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Patient-Reported Outcomes and Disease-Specific Quality of Life After Surgical and Conservative Treatments for Lower Limb Varicose Veins: A Systematic Review

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Abstract

Lower limb varicose veins are a common manifestation of chronic venous disease and can adversely affect physical functioning, symptom burden, and disease-specific quality of life (QoL). Although high ligation and stripping have traditionally been considered standard surgical approaches, conservative and minimally invasive options, such as compression therapy, sclerotherapy, and endovenous thermal or non-thermal techniques, have increasingly gained prominence. However, comparative evidence regarding patient-reported outcomes (PROMs) remains heterogeneous and dispersed across randomized trials.

This systematic review aimed to evaluate randomized controlled trials (RCTs) published between 2016 and 2026 that compared surgical with conservative or minimally invasive interventions for lower limb varicose veins, with particular emphasis on patient-reported and disease-specific QoL outcomes.

The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. PubMed/Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science, Excerpta Medica database (Embase), the Cochrane Library, and Google Scholar were searched for eligible RCTs published from January 2016 to July 2026. Studies evaluating surgical versus conservative or minimally invasive management and reporting PROMs or disease-specific QoL outcomes were included. Methodological quality was evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool. Due to substantial clinical and methodological heterogeneity, findings were synthesized narratively in accordance with Synthesis Without Meta-analysis (SWiM) guidance.

Fourteen RCTs met the eligibility criteria. Interventions included open surgery, endovenous laser ablation (EVLA), radiofrequency ablation (RFA), mechanochemical ablation (MOCA), cyanoacrylate adhesive closure, ultrasound-guided foam sclerotherapy (UGFS), and compression therapy. Improvements in disease-specific QoL and PROMs were reported from baseline in most treatment groups. However, these within-group improvements did not necessarily indicate superiority over alternative treatments. Between-group differences in QoL outcomes were generally small and inconsistent, although some trials reported differences in procedural pain, anatomical outcomes, or the need for re-intervention. Due to substantial clinical and methodological heterogeneity, the findings were synthesized narratively.

Surgical, conservative, and minimally invasive approaches were associated with meaningful improvements in patient-reported and disease-specific QoL, with no consistent evidence demonstrating clear superiority of one modality. Treatment decisions should therefore incorporate anatomical suitability, patient preference, procedural morbidity, potential need for re-intervention, and healthcare resource considerations alongside QoL outcomes.

Categories: Physical Medicine & Rehabilitation, General Surgery, Cardiac/Thoracic/Vascular Surgery
Keywords: chronic venous insufficiency (cvi), disease-specific quality of life, endovenous laser thermal ablation, patient-reported outcome measures (proms), venous clinical severity

Introduction And Background

Varicose veins are a common manifestation of chronic venous disease, characterized by dilatation and tortuosity of superficial veins in the lower extremities. They may produce symptoms such as pain, heaviness, aching, swelling, itching, and discomfort, which can negatively affect physical activity and quality of life (QoL). The severity and presentation of venous disease may also vary according to lifestyle and the level of physical activity performed. Recent evidence has examined differences in venous morphology, disease stage, and symptoms among individuals participating in high- and low-impact activities [1].

The development and progression of varicose veins are influenced by multiple demographic and clinical factors. Sex, ethnicity, age, body composition, family history, occupation, and lifestyle may contribute to differences in disease presentation and treatment outcomes. However, evidence regarding the influence of gender and ethnicity on the management of varicose veins and venous leg ulcers remains limited, highlighting the importance of considering patient characteristics when evaluating venous disease and its treatment [2].

Chronic venous disease can present with a wide range of clinical manifestations, from mild symptoms to significant limb swelling and advanced skin changes. Treatment outcomes may therefore vary between individuals depending on their clinical and demographic characteristics. However, studies of combined endovenous therapies have suggested that demographic and clinical characteristics may not necessarily have a significant influence on outcomes in patients treated for leg swelling [3].

Conservative and pharmacological approaches also have an important role in the management of chronic venous disease. Pharmacological agents such as sulodexide and micronized purified flavonoid fraction have been investigated for their potential effects on venous inflammation and associated symptoms. Their use reflects the growing recognition of inflammation as an important component of the pathophysiology of varicose vein disease and chronic venous insufficiency [4].

