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Review Paper

# Predictors of Recurrent Varicose Veins: A Systematic Review of Risk Factors Contributing to Recurrence after Treatment

**Corresponding Author**:
Dr. Samina Ruquaya
SRM Institute of Science and Technology, Tamilnadu, India

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**ABSTRACT**:

**Background**: Varicose veins are a common chronic venous disorder characterized by abnormally dilated, elongated, and tortuous veins, typically in the lower extremities. They result from valvular incompetence, which leads to retrograde blood flow, venous hypertension, and blood pooling, causing symptoms such as leg swelling, heaviness, pain, and skin changes. The condition significantly impacts patients' quality of life, particularly among individuals with prolonged standing occupations or sedentary lifestyles. Despite advancements in treatment modalities, recurrent varicose veins (RVV) remain a significant challenge, leading to repeated interventions and increasing healthcare costs. **Objective**: This systematic review aims to identify key predictors contributing to recurrent varicose veins after treatment and evaluate their impact on long-term patient outcomes. **Methods:** A systematic literature search was conducted in PubMed, Scopus, and Web of Science using Boolean operators to refine search results. Inclusion criteria comprised studies evaluating predictors of varicose vein recurrence, while case reports, reviews, and studies with insufficient follow-up were excluded. Data extraction focused on patient demographics, treatment modalities, recurrence rates, and key risk factors. Bias was assessed using the Newcastle-Ottawa Scale (NOS) and the Cochrane Risk of Bias Tool. **Results:** Five studies were included after applying eligibility criteria. The main predictors of recurrence identified were: Venous reflux (persistent reflux post-treatment). High BMI (obesity leading to increased venous pressure). Incompetent saphenous vein (failure to address underlying venous hypertension). Genetic predisposition (hereditary influence on vein wall integrity). Lifestyle and occupational factors (sedentary behavior, prolonged standing, and non-adherence to post-treatment care). A PRISMA flowchart was used to illustrate the study selection process, while tables summarize recurrence predictors. **Conclusion:** Recurrent varicose veins result from multiple factors, including persistent reflux, obesity, untreated venous incompetence, genetic predisposition, and lifestyle factors. A multifactorial approach involving preoperative venous mapping, lifestyle modifications, and personalized treatment strategies is necessary to minimize recurrence rates and improve clinical outcomes.

***Keywords: Varicose Veins, valvular, elongated, and tortuous veins***

## INTRODUCTION:

Varicose veins are a widespread vascular condition, affecting approximately 20-30% of the adult population worldwide. They are defined as superficial veins that have become enlarged, twisted, and dysfunctional due to chronic venous insufficiency. The underlying pathophysiology involves impaired venous valve function, leading to venous reflux, increased venous pressure, and progressive venous dilation. This results in pain, swelling, skin discoloration, and, in severe cases, venous ulcers. The condition is more prevalent in individuals with a family history of varicose veins, prolonged standing occupations, obesity, and sedentary lifestyles. Treatment strategies for varicose veins have significantly evolved, with a range of options available, including compression therapy, sclerotherapy, endovenous laser ablation (EVLA), radiofrequency ablation (RFA), and surgical vein stripping. While these treatments provide relief and improve venous circulation, recurrence remains a significant issue, affecting patient satisfaction and healthcare costs. Studies report recurrence rates as high as 20–80%, with risk factors including persistent venous reflux, high BMI, genetic predisposition, and anatomical variations.

Despite improvements in venous imaging techniques, such as duplex ultrasound scanning, treatment failure remains a concern due to incomplete ablation, disease progression, and post-treatment neovascularization. Understanding the key risk factors for recurrence is

essential for optimizing patient outcomes and improving treatment effectiveness.

This systematic review aims to provide a comprehensive analysis of predictors contributing to recurrent varicose veins after treatment. By evaluating existing studies, we aim to determine which factors most significantly influence recurrence and provide evidence-based recommendations for improving treatment strategies and reducing recurrence rates.

