Section: General Surgery

Original Research Article

A COMPARATIVE STUDY OF LINTONS PROCEDURE AND AMBULATORY PHLEBECTOMY FOR INCOMPETENT PERFORATOR–IN THE MANAGEMENT OF LOWER LIMB VARICOSE VEINS

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ABSTRACT

Background: Lower limb varicose veins are a common manifestation of chronic venous insufficiency, with incompetent perforator veins playing a major role in disease progression. Surgical treatment aims to eliminate venous reflux and improve symptoms. Linton's procedure has traditionally been used for perforator incompetence, whereas ambulatory phlebectomy has emerged as a minimally invasive alternative with potentially better postoperative outcomes.
Aim: To compare the clinical outcomes of Linton's procedure and ambulatory phlebectomy in the management of incompetent perforator-associated lower limb varicose veins.
Materials and Methods: This prospective observational comparative study was conducted in the Department of General Surgery, Government Medical College, Ongole, over a period of three months. Sixty patients aged 18–70 years with Doppler-confirmed incompetent perforator-associated lower limb varicose veins were included and allocated into two groups by simple randomization. Group A underwent Linton's procedure, while Group B underwent ambulatory phlebectomy. Patients were evaluated for operative time, postoperative pain using the Visual Analog Scale (VAS), postoperative complications, duration of hospital stay, symptom relief, and recurrence at six months. Statistical analysis was performed using SPSS software, and a p-value <0.05 was considered statistically significant.
Results: Ambulatory phlebectomy was associated with significantly shorter operative time, lower postoperative pain scores, fewer wound-related complications, and a shorter hospital stay compared with Linton's procedure ($p<0.05$). Both procedures provided satisfactory symptom relief, and there was no significant difference in recurrence rates at six months of follow-up.
Conclusion: Both Linton's procedure and ambulatory phlebectomy are effective in the management of incompetent perforator-associated lower limb varicose veins. However, ambulatory phlebectomy offers superior postoperative outcomes, faster recovery, reduced morbidity, and comparable short-term recurrence, making it the preferred surgical option in appropriately selected patients.

Keywords: Lintons Procedure, Ambulatory Phlebectomy, Lower Limb Varicose Veins.

INTRODUCTION

Varicose veins of the lower limbs are among the most common manifestations of chronic venous disease encountered in surgical practice, affecting a significant proportion of the adult population worldwide. They are characterized by dilated, elongated, and tortuous superficial veins resulting from venous valve incompetence, leading to venous reflux and sustained venous hypertension. The condition commonly involves the great saphenous vein, small saphenous vein, and perforator veins, producing symptoms such as pain, heaviness, fatigue, limb swelling, nocturnal cramps, itching, and cosmetic concerns. If left untreated, progressive venous hypertension may result in chronic skin changes, including hyperpigmentation, lipodermatosclerosis, eczema, and venous ulceration, significantly impairing quality of life.

Among the various etiological factors contributing to chronic venous insufficiency, incompetence of perforator veins plays a pivotal role in disease progression. Perforator veins normally permit unidirectional blood flow from the superficial venous system to the deep venous system. Failure of the perforator valves results in reverse blood flow from the deep to the superficial veins, increasing ambulatory venous pressure and perpetuating venous hypertension. Persistent perforator incompetence has been strongly associated with advanced stages of chronic venous disease, particularly in patients with skin changes and venous ulcers, making its identification and treatment an important component of comprehensive varicose vein management.[1,2]

The management of incompetent perforator veins has evolved considerably over the past several decades. Traditionally, open surgical techniques such as Linton's procedure were regarded as the standard treatment. Described by Cecil Linton, this procedure involves subfascial ligation of incompetent perforator veins through a long medial leg incision. Although effective in interrupting pathological reflux and reducing venous hypertension, the extensive surgical exposure is associated with significant postoperative morbidity, including wound infection, delayed healing, hematoma formation, painful scarring, prolonged hospitalization, and delayed return to normal activities. Consequently, its use has gradually declined with the advent of less invasive techniques.[3,4]

