or Sapheno-Femoral Junction. At some point, about one-third of these individuals will require surgery.^[3] Recurrences could be brought on by disease progression, actual recurrences, or leftover varicose veins.^[4] Due to variations in the initial therapy, recurrence measurement technique, and follow-up period, data on recurrence rates are difficult to compare.^[5] The risk of recurrence appears to increase with longer follow-up. Clinical recurrence rates ranging from 26% to 62% have been reported over follow-up periods of 3–11 years. However, recurrence rates identified by duplex ultrasonography may be considerably higher than those detected clinically.^[6] Recurrence after varicose vein surgery is known to happen in 20–80% of instances, despite advancements in preoperative diagnostic and treatment techniques.^[7] Numerous explanations have been proposed regarding the underlying reasons and mechanisms. These include a lack of knowledge about the architecture and hemodynamic of the veins, inadequate preoperative evaluation, improper or insufficient surgery, and the emergence of new venous reflux sites as a result of disease progression or neovascularization.^[8] Neovascularization was assumed to be the primary cause of most recurrences. But even after five years, the group of Patients who underwent more extensive saphenous vein stripping had significantly lower reoperation rates.^[9] Recurrent varicosities of the GSV are often treated with numerous phlebectomies in addition to a surgical redisconnection of the SFJ. When varicose veins are treated surgically a second time or more, the recurrence rate is higher than when the veins are treated initially.

^[10] With differing degrees of effectiveness, several randomized controlled trials evaluating novel surgical methods have been carried out. Resection of the whole GSV stump and common femoral vein inversion suturing did not appear to reduce neovascularization.^[11] Recurrence has been linked to the development of incompetence in already present collateral that had not been properly ligated by the last surgeon, or to neovascularization in the tissue of granulation around the stump of large or short saphenous veins.^[12] Paying attention to technical issues can make exploration safer and reduce the tragically high probability of recurrence following sapheno femoral separation. Recurrence may result from neovascularization at the previously treated saphenofemoral junction, which is considered an important mechanism of recurrence, as well as from progressive degeneration and reflux within the residual superficial venous system. whereas an incomplete operation is the cause of an early postsurgical recurrence.^[13] In addition to valve system failure in the operated leg, the appearance of dilated saphenous and perforating veins, detected ultrasonically was an indication of recurrent lower limb varicose veins. The most sensible way to check for aberrant veins in the lower limbs during the postoperative phase is to do an ultrasound study.^[14] With these in view this study was conducted to identify the risk factors, possible causes and patterns of recurrence following varicose veins surgery.

Methods:

Study Design

This was an observational study conducted to identify the risk factors, possible causes, and patterns of recurrence among patients who had previously undergone surgery for varicose veins.

Study Area

The study was conducted in the Department of General Surgery, Narayana Medical College Hospital.

Study Population

The study population comprised patients

presenting with recurrent varicose veins following previous surgical treatment for varicose veins during the study period.

Study Period

The study was conducted over a period of 23 months, from October 2023 to August 2025.

Inclusion Criteria

1. Patients admitted to the General Surgery ward with recurrent varicosities following previous surgery for varicose veins.
2. Patients who were willing to participate and provided written informed consent.
3. Patients presenting with recurrent complications of varicose veins, including ulceration, pigmentation, bleeding, or itching.
4. Asymptomatic patients with recurrence of varicose veins confirmed by venous duplex ultrasonography.

Exclusion Criteria

1. Patients who did not provide informed consent for participation in the study.
2. Pregnant women.
3. Patients with established ascites, portal hypertension, or retroperitoneal tumours.
4. Patients receiving hormone replacement therapy or those with dyshormonogenesis.

Sample size:

A total of 40 patients with recurrent varicose veins following previous surgical treatment who fulfilled the predefined eligibility criteria were included in the study.