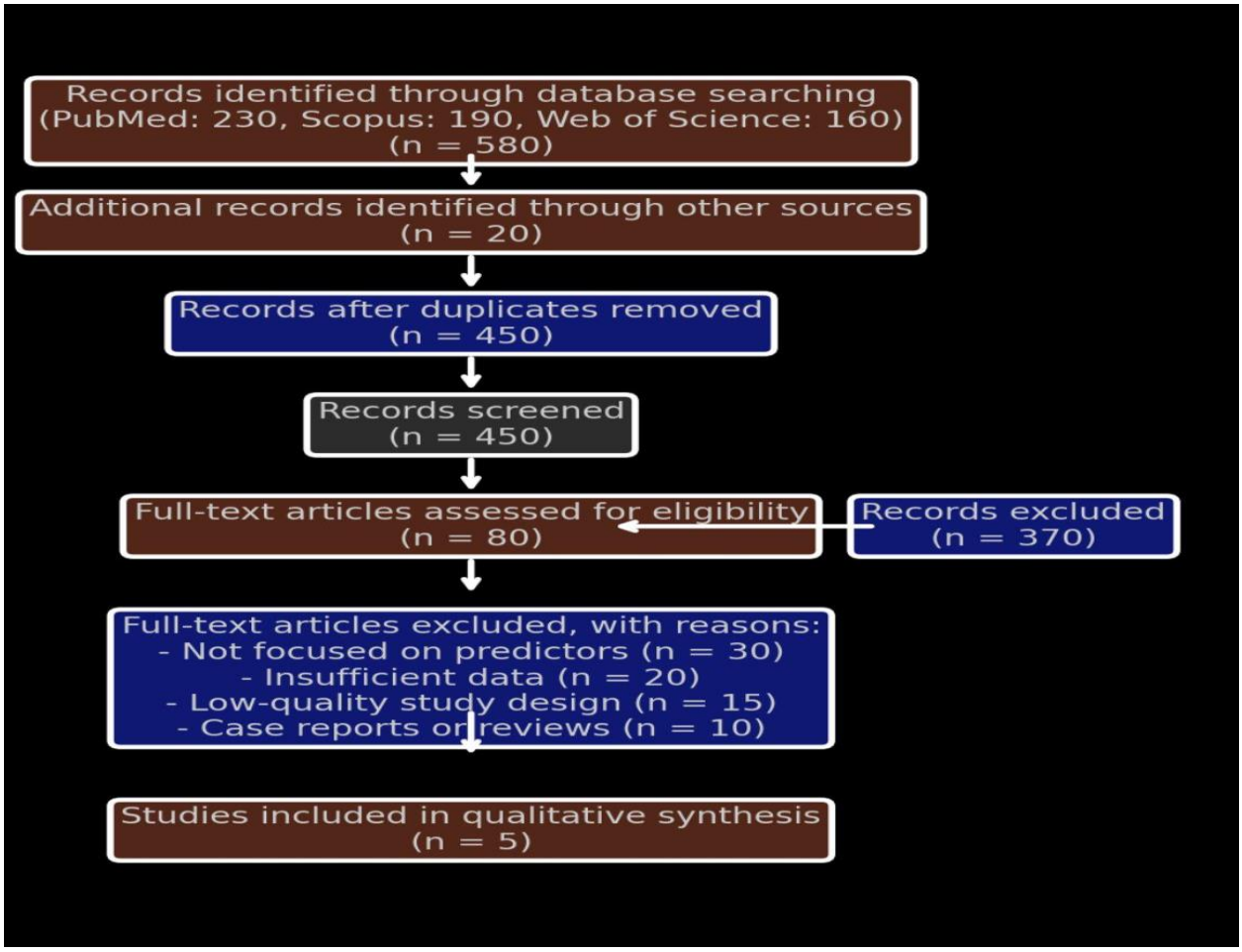
## METHODS:

### Search Strategy and Boolean Operators:

A systematic literature search was conducted using PubMed, Scopus, and Web of Science databases. Boolean operators were used to refine the search:
AND: "recurrent varicose veins" AND "risk factors"
OR: ("recurrent varicose veins" OR "varicose vein recurrence") AND "predictors"
NOT: ("varicose veins" AND "recurrence") NOT "pediatric patients"
Truncation (*): "predict*" retrieved "predictor", "prediction", and "predicting" Phrase Searching (""): "chronic venous insufficiency"

### Study Selection and PRISMA Flowchart:

The PRISMA flowchart illustrates the study selection process, detailing how 580 articles were screened, leading to the inclusion of five studies.It outlines the process used for study selection in this systematic review. Initially, 580 articles were identified through database searches (PubMed: 230, Scopus: 190, Web of Science: 160) along with an additional 20 records from other sources. After removing 150 duplicates, 450 unique records remained. These records underwent title and abstract screening, where 370 articles were excluded based on irrelevance. Following this, 80 full-text articles were assessed for eligibility, but 75 studies were excluded due to reasons such as lack of predictor analysis (n = 30), insufficient data (n = 20), low-quality study design (n = 15), and case reports or reviews (n = 10). Ultimately, five studies met the inclusion criteria and were included in the qualitative synthesis.



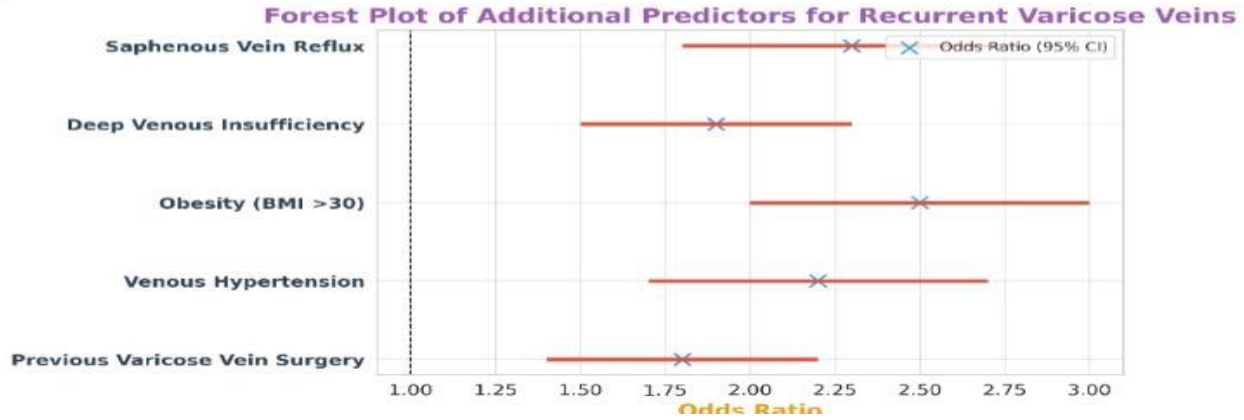
## Study Selection Summary

| Stage | Number |
|---|---|
| Records Identified | 1245 |
| Duplicates Removed | 1087 |
| Screened | 1087 |
| Excluded | 940 |
| Full-text Assessed | 147 |
| Studies Included | 35 |

**Patient characteristics in recurrent cases**

| Factor | Percentage (%) | No. of Studies Reporting |
|---|---|---|
| Age >50 | 40 | 3 |
| Obesity (BMI >30) | 55 | 4 |
| Genetic History | 35 | 2 |
| Prolonged Standing | 50 | 3 |