Alongside conservative management, minimally invasive endovenous procedures have become increasingly important alternatives to traditional surgical treatment. Endovenous thermal techniques, including laser and microwave ablation, are widely used for the treatment of lower-limb varicose veins. Recent randomized evidence comparing microwave and laser ablation has demonstrated continued interest in evaluating the safety and efficacy of different endovenous technologies [5].

Endovenous laser ablation has also been investigated with regard to the extent of vein treated. In patients with great saphenous vein varicosities, comparisons between above-knee and full-length ablation provide further evidence regarding the optimization of procedural techniques while maintaining favorable clinical outcomes [6].

Patient-reported symptoms and QoL are important outcomes when assessing the effectiveness of varicose vein treatment. Improvements in symptoms have been reported following both cyanoacrylate glue adhesion and endovenous laser ablation (EVLA), particularly among patients with lower-grade clinical disease. These findings emphasize that treatment success should not be assessed solely through anatomical outcomes but should also consider patients' symptoms and functional well-being [7,8].

Accurate assessment of treatment outcomes in patients with varicose veins requires consideration of clinical severity, disease-specific symptoms, health-related QoL, and patient satisfaction. The Aberdeen Varicose Vein Questionnaire (AVVQ) was developed to assess the impact of varicose veins from the patient's perspective and provided an important foundation for standardized patient-reported outcome assessment in venous disease [9]. The Venous Clinical Severity Score (VCSS) subsequently introduced a structured clinical measure for evaluating the severity and progression of venous disease and assessing treatment outcomes [10], which was later revised (rVCSS) to improve its applicability and responsiveness in contemporary venous practice [11]. The repeatability and reproducibility of the rVCSS have also been demonstrated in a multicenter evaluation, supporting its use as a reliable clinical outcome measure [12]. In addition to clinical assessment, disease-specific QoL can be evaluated using the Chronic Venous Insufficiency Questionnaire (CIVIQ), which was specifically developed and validated to measure the impact of chronic venous insufficiency on patients' QoL [13]. Generic health-related QoL may be assessed using standardized instruments such as the EuroQol 5-Dimension Questionnaire (EQ-5D) [14] and the 36-Item Short Form Health Survey (SF-36) [15], allowing broader evaluation of the effects of venous disease and its treatment on overall health status. More recently, the Venous Treatment Satisfaction Questionnaire (VenousTSQ) was developed to specifically assess patient satisfaction following varicose vein treatment, further emphasizing the importance of incorporating patient perspectives into treatment evaluation [16]. Collectively, these complementary outcome measures provide a multidimensional framework for evaluating the clinical effectiveness, symptomatic benefit, QoL improvement, and patient-centered outcomes of varicose vein interventions. The clinical features and contributing factors associated with chronic venous disease and varicose veins are illustrated in Figure *1*.