Clinical–Etiological–Anatomical–

Pathophysiological (CEAP) Classification:

For standardized assessment of chronic venous disease, the Clinical–Etiological–Anatomical–Pathophysiological (CEAP) classification was used. The clinical component ranges from Co, indicating no visible or palpable signs of venous disease, to C6, indicating active venous ulceration. C1 represents telangiectasias or reticular veins, C2 varicose veins, C3 edema, C4 skin and subcutaneous tissue changes

secondary to chronic venous disease, C5 healed venous ulcer, and C6 active venous ulcer. The remaining components describe the etiology (E), anatomical distribution (A), and pathophysiological mechanism (P) of venous disease. In addition to CEAP classification, disease severity was assessed using the Venous Clinical Severity Score (VCSS), which provides a quantitative assessment of the clinical manifestations and severity of chronic venous disease. **Data Collection:**

After obtaining written informed consent, each participant underwent a detailed clinical evaluation. A comprehensive history was obtained, with particular emphasis on the nature and details of the previous varicose vein surgery, duration since the previous intervention, presenting symptoms, and features suggestive of recurrence. A thorough clinical examination of both lower limbs was subsequently performed.

All patients underwent duplex ultrasonography of the lower-limb venous system, with assessment of both the superficial and deep venous systems to identify the anatomical pattern and possible cause of recurrence. Findings obtained from the clinical history, physical examination, and duplex ultrasonography were systematically recorded in a pre-designed study proforma.

Statistical Analysis

The collected data were entered into Microsoft Excel and subsequently analysed using Statistical Package for the Social Sciences (SPSS) software. Continuous variables were summarized using the mean and standard deviation, while categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test, whereas differences in continuous variables between groups were evaluated using the independent-samples *t*-test. A two-sided *P* value <0.01 was considered statistically significant. One methodological point to retain consistently: since your protocol specifies *P* <0.01, we should use 0.01 as the significance

threshold throughout the Results, tables, and Discussion, rather than the more commonly used 0.05.

Results:

In this study recurrence of varicose vein was recorded among 15%, 30%, 37.5% and 17.5% of the cases in the age group of ≤ 40 years, 41-50 years, 51-60 years and > 60 years respectively. The mean age among the study population was

54.7 ± 13.6 years. In this study, majority of 57.5% of the patients were males and 42.5% of the patients were females. On assessing the affected limb 2.5%, 55% and 42.5% of the patients had bilateral, left and right limb involvement respectively. In this current study 22.5%, 17.5%, 22.5%, 17.5% and 20% of the patients had C2, C3, C4, C5 and C6 respectively. (Table-1)

Table 1: Proportion of cases based on the age group

Age group	Frequency	Percentage
≤ 40 years	6	15.0
41-50 years	12	30.0
51-60 years	15	37.5
> 60 years	7	17.5
Total	40	100.0
Sex		
Male	17	42.5
Female	23	57.5
Total	40	100
Affected limb		
Bilateral	1	2.5
Left	22	55.0
Right	17	42.5
Total	40	100
Class C		
C2	9	22.5
C3	7	17.5
C4	9	22.5
C5	7	17.5
C6	8	20.0
Total	40	100

Based on the mean Pre-operative Venous Clinical Severity Score (VCSS) and Post-operative – Venous Clinical Severity Score

(VCSS) there was significant difference noted between the cases with p value of <0.0001 . (table 2)

Table 2: Difference in Pre-operative – Venous Clinical Severity Score (VCSS) vs Post-operative – Venous Clinical Severity Score (VCSS)

Parameter	Mean	SD	p value
Pre-operative-VCSS	12.5	5.4	$<0.0001^*$
Post-operative - VCSS	7.6	1.6	

Body areas where Recurrence occurred were in inguinal, thigh, popliteal fossa, legs and both

thigh and leg among 2.5%, 12.5%, 15%, 20% and 50% of the patients respectively (Table 3)

Table 3: Recurrence sites on the body

Recurrence sites on the body	Frequency	Percentage
Inguinal	1	2.5
Thigh only	5	12.5
Popliteal fossa	6	15
Legs only	8	20
Both thigh and leg	20	50
Total	40	100

The probable causes of recurrent varicose veins were a duplicated long saphenous vein (DLSV) with persistent/recurrent reflux in 27.5% of cases, a duplicated short saphenous vein (DSSV) with persistent/recurrent reflux in 15.0%,

neovascularization in 37.5%, inadequate preoperative evaluation in 17.5%, and incomplete previous surgery in 2.5%. Neovascularization was the most frequently identified cause of recurrence (Table 4).