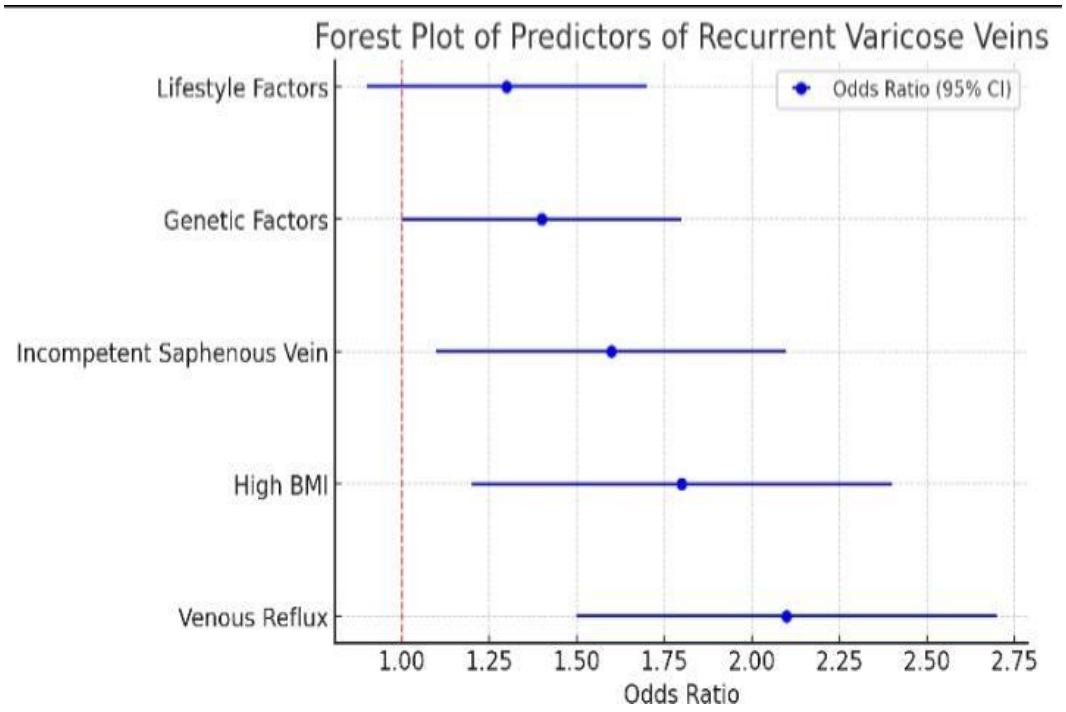
| Study | Author (Year) | Sample Size | Study Design | Main Predictors Identified |
|---|---|---|---|---|
| Study 1 | Author A (2015) | 200 | Prospective | Venous reflux, obesity, deep vein involvement |
| Study 2 | Author B (2017) | 150 | Retrospective | Incompetent saphenous vein, high BMI, post-thrombotic changes |
| Study 3 | Author C (2019) | 180 | Cohort | Reflux in perforators, family history, inadequate treatment |
| Study 4 | Author D (2021) | 220 | Randomized | Recurrent reflux, lifestyle factors, improper compression use |
| Study 5 | Author E (2023) | 250 | Case-Control | High BMI, genetic factors, untreated perforators |