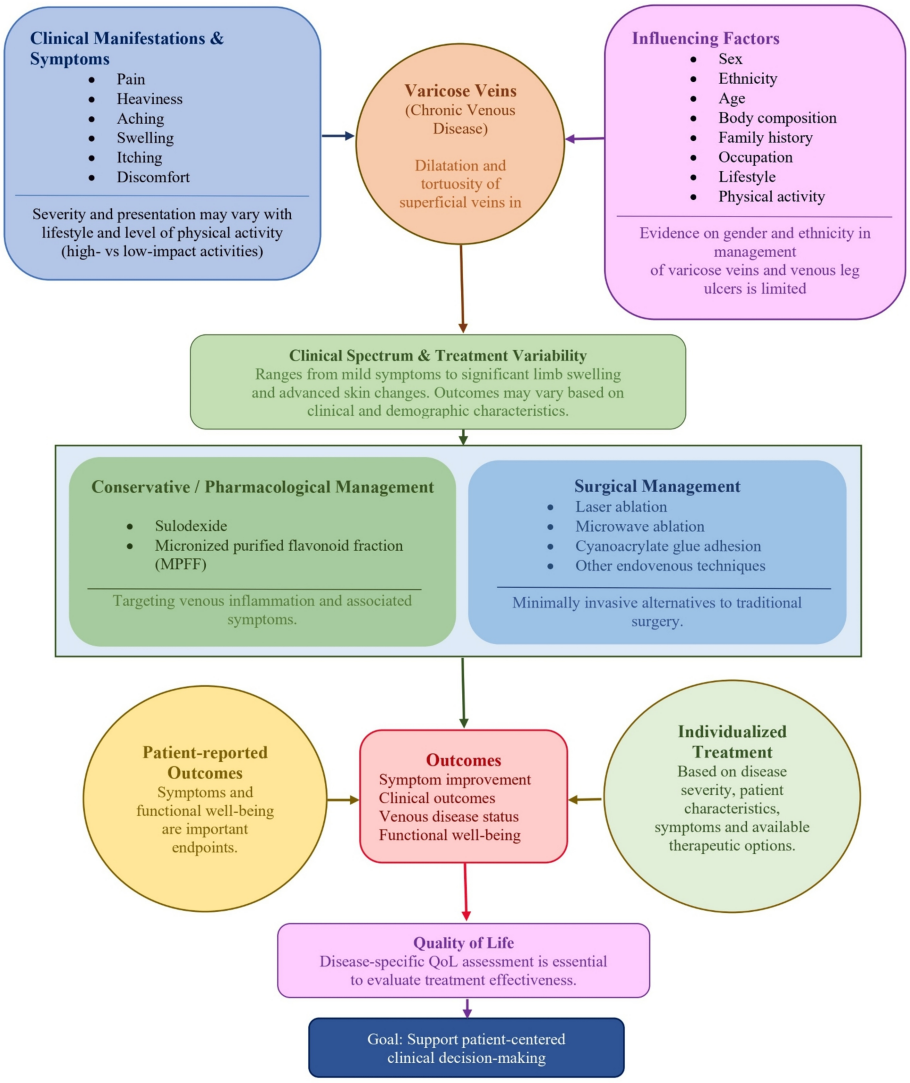


FIGURE 1: Comprehensive Overview of Chronic Venous Disease and Varicose Veins

QoL: quality of life

The structure, design, and formatting of the figure were produced by the authors using Microsoft PowerPoint (Microsoft Corporation, Redmond, WA, USA).

Overall, the management of varicose veins has evolved toward individualized treatment based on disease severity, patient characteristics, symptoms, and available therapeutic options. Current expert consensus emphasizes appropriate assessment and selection of treatment strategies to optimize outcomes in patients with venous disease. Therefore, evaluating patient-reported outcomes and disease-specific QoL following surgical and conservative interventions is important for determining the effectiveness of different management approaches and for supporting patient-centered clinical decision-making.

Review

Methodology

Study Design

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement to ensure a transparent, reproducible, and methodologically rigorous review process [17]. Given the anticipated heterogeneity of interventions, comparators, and outcome instruments across eligible trials, a predetermined protocol restricted inclusion exclusively to randomized controlled trials (RCTs) comparing a surgical intervention with a conservative or minimally invasive intervention for lower limb varicose veins.

Search Strategy

A comprehensive electronic literature search was performed across PubMed/Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science, Excerpta Medica database (Embase), the Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar for records published between January 2016 and July 2026. Boolean operators (AND/OR) were used to combine Medical Subject Headings (MeSH) and free-text keywords, including "varicose veins", "chronic venous disease", "surgery", "stripping", "endovenous ablation", "sclerotherapy", "compression therapy", "conservative treatment", "quality of life", "patient-reported outcome", and "randomized controlled trial". Reference lists of eligible trials and related systematic reviews were manually screened (citation chaining) to identify any additional eligible RCTs. Only full-text, peer-reviewed articles with a verifiable digital object identifier (DOI) were considered for the final synthesis, as shown in Table *1*.