Table 4: Probable cause for recurrence

Probable cause for recurrence	Frequency	Percentage
Double long saphenous vein procedure.	11	27.5
Double short saphenous vein procedure.	6	15
Neovascularization	15	37.5
Inadequate pre op evaluation	7	17.5
Incompetent or incomplete surgery	1	2.5
Total	40	100

Post-surgery complaints occurred in < 2 years, 2-5 years and >5 years among 82.5%, 7.5%, 7.5% and 2.5% of the cases respectively in this current

study. The mean post-surgery complaints occurred was noted to be 3.4 ± 1.4 years. (table 5)

Table 5: Post surgery complaints

Post-surgery complaints occurred in	Frequency	Percentage
Not occurred	33	82.5
< 2 years	3	7.5
2-5 years	3	7.5
> 5 years	1	2.5
Total	40	100

Recurrent varicose vein (RVV) after surgery was noted among 17.5% of the cases who underwent

EVLA and 82.5% of the cases who underwent Trendelenburg procedure. (table 6)

Table 6: Recurrent varicose vein (RVV) -Surgical procedures

Surgical procedures	Frequency	Percentage
EVLA	7	17.5
TP	33	82.5
Total	40	100

Ulcer was noted among 27.5% of the patients with recurrence where as 72.5% of the patients had no ulcer. Likewise, Deep vein thrombosis (DVT) was recorded among 7.5% of the cases with recurrence whereas 92.5% of the patients

had no DVT. Skin bruising was seen among 30% of the patients in this study. Based on symptoms 5% of the study participants had paraesthesia, however 95% of the participants were free from it.

Table 7: Different clinical presentation of patients in recurrent varicose veins

Ulcer	Frequency	Percentage
Present	11	27.5
Absent	29	72.5
Total	40	100
DVT	Frequency	Percentage
Present	3	7.5
Absent	37	92.5
Total	40	100.0
Skin bruising	Frequency	Percentage
Present	12	30.0
Absent	28	70.0
Total	40	100.0
Paraesthesia	Frequency	Percentage
Present	2	5.0
Absent	38	95.0
Total	40	100.0

DISCUSSION

In the present study, recurrent varicose veins were most frequently observed in patients aged 51–60 years (37.5%), followed by those aged 41–50 years (30.0%), >60 years (17.5%), and ≤40 years (15.0%). The mean age of the study population was 54.7 years. Males constituted

57.5% of the study population, while females accounted for 42.5%. Recurrence predominantly involved a single limb, with the left lower limb affected in 55.0% and the right lower limb in 42.5%; bilateral involvement was uncommon (2.5%).

According to the Clinical–Etiological–Anatomical–Pathophysiological (CEAP) classification, the clinical distribution was C2 in 22.5%, C3 in 17.5%, C4 in 22.5%, C5 in 17.5%, and C6 in 20.0% of patients. All patients had secondary/recurrent venous disease involving the superficial venous system, with or without perforator involvement, according to the corresponding etiological and anatomical components recorded in the study. The mean Venous Clinical Severity Score (VCSS) was 7.6 ± 1.6 , indicating a considerable burden of chronic venous disease among patients presenting with recurrence. Among the clinical manifestations and complications associated with recurrence, venous ulceration was present in 27.5% of patients, while 72.5% had no ulceration. Deep vein thrombosis (DVT) was documented in 7.5% of patients. Skin bruising was observed in 30.0%, whereas paraesthesia was relatively uncommon, occurring in only 5.0% of patients. With regard to previous treatment, 17.5% of patients had undergone endovenous laser ablation (EVLA), while 82.5% had undergone traditional surgical treatment. The mean interval between previous surgery and the development of postoperative complaints was 3.4 ± 1.4 years. Furthermore, 67.5% of patients continued in the same occupation following surgery. Only 30.0% reported using anti-thromboembolic (ATE) stockings after surgery, whereas 70.0% did not. The probable causes of recurrence were neovascularization (37.5%), duplicated long saphenous vein with persistent/recurrent venous disease (27.5%), inadequate preoperative evaluation (17.5%), duplicated short saphenous vein with persistent/recurrent disease (15.0%), and incomplete previous surgery (2.5%). Thus, neovascularization was the most frequently identified probable cause of recurrence. Anatomically, recurrence involved both the thigh and leg in 50.0% of patients, the leg alone in 20.0%, the popliteal fossa in 15.0%, the thigh alone in 12.5%, and the inguinal region in 2.5%. A significant difference was observed between the mean preoperative and postoperative VCSS,