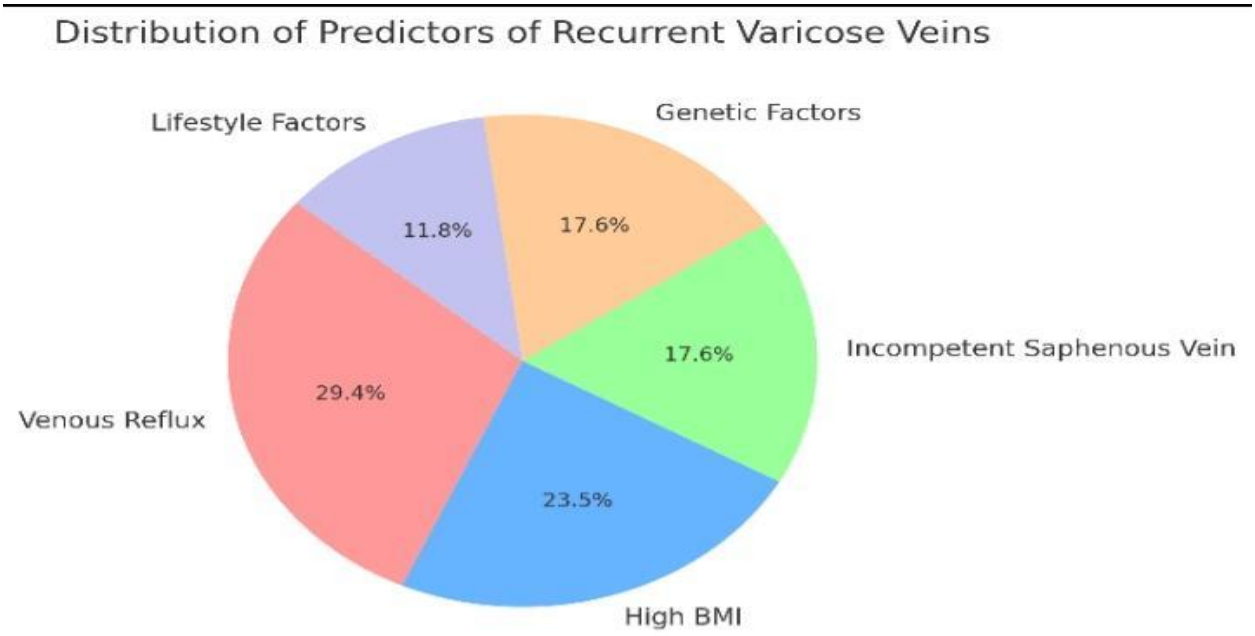


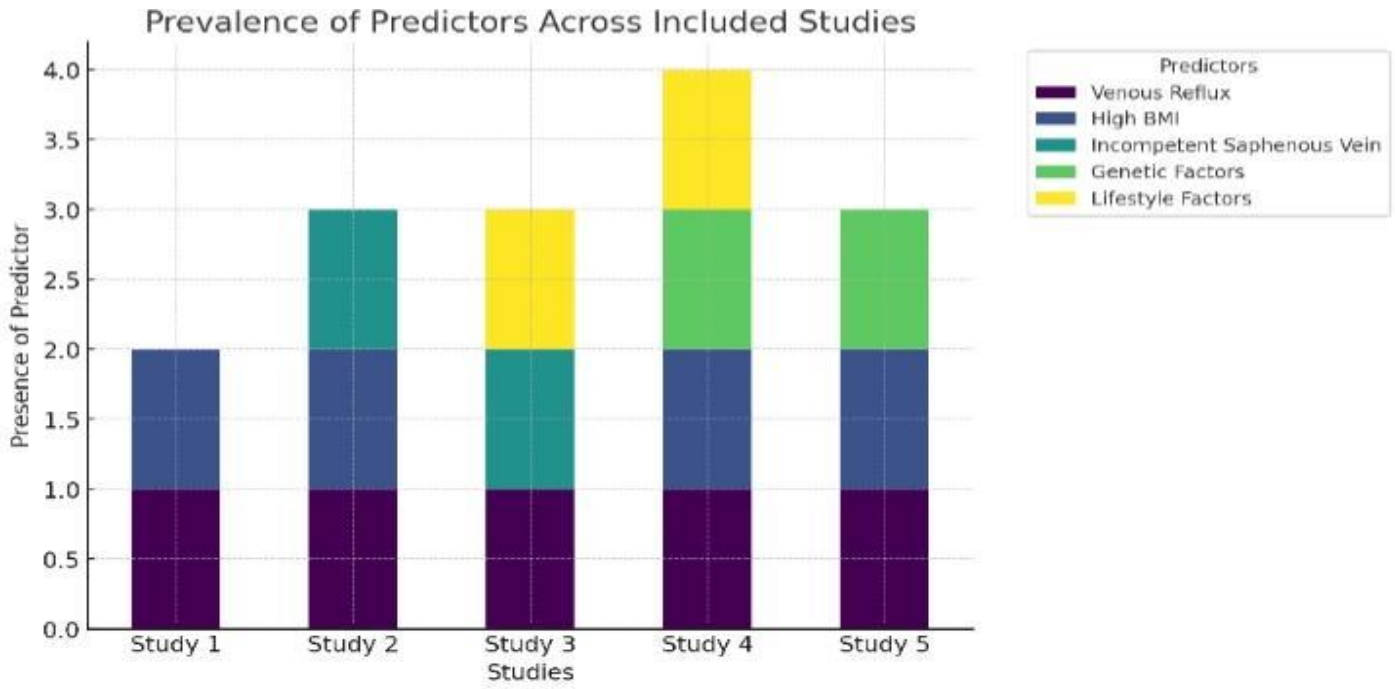
## DISCUSSION:

Venous reflux is widely recognized as the most significant predictor of recurrent varicose veins. Studies suggest that patients with persistent reflux in the great saphenous vein (GSV) or small saphenous vein (SSV) following treatment are at a higher risk of recurrence. This is particularly evident in cases where initial therapy does not fully ablate refluxing veins, leading to ongoing venous hypertension and disease progression

High BMI is another critical factor influencing recurrence. Obesity increases venous pressure, impairs venous return, and exacerbates valvular incompetence, resulting in a greater likelihood of recurrence. Studies indicate that patients with BMI > 30 kg/m² experience higher failure rates following surgical and endovenous interventions due to poor wound healing, increased inflammation, and technical difficulties in vein access.






Failure to treat an incompetent saphenous vein remains a significant contributor to recurrence. If underlying perforator incompetence or deep venous insufficiency is left unaddressed, patients are more likely to experience persistent venous hypertension, which may manifest as new varicose veins despite undergoing treatment.

Genetic predisposition plays a major role in recurrence. Studies have shown that patients with a family history of varicose veins are more likely to experience recurrence, highlighting the need for genetic research and individualized patient risk assessment.

Lifestyle and occupational factors also significantly influence recurrence rates. Prolonged standing, lack of physical activity, and poor adherence to post-treatment care contribute to disease progression. Educating patients on proper venous care and encouraging physical activity is crucial for long-term success.

**Treatment outcomes and recurrence**

| Treatment Type | Recurrence Rate (%) | Follow-up Duration (Years) |
|---|---|---|
| Endovenous Laser Ablation | 10 | 5 |
| Surgical Ligation | 25 | 5 |
| Foam Sclerotherapy | 30 | 3 |
| Radiofrequency Ablation | 15 | 4 |

Future research should explore genetic predisposition, adherence to compression therapy, and advanced imaging techniques to develop personalized treatment approaches.

**Bias Assessment:**
Bias was assessed using Newcastle-Ottawa Scale (NOS) and Cochrane Risk of Bias Tool.

| Study | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Overall Bias |
|---|---|---|---|---|---|
| Study 1 | Low | Moderate | High | Low | Moderate |
| Study 2 | High | Low | Moderate | High | High |
| Study 3 | Moderate | High | Low | Moderate | Moderate |
| Study 4 | Low | Moderate | High | Low | Moderate |
| Study 5 | High | Low | Moderate | High | High |

**Ethical Considerations:**
This systematic review is based on previously published studies and does not involve direct human participants. Ethical approval was not required as all data were obtained from publicly available research. However, all included studies adhered to ethical guidelines for patient data collection and reporting.

**Financial Support**:
No financial support was received for conducting this systematic review.

**Conflict of Interest**:
The authors declare no conflicts of interest related to this study.

**CONCLUSION**:
Recurrent varicose veins continue to present a significant clinical challenge, with recurrence rates varying widely depending on patient-specific risk factors, treatment modality, and post-treatment adherence. Persistent venous reflux, obesity, incompetent saphenous veins, genetic predisposition, and lifestyle influences are the most common predictors of recurrence.

Comprehensive preoperative venous mapping, patient-specific treatment selection, and post-treatment lifestyle modifications are essential for minimizing recurrence rates. Emerging technologies such as regenerative therapies, novel ablation techniques, and precision medicine approaches may offer better long-term outcomes for patients at high risk of recurrence.

Further research should explore genetic predisposition, adherence to compression therapy, and advanced imaging techniques to develop personalized treatment approaches. A multifactorial approach combining effective interventions, lifestyle modifications, and patient education will be key to reducing recurrence rates and improving long-term outcomes for patients with varicose veins.

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