Database	Boolean Search Strategy	Publication Year
PubMed/MEDLINE	("varicose veins" OR "chronic venous disease") AND ("surgery" OR "stripping" OR "endovenous ablation" OR "sclerotherapy") AND ("compression therapy" OR "conservative treatment") AND ("quality of life" OR "patient-reported outcome") AND ("randomized controlled trial" OR "RCT")	2016–2026
Scopus	("varicose veins" OR "chronic venous disease") AND ("surgical treatment" OR "stripping" OR "endovenous ablation" OR "sclerotherapy") AND ("conservative treatment" OR "compression therapy") AND ("quality of life" OR "patient-reported outcomes")	2016–2026
Web of Science	("varicose veins" OR "chronic venous disease") AND ("surgery" OR "endovenous ablation" OR "sclerotherapy") AND ("conservative treatment" OR "compression") AND ("quality of life" OR "patient-reported outcome") AND ("randomized controlled trial")	2016–2026
Embase	("varicose veins" OR "chronic venous disease") AND ("surgery" OR "stripping" OR "endovenous ablation" OR "sclerotherapy") AND ("compression therapy" OR "conservative treatment") AND ("quality of life" OR "patient-reported outcomes")	2016–2026
Cochrane CENTRAL	("varicose veins" OR "chronic venous disease") AND ("surgery" OR "endovenous ablation" OR "stripping") AND ("conservative treatment" OR "compression therapy") AND ("quality of life" OR "patient-reported outcome") AND ("RCT")	2016–2026
Google Scholar	"varicose veins" AND "surgery" AND "quality of life"; "varicose veins" AND "conservative treatment" AND "patient-reported outcomes"; "varicose veins" AND "endovenous ablation" AND "RCT"	2016–2026
Citation chaining	Manual screening of reference lists of eligible RCTs and relevant systematic reviews	2016–2026

TABLE 1: Search Stratergy Table

RCT: Randomized Controlled Trial; CENTRAL: Cochrane Central Register of Controlled Trials; MEDLINE: Medical Literature Analysis and Retrieval System Online; Embase: Excerpta Medica database

Selection Criteria

Study selection followed the Population, Intervention, Comparison, Outcomes and Study (PICOS) framework, restricted specifically to RCTs. Details of the inclusion and exclusion criteria applied at the title/abstract and full-text screening stages are summarised in Table *1*.

Inclusion Criteria

Studies were included if they involved adult patients aged ⩾18 years, of any gender, diagnosed with lower-limb varicose veins classified as Clinical-Etiology-Anatomy-Pathophysiology (CEAP) class C2 or above. Only RCTs, including parallel-group or crossover designs, published between 2016 and 2026, were considered eligible. Studies were required to compare a surgical intervention, such as high ligation and stripping or phlebectomy, with a conservative, non-surgical, or minimally invasive comparator, including compression therapy, sclerotherapy, or endovenous thermal or non-thermal ablation. Eligible studies were required to report patient-reported outcome measures (PROMs) or disease-specific or generic health-related QoL outcomes, such as the Aberdeen Varicose Vein Questionnaire (AVVQ), Aberdeen Varicose Vein Symptom Score (AVVSS), Chronic Venous Insufficiency Questionnaire (CIVIQ), Venous Insufficiency Epidemiological and Economic Study Quality of Life Questionnaire (VEINES-QoL), EQ-5D, or SF-36 [9,13-15]. Full-text articles published in English with an available DOI were included, as shown in Table *2*.

Category	Inclusion Criteria	Exclusion Criteria
Population	Adult patients (≥18 years), any gender, diagnosed with lower limb varicose veins (CEAP class C2 and above)	Paediatric populations; secondary varicose veins due to deep venous thrombosis, pelvic congestion, or vascular malformation
Study Design	RCTs (parallel-group or crossover) published between 2016 and 2026	Observational studies, cohort studies, case-control studies, case series, case reports, narrative reviews, systematic reviews, meta-analyses, conference abstracts, and study protocols without reported outcomes
Interventions	Any surgical treatment (high ligation and stripping, phlebectomy) compared with any conservative or minimally invasive treatment (compression therapy, sclerotherapy, endovenous thermal or non-thermal ablation)	Studies not comparing a surgical arm with a conservative/non-surgical or minimally invasive comparator; pharmacological-only interventions
Outcomes	Studies reporting PROMs or disease-specific QoL instruments (e.g., AVVQ, AVVSS, CIVIQ, VEINES-QoL, EQ-5D, SF-36)	Studies reporting only technical/anatomical outcomes (occlusion rate, recurrence) without any PROM or QoL measure
Publication	Full-text articles published in English with available DOI	Non-English publications; duplicate publications or overlapping trial populations; full text unavailable

TABLE 2: PICOS Eligibility Criteria for Study Selection

PICOS: Population, Intervention, Comparison, Outcomes and Study; CEAP: Clinical-Etiology-Anatomy-Pathophysiology; RCT: Randomized Controlled Trial; PROMs: Patient-Reported Outcome Measures; QoL: Quality of Life; AVVQ: Aberdeen Varicose Vein Questionnaire; AVVSS: Aberdeen Varicose Veins Symptom Severity Score; CIVIQ: Chronic Venous Insufficiency Questionnaire; VEINES-QoL: Venous Insufficiency Epidemiological and Economic Study Quality of Life Questionnaire; EQ-5D: EuroQol 5-Dimension Questionnaire; SF-36: 36-Item Short Form Health Survey; DOI: Digital Object Identifier.