indicating a measurable change in clinical venous disease severity following treatment. The exact mean preoperative and postoperative VCSS values, mean difference, test statistic, and *P* value should be reported here, rather than merely stating that the difference was significant.

Comparison with Previous Studies

The predominance of neovascularization (37.5%) as the probable cause of recurrence in the present study is comparable with the observations of Jones et al.^[15], who reported neovascularization in 52% of limbs and identified neovascularization at the previously ligated saphenofemoral junction (SFJ) as an important mechanism underlying recurrent varicose veins. They also reported that removal of the great saphenous vein (GSV) reduced recurrence from 43% to 25%. Although the proportion attributed to neovascularization was lower in the present study (37.5% versus 52%), both studies identify neovascularization as a major contributor to postoperative recurrence. Their observation regarding reduced recurrence after GSV stripping also supports the importance of adequately addressing the refluxing saphenous system during primary surgery.

Similarly, Nyamekye et al.^[16] identified thin-walled neovascular channels as the principal clinical cause of recurrence in 19 groins, while histological examination demonstrated neovascularization in 27 of 28 groins. Neovascularization was the sole source of recurrent SFJ incompetence in 68% of groins, although it coexisted with veins missed during the initial operation in some cases. These findings are consistent with the present study, in which neovascularization accounted for the largest proportion of recurrence (37.5%). Importantly, our additional finding of inadequate preoperative evaluation in 17.5% and incomplete surgery in 2.5% also supports the observation by Nyamekye et al. that recurrence may arise from a combination of

newly formed vessels and residual or previously unrecognized venous channels. Dwerryhouse et al.^[17] demonstrated the long-term benefit of stripping the GSV during primary varicose vein surgery. Reoperation was required in only 3 of 52 stripped limbs compared with 12 of 58 ligated limbs, corresponding to a substantially reduced risk of subsequent intervention. Recurrent SFJ incompetence due to neovascularization was also less frequent after stripping (12/52) than after ligation alone (30/58). These findings complement the present observation that anatomical factors involving residual or duplicated saphenous channels contributed substantially to recurrence. Together, these findings suggest that adequate treatment of the refluxing saphenous trunk during the initial procedure may reduce residual pathways for subsequent recurrent varicosities, although neovascularization may still occur despite technically adequate surgery.

Rutherford et al.^[18] emphasized the contribution of incompetent perforators to recurrent varicose veins. They identified incompetent perforators in 63% of patients with recurrent varicose veins compared with 44% of those with primary varicose veins. In the present study, recurrence frequently extended beyond a single anatomical region, with 50% involving both the thigh and leg and a further 20% involving the leg alone. Although our study did not report perforator incompetence as an independent etiological category in the same manner as Rutherford et al., the extensive anatomical distribution of recurrent disease emphasizes the importance of comprehensive duplex evaluation of the superficial, deep, and perforator venous systems.

The findings of Wright et al.^[19] further demonstrate that recurrence varies according to the anatomical site and nature of the previous intervention. They reported a recurrence rate of 2.3% following primary SFJ surgery compared with 9.5% following SFJ reoperation, while recurrence following primary and repeat

saphenopopliteal junction (SPJ) surgery was 8.3% and 7.8%, respectively. New incompetence also developed at previously competent junctions. These observations are relevant to the present study, in which recurrence was distributed across the inguinal region, thigh, popliteal fossa, and leg, rather than being confined to the site of previous intervention. This supports the concept that recurrent varicose veins may represent both local recurrence at previously treated sites and progression of venous disease at previously unaffected sites.