Advances in surgical technology have led to the development of minimally invasive procedures aimed at achieving comparable clinical efficacy while minimizing postoperative complications. Ambulatory phlebectomy is one such technique in which varicose veins are removed through multiple small stab incisions under local or regional anesthesia. The procedure offers several advantages, including minimal tissue trauma, superior cosmetic outcomes, reduced postoperative pain, shorter hospital stay, faster recovery, and earlier return to routine activities. It has become an integral component of contemporary varicose vein surgery and is frequently combined with other procedures to manage superficial venous reflux and perforator incompetence.[5]

Despite the widespread adoption of minimally invasive approaches, conventional open procedures continue to be performed in selected patients, particularly in resource-limited settings where advanced endovenous technologies may not be readily available. Furthermore, certain complex or advanced cases of chronic venous insufficiency may still warrant open perforator ligation. While both Linton's procedure and ambulatory phlebectomy aim to eliminate venous reflux and improve clinical outcomes, differences remain regarding operative duration, postoperative morbidity, wound-related complications, recovery time, recurrence rates, patient satisfaction, and overall cost-effectiveness.

Comparative evidence evaluating these two surgical approaches remains limited, particularly in the context of incompetent perforator-associated lower limb varicose veins. A direct comparison of their clinical outcomes is essential to determine the relative benefits and limitations of each technique and to facilitate evidence-based surgical decision-making. Such information is particularly relevant in healthcare settings where treatment selection is influenced by resource availability, surgeon expertise, and patient preferences.

Therefore, the present study was undertaken to compare Linton's procedure and ambulatory phlebectomy in the management of lower limb varicose veins associated with incompetent perforator veins. The study evaluates operative parameters, postoperative complications, symptom relief, duration of hospital stay, recovery, and recurrence, with the objective of identifying the safer and more effective surgical approach for improving patient outcomes.

MATERIALS AND METHODS

Study Design

This was a prospective observational comparative study conducted to evaluate and compare the clinical outcomes of Linton's procedure and ambulatory phlebectomy in the management of incompetent perforator-associated lower limb varicose veins.

Study Setting

The study was conducted in the Department of General Surgery, Government Medical College (GMC), Ongole, Prakasam District, Andhra Pradesh, India.

Study Duration

The study was conducted over a period of 3 months.

Study Population

The study included all patients diagnosed with lower limb varicose veins associated with incompetent perforator veins who attended the Department of General Surgery during the study period and fulfilled

the inclusion criteria. Patients who provided written informed consent were enrolled in the study.

Sample Size

All eligible patients presenting during the study period were included in the study. The enrolled patients were allocated into two treatment groups by **simple randomization**:

- **Group A:** Patients undergoing Linton's procedure (open subfascial ligation of incompetent perforator veins).
- **Group B:** Patients undergoing ambulatory phlebectomy.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Age between 18 and 70 years.
- Clinically diagnosed lower limb varicose veins with incompetent perforator veins confirmed by Duplex Doppler ultrasonography.
- Patients willing to undergo surgery and provide written informed consent.

Exclusion Criteria

Patients with any of the following conditions were excluded:

- Deep vein thrombosis.
- Recurrent varicose veins.
- Severe peripheral arterial disease.
- Pregnancy.

Preoperative Assessment

All patients underwent a detailed preoperative evaluation, which included:

- Detailed clinical history and physical examination.
- Clinical classification using the CEAP (Clinical, Etiological, Anatomical, and Pathophysiological) classification system.
- Duplex Doppler ultrasonography of the lower limb venous system to identify venous reflux and incompetent perforator veins.
- Routine preoperative laboratory investigations, including complete blood count, blood sugar, renal function tests, coagulation profile, electrocardiography, and other investigations as indicated.

Surgical Procedure

Group A – Linton's Procedure

Patients assigned to Group A underwent open subfascial ligation of incompetent perforator veins (Linton's procedure) under appropriate anesthesia. Through a longitudinal medial leg incision, the deep fascia was opened, incompetent perforator veins were identified and ligated, and the wound was closed in layers with appropriate postoperative wound care.

Group B – Ambulatory Phlebectomy

Patients in Group B underwent ambulatory phlebectomy through multiple small stab incisions under regional or local anesthesia. The incompetent superficial varicosities associated with perforator incompetence were removed using specialized phlebectomy hooks. The small skin incisions were closed with adhesive strips or fine sutures as required, followed by compression bandaging.