Exclusion Criteria

Studies involving paediatric populations or patients with secondary varicose veins associated with deep venous thrombosis, pelvic congestion, or vascular malformations were excluded. Observational studies, cohort studies, case-control studies, case series, case reports, narrative reviews, systematic reviews, meta-analyses, conference abstracts, and study protocols without reported outcomes were excluded. Studies that did not compare a surgical intervention with a conservative, non-surgical, or minimally invasive comparator, as well as studies evaluating pharmacological-only interventions, were excluded. Studies reporting only technical or anatomical outcomes, such as vein occlusion or recurrence, without any PROM or QoL measure were also excluded. Non-English publications, duplicate publications, studies involving overlapping trial populations, and articles for which the full text was unavailable were excluded, as shown in Table *2*.

Study Selection and Data Extraction

Titles and abstracts identified through the search strategy were screened against the eligibility criteria, and full texts of potentially eligible articles were subsequently retrieved and assessed in detail. Duplicate records and overlapping trial populations (for example, multiple publications from the same RCT reporting different follow-up intervals) were identified and reconciled so that each unique trial contributed only once to the qualitative synthesis, using the report with the most relevant PROM/QoL data. Data extraction was performed using a standardized extraction form capturing study title, authors, year of publication, country, sample size, study design, surgical intervention, conservative/comparator intervention, PROM/QoL instrument used, follow-up duration, and key findings.

Quality Assessment

The methodological quality of all included randomized controlled trials was assessed using the Cochrane Risk of Bias 2 (RoB 2) tool, which evaluates the risk of bias in a specific result from a randomized trial rather than the trial as a whole. The tool assesses five domains: (1) bias arising from the randomization process; (2) bias due to deviations from intended interventions; (3) bias due to missing outcome data; (4) bias in measurement of the outcome; and (5) bias in selection of the reported result [18].

Risk-of-bias assessments focused on the PROMs and disease-specific or generic health-related QoL outcomes relevant to this review. Because RoB 2 judgments are outcome-specific, the outcome measure and follow-up time point to which each assessment applied were identified during the evaluation. Where multiple eligible outcomes or follow-up time points were reported, the scope of the assessment was

determined according to the outcome data available from the included trial reports. The assessment records documented the relevant outcome, follow-up time point, domain-level judgments, and supporting justifications to facilitate transparency and reproducibility.

Each domain and the overall risk-of-bias judgment were classified as "low risk," "some concerns," or "high risk" in accordance with RoB 2 guidance. Overall judgments were based on the domain-level assessments for the specific result being evaluated. No formal risk-of-bias threshold was used to exclude otherwise eligible studies; instead, the assessments informed the interpretation of the findings during narrative synthesis. Studies with some concerns or a high risk of bias were retained where they met the predefined eligibility criteria, and their findings were interpreted with appropriate caution.

Data Synthesis

A quantitative meta-analysis was not undertaken because of substantial clinical heterogeneity across the included trials in terms of comparator interventions (open surgery, EVLA, radiofrequency ablation (RFA), mechanochemical ablation (MOCA), cyanoacrylate embolization, ultrasound-guided foam sclerotherapy (UGFS), and compression therapy), PROM/QoL instruments used (AVVQ/AVVSS, CIVIQ, EQ-5D, SF-36, VAS), and follow-up duration (12 weeks to 14 years). Instead, the findings were synthesised narratively in accordance with the Synthesis Without Meta-analysis (SWiM) reporting guideline. Studies were grouped and compared according to three domains: (1) trials comparing open surgery with endovenous thermal or non-thermal ablation; (2) trials comparing endovenous or sclerotherapy techniques against one another; and (3) trials evaluating conservative adjuncts (compression) around a procedural intervention.

Results

A total of 386 records were identified through database and register searching. After the removal of 154 duplicate records, 232 records remained for screening. Following title and abstract screening, no records were excluded at this stage, and all 78 reports were sought for retrieval, all of which were successfully obtained. These 78 reports were then assessed for eligibility. Of these, 64 studies were excluded for the following reasons: non-randomized design (n = 21), publication outside the 2016-2026 window (n = 14), no patient-reported or disease-specific QoL outcome (n = 17), and duplicate or overlapping trial populations (n = 12). Ultimately, 14 RCTs met the eligibility criteria and were included in the systematic review. The detailed process of study identification, screening, eligibility assessment, and inclusion, in accordance with the PRISMA guidelines, is shown in Figure *2*.

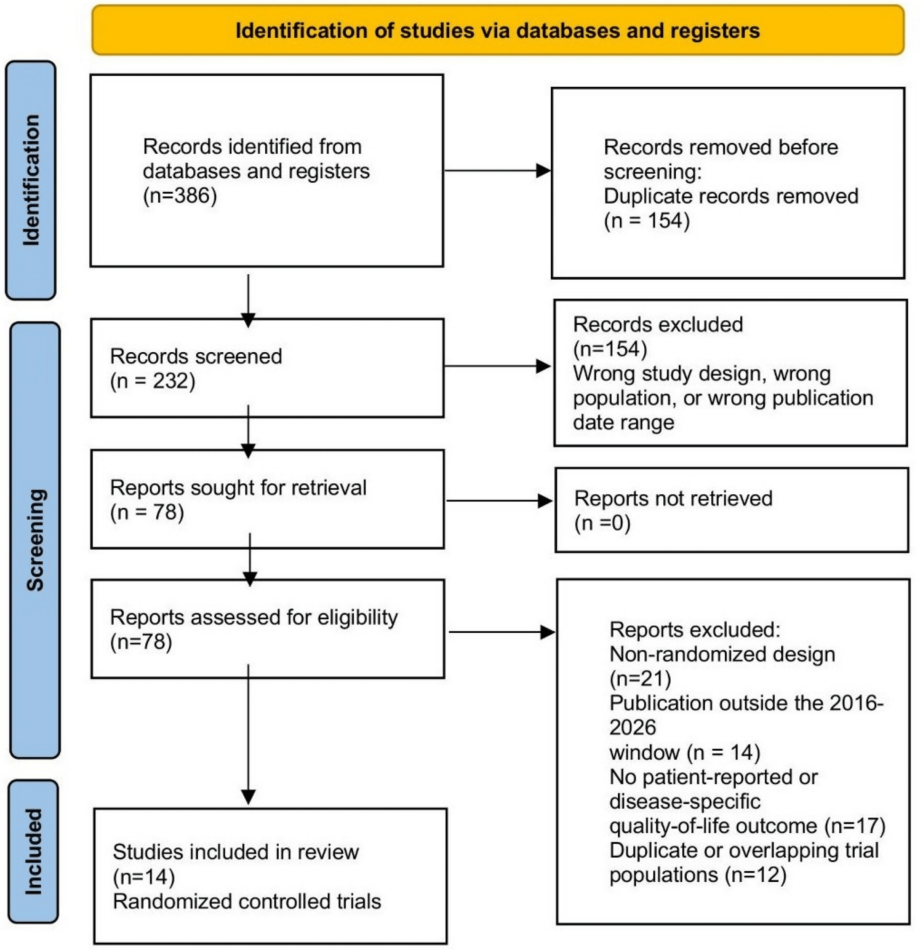


FIGURE 2: PRISMA Flow Diagram Showing the Identification, Screening, Eligibility, and Inclusion of Studies

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; n: Number of records or studies.

The 14 RCTs included in this systematic review evaluated a range of surgical, endovenous, sclerotherapy, and conservative treatment strategies for lower limb varicose veins. The studies varied in sample size, intervention type, and follow-up duration, while commonly assessing disease-specific symptoms and QoL using validated PROMs such as AVVSS, AVVQ, CIVIQ, VCSS, and EQ-5D. Overall, the included studies demonstrated substantial improvement in patient-reported outcomes following treatment, with several minimally invasive approaches showing outcomes comparable to conventional surgery. A year-wise distribution of the included trials and the detailed characteristics of each included RCT are presented in Table 3.

Sr. No.	Study Title	Author (Year)	Study design	Sample Size (n)	Surgical Intervention	Conservative/Comparator Intervention	PROM/QoL Instrument	Follow-Up	Key Findings
1	Randomized trial comparing surgery, EVLA, and ultrasound-guided foam sclerotherapy for great saphenous varicose veins	Venermo et al. (2016) [19]	RCT	214	Open surgery (high ligation + stripping)	EVLA; UGFS (conservative/minimally invasive)	AVVSS	One year	AVVSS improved significantly and comparably in all groups; GSV occlusion was higher after surgery and EVLA than UGFS.
2	Prospective RCT of UGFS combined with high ligation vs surgical stripping for severe lower-extremity varicosis	Yin et al. (2017) [20]	RCT	170	Conventional surgical stripping	UGFS + high ligation	VCSS, patient-reported symptom relief	12 months	Both approaches improved clinical severity and symptoms; UGFS combined with ligation offered comparable relief with less invasiveness.
3	Five-year follow-up of open surgery, foam sclerotherapy and EVLA for great	Vähäaho et al. (2018)	RCT	196	Open	Foam sclerotherapy; EVLA	AVVSS	Five	Occlusion rates were higher after surgery/EVLA than foam; disease-

	saphenous varicose veins	[21]			surgery			years	specific QoL improvement was sustained across all groups.
4	RCT of mechanochemical and endovenous thermal ablation of great saphenous varicose veins	Vähäaho et al. (2019) [22]	RCT	125	Endovenous thermal ablation (EVLA/RFA)	MOCA	AVVQ, VCSS	One year	MOCA achieved comparable QoL improvement and clinical severity scores to thermal ablation with less procedural pain.
5	MARADONA trial: mechanochemical ablation vs radiofrequency ablation for primary GSV incompetence	Holewijn et al. (2019) [23]	RCT	170	RFA	MOCA	CIVIQ-20, EQ-5D	Two years	Both non-thermal and thermal ablation produced comparable and sustained disease-specific and generic QoL improvement.
6	Post-procedural compression vs no compression after RFA and concomitant foam sclerotherapy	Pihlaja et al. (2020) [24]	RCT	134	RFA with post-procedural compression	RFA without compression (conservative adjunct)	AVVQ, VAS pain	Six months	Omission of post-procedural compression was non-inferior; QoL and pain outcomes were comparable between groups.
7	Role of compression after radiofrequency ablation of varicose veins	Onwudike et al. (2020) [25]	RCT	100	RFA with compression stocking	RFA alone (no compression)	AVSS, RVCSS	12 weeks	No compression was non-inferior for vein obliteration and patient-reported QoL, supporting selective use of compression.
8	Laser ablation versus mechanochemical ablation in primary varicose veins	Tawfik et al. (2020) [26]	RCT	100	EVLA	MOCA	CIVIQ	12 months	MOCA showed better VCSS improvement and fewer complications than EVLA, with comparable disease-specific QoL gains.
9	CLASS trial: five-year outcomes of laser ablation, foam sclerotherapy and surgery for varicose veins	Brittenden et al. (2019) [27]	RCT	798	Surgery (high ligation and stripping)	Laser ablation; foam sclerotherapy (conservative/minimally invasive)	AVVQ, EQ-5D, SF-36	Five years	Disease-specific QoL (AVVQ) was better after laser ablation or surgery than after foam sclerotherapy at five years.
10	LAMA trial: EVLA versus mechanochemical ablation with ClariVein for superficial venous incompetence	Mohamed et al. (2021) [28]	RCT	170	EVLA	MOCA	AVVQ, EQ-5D	One year	MOCA produced significantly lower intraprocedural pain with comparable occlusion rates and disease-specific QoL to EVLA.
11	MOCCA trial: pain outcomes following mechanochemical ablation vs cyanoacrylate adhesive	Belramman et al. (2022) [29]	RCT	167	CAE	MOCA	AVVQ, EQ-5D	12 months	Pain scores, clinical severity and disease-specific QoL outcomes were comparable between the two non-tumescent techniques.
12	Polidocanol-foam treatment of varicose veins: quality-of-life impact compared with conventional surgery	Sakugawa et al. (2024) [30]	RCT	80	Conventional surgery (stripping)	Polidocanol foam