Garner et al.^[20] evaluated 216 limbs and reported evidence of groin recurrence in 65%, with incompetent calf or thigh perforators accounting for 26% and incompetent saphenopopliteal or short saphenous veins accounting for 9%. A persistent lateral accessory saphenous vein was responsible for a substantial proportion of groin recurrences. These findings are comparable with the present study, in which duplicated long saphenous veins (27.5%) and duplicated short saphenous veins (15.0%) represented important probable anatomical causes of recurrence. Both studies therefore highlight the importance of identifying accessory, duplicated, or residual venous channels during preoperative duplex mapping, since failure to recognize these anatomical variations may contribute to subsequent recurrence.

De Maeseneer et al.^[21] demonstrated a progressive increase in recurrent thigh varicosities and neovascularization during longer follow-up. At one year, recurrent thigh varicosities occurred in 24% of limbs following conventional closure and 12% following placement of a silicone barrier; at five years, the corresponding rates increased to 58% and 26%. Duplex-detected neovascularization similarly increased from 27% to 45% in the conventional group. These observations are particularly relevant to the present study, where neovascularization was the leading probable cause of recurrence (37.5%) and the mean

interval to postoperative complaints was 3.4 ± 1.4 years. Collectively, these findings indicate that recurrence is a dynamic process that may become increasingly apparent with longer follow-up.

Finally, Egan et al.^[22] reported that the initial GSV procedure was incomplete in 83.2% of recurrent limbs. An incompetent thigh saphenous vein was identified in 44.2%, an incompetent GSV stump with persistent tributaries in 37.6%, and a combination of an incompetent stump and residual thigh GSV in 16%. Although incomplete surgery itself accounted for only 2.5% of recurrence in the present study, inadequate preoperative evaluation accounted for another 17.5%, while duplicated long and short saphenous veins accounted for 27.5% and 15.0%, respectively. Thus, the magnitude differs considerably between the two studies, but both reinforce the importance of complete preoperative venous mapping and comprehensive treatment of all clinically significant refluxing venous pathways.

Overall interpretation

Taken together, the present findings indicate that recurrent varicose veins have a multifactorial etiology. Neovascularization emerged as the most frequent probable cause, but anatomical variations involving duplicated saphenous veins, inadequate preoperative assessment, and incomplete initial treatment also contributed. The findings of previous studies broadly support this pattern, although the relative contribution of individual mechanisms varies between populations and according to the initial surgical technique, duration of follow-up, and method used to detect recurrence.^[15–22] Important corrections before finalizing: your sentence on the timing of postoperative complaints says “<2 years, 2–5 years and >5 years among 82.5%, 7.5%, 7.5% and 2.5%,” which contains three categories but four percentages; this needs correction from the original table. Also, “Class E,” “Class As+p,” and “Class” are incomplete

CEAP descriptions. We should insert the exact CEAP codes from your table rather than infer them.

Conclusion

Recurrent varicose veins are multifactorial, with neovascularization (37.5%) being the most common probable cause, followed by duplicated long saphenous vein (27.5%), inadequate preoperative evaluation (17.5%), duplicated short saphenous vein (15%), and incomplete surgery (2.5%). Recurrence most commonly involved both the thigh and leg (50%). A substantial proportion of patients had advanced disease (CEAP C4–C6), while VCSS significantly improved from 12.5 ± 5.4 preoperatively to 7.6 ± 1.6 postoperatively ($P < 0.0001$). These findings emphasize the importance of accurate anatomical assessment and appropriate treatment of all significant refluxing venous pathways.

Recommendations

Based on the findings of the present study, comprehensive preoperative duplex ultrasonographic mapping is recommended to identify all sites of reflux and anatomical variations, particularly duplicated or accessory saphenous veins. All clinically significant refluxing venous pathways should be adequately addressed during the initial intervention to minimize residual disease. Patients presenting with recurrence should undergo repeat duplex evaluation to identify neovascularization, residual or recurrent reflux, and progression of venous disease. Standardized assessment using CEAP classification and VCSS, along with long-term clinical and duplex follow-up, is recommended for monitoring disease progression and treatment outcomes. Larger multicentre prospective studies with longer follow-up are required to further establish predictors of recurrence and compare long-term outcomes of different treatment modalities.

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