Postoperative Care and Follow-up

Postoperatively, all patients received standardized analgesics, antibiotics whenever indicated, limb elevation, early ambulation, and compression therapy using elastic compression stockings. Patients were followed up periodically to assess wound healing, symptom relief, postoperative complications, and recurrence of varicose veins. Final assessment for recurrence was performed at 6 months after surgery.

Outcome Measures

The primary outcome measures included:

- Operative time (minutes).
- Postoperative pain assessed using the Visual Analog Scale (VAS).
- Postoperative complications, including:
- Wound infection
    - Hematoma
    - Delayed wound healing
    - Seroma formation
- Duration of hospital stay (days).
- Clinical improvement and symptom relief.
- Recurrence of varicose veins at 6-month follow-up.

Data Collection

Clinical and operative data were recorded using a predesigned data collection proforma. Demographic details, clinical findings, CEAP classification, Doppler findings, intraoperative observations, postoperative complications, duration of hospitalization, and follow-up findings were documented systematically.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software (Version 25.0 or later). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages.

Comparisons between the two groups were performed using:

Independent Student's t-test for continuous variables.

Chi-square test or Fisher's exact test for categorical variables.

A **p-value <0.05** was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Government Medical College, Ongole, before commencement of the study. Written informed consent was obtained from all participants prior to enrollment. The objectives, procedures, potential benefits, and possible risks of the study were explained to each participant in their native language. Participation was voluntary, and confidentiality of patient information was maintained throughout the study. The study did not involve any additional investigations or interventions beyond routine clinical management, and all data were

collected using an approved data collection proforma in accordance with ethical principles.

RESULTS

A total of 60 patients with incompetent perforator-associated lower limb varicose veins were included in the study. Patients were randomly allocated into two groups, with 30 patients undergoing Linton's procedure (Group A) and 30 patients undergoing ambulatory phlebectomy (Group B).

Age Distribution

Table 1: Age Distribution of Patients

Age Group (Years)	Linton's Procedure (n=30)	Ambulatory Phlebectomy (n=30)	Total
18–30	3	4	7
31–40	6	7	13
41–50	10	9	19
51–60	8	7	15
61–70	3	3	6
Total	**30**	**30**	**60**
Gender			
Male	21	21	42
Female	9	9	18

The majority of patients belonged to the 41–50 years age group in both study groups. The mean age was 46.3 ± 10.8 years in the Linton's group and 44.9 ± 9.7 years in the ambulatory phlebectomy group. There was no statistically significant difference in age distribution between the two groups ($p > 0.05$). Male patients predominated in both groups, accounting for 70% of the study population.

Table 2: CEAP Clinical Classification

CEAP Class	Linton's	Ambulatory Phlebectomy	Total
C2	4	5	9
C3	10	11	21
C4	9	8	17
C5	4	3	7
C6	3	3	6
Total	**30**	**30**	**60**

Most patients presented with CEAP C3 and C4 disease, indicating moderate to advanced chronic venous insufficiency.

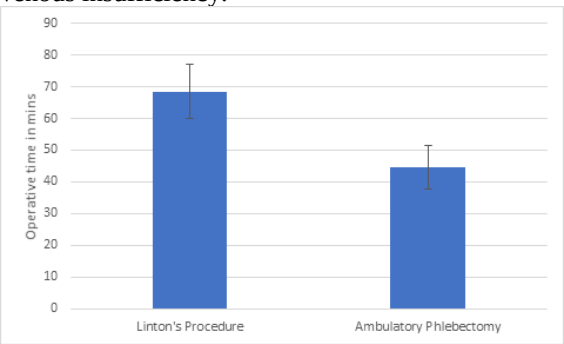

Figure 1: Operative Time in both procedures

The mean operative time was significantly longer in the Linton's procedure group compared to the ambulatory phlebectomy group (68.4 ± 8.5 minutes vs. 44.6 ± 6.9 minutes, $p < 0.001$).

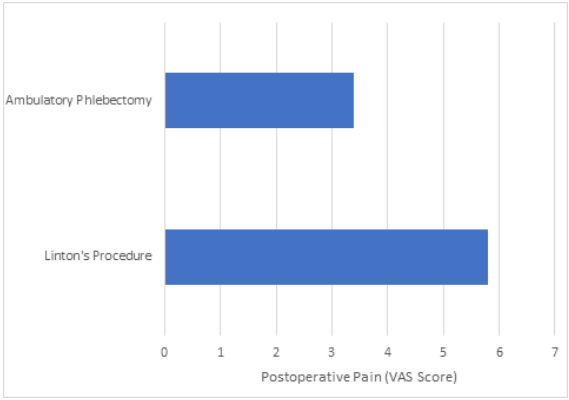

Figure 2: Postoperative Pain (VAS Score)

Postoperative pain assessed using the Visual Analog Scale (VAS) was significantly lower in patients who underwent ambulatory phlebectomy.

Table 3: Postoperative Complications

Complication	Linton's (n=30)	Ambulatory Phlebectomy (n=30)	p-value
Wound Infection	5 (16.7%)	1 (3.3%)	0.041
Hematoma	3 (10.0%)	2 (6.7%)	0.640
Delayed Healing	4 (13.3%)	1 (3.3%)	0.160
Seroma	2 (6.7%)	1 (3.3%)	0.550
No Complications	16 (53.3%)	25 (83.3%)	0.014

Postoperative complications were more common following Linton's procedure. Wound infection and delayed wound healing occurred more frequently in Group A, whereas ambulatory phlebectomy was associated with fewer complications.

Table 4: Duration of Hospital Stay

Procedure	Mean ± SD (Days)	p-value
Linton's Procedure	5.4 ± 1.2	<0.001
Ambulatory Phlebectomy	2.1 ± 0.7	

The mean hospital stay was significantly shorter in the ambulatory phlebectomy group compared with the Linton's procedure group (2.1 ± 0.7 days vs. 5.4 ± 1.2 days, $p < 0.001$).

Recurrence at Six Months

Table 5: Recurrence at Six-Month Follow-up

Recurrence	Linton's (n=30)	Ambulatory Phlebectomy (n=30)	p-value
Present	3 (10.0%)	2 (6.7%)	0.640
Absent	27 (90.0%)	28 (93.3%)	
Total	**30**	**30**	

At six months of follow-up, recurrence was observed in 3 patients (10.0%) in the Linton's group and 2 patients (6.7%) in the ambulatory phlebectomy group. The difference was not statistically significant ($p = 0.640$).

Symptom Relief

Both procedures resulted in significant improvement in symptoms during follow-up. However, patients undergoing ambulatory phlebectomy reported earlier pain relief, improved cosmetic satisfaction, and quicker return to normal daily activities.

DISCUSSION

The present prospective comparative study evaluated the clinical outcomes of Linton's procedure and ambulatory phlebectomy in the management of incompetent perforator-associated lower limb varicose veins. Both procedures were effective in relieving symptoms; however, ambulatory phlebectomy demonstrated superior postoperative outcomes with lower morbidity, shorter hospital stay, and faster recovery.

The majority of patients in the present study belonged to the 41–50-year age group, with a predominance of male patients. This finding is comparable to the study by R. Kishore et al,[6] who also observed that varicose veins commonly affected middle-aged adults, with males constituting the majority of their study population.

Most patients in our study were classified as CEAP C3 and C4, indicating that patients generally presented after the development of edema and skin changes. Similar observations were reported by Kishore et al,[6] who found that a significant proportion of patients with isolated perforator incompetence presented with C3–C4 disease, emphasizing the importance of early diagnosis and intervention.

The mean operative time was significantly longer in patients undergoing Linton's procedure than in those undergoing ambulatory phlebectomy. This difference is expected because Linton's operation requires extensive subfascial dissection through a long medial leg incision, whereas ambulatory phlebectomy is performed through multiple small stab incisions with minimal tissue dissection. Although Kishore et al,[6] compared ambulatory phlebectomy with foam sclerotherapy rather than Linton's procedure, they similarly demonstrated that minimally invasive procedures reduce operative trauma while maintaining effective treatment of incompetent perforators.[7]

Postoperative pain was significantly lower in the ambulatory phlebectomy group. The smaller incisions and limited soft tissue dissection associated with ambulatory phlebectomy contribute to reduced postoperative discomfort and earlier mobilization. These findings agree with the review by Jose Antonio Olivencia,[4] who highlighted ambulatory phlebectomy as a minimally invasive procedure associated with less postoperative pain, improved cosmetic outcomes, and rapid return to normal activities.

Postoperative wound complications were considerably more frequent after Linton's procedure. Wound infection, delayed wound healing, and seroma formation occurred more commonly in the Linton's group, whereas ambulatory phlebectomy had very few wound-related complications. These observations are consistent with the review by Alfonso J. Tafur and Suman Rathbun,[7] who reported that the traditional Linton procedure is associated with substantially higher wound complication rates than newer minimally invasive perforator procedures.

The duration of hospital stay was significantly shorter following ambulatory phlebectomy than after Linton's procedure. Earlier ambulation, minimal postoperative pain, and fewer wound complications contributed to quicker discharge. Similar advantages of ambulatory phlebectomy have been reported by Jose Antonio Olivencia,[5] who emphasized its suitability as an outpatient or short-stay procedure with rapid postoperative recovery.

Recurrence rates at six months were low in both treatment groups and did not differ significantly. Although the present follow-up period was relatively short, both procedures effectively interrupted pathological venous reflux. Kishore et al,[6] similarly demonstrated that adequate treatment of incompetent perforator veins leads to effective symptom relief and low recurrence when appropriate patient selection and postoperative compression therapy are employed. The higher incidence of wound-related complications observed after Linton's procedure in the present study is consistent with the findings of Stuart et al,[8] and TenBrook et al,[9] who demonstrated significantly greater postoperative wound morbidity and longer hospital stay following the conventional open Linton procedure compared with minimally invasive perforator surgery.

The overall findings of the present study support the growing preference for minimally invasive surgery in the management of varicose veins. Modern venous surgery has increasingly shifted from extensive open procedures such as Linton's operation to less invasive techniques because they achieve comparable efficacy with lower postoperative morbidity and greater patient satisfaction. Reviews by R. Hampton Andrews and Robert G. Dixon,[10] also conclude that ambulatory phlebectomy is a safe and effective treatment for superficial varicosities, particularly when combined with appropriate management of underlying venous reflux.[11]

The findings of the present study indicate that both Linton's procedure and ambulatory phlebectomy are effective surgical options for incompetent perforator-associated lower limb varicose veins. However, ambulatory phlebectomy offers significant advantages in terms of reduced postoperative pain, fewer wound complications, shorter hospital stay, faster recovery, and comparable short-term recurrence rates. Based on these observations and in agreement with the published literature, ambulatory phlebectomy may be considered the preferred surgical option for appropriately selected patients with incompetent perforator-associated varicose veins.

Limitations

The present study has certain limitations. It was conducted at a single tertiary care center with a relatively small sample size and a short follow-up period of six months. Long-term recurrence, quality-of-life assessment, and cost-effectiveness were not evaluated. Larger multicenter studies with extended follow-up are required to validate these findings and establish long-term outcomes.

CONCLUSION

In conclusion, both Linton's procedure and ambulatory phlebectomy are effective surgical options for the management of incompetent perforator-associated lower limb varicose veins, providing satisfactory symptom relief and low short-term recurrence rates. However, ambulatory phlebectomy demonstrated clear advantages over Linton's procedure, including shorter operative time, reduced postoperative pain, fewer wound-related complications, shorter hospital stay, faster recovery, and better cosmetic outcomes. Although Linton's procedure remains an effective treatment in selected cases, particularly where minimally invasive facilities are unavailable, the findings of the present study suggest that ambulatory phlebectomy is a safer, less invasive, and more patient-friendly alternative with comparable clinical efficacy. Therefore, ambulatory phlebectomy may be considered the preferred surgical approach for appropriately selected patients with incompetent perforator-associated lower limb varicose veins, while larger studies with longer follow-up are warranted to further validate these findings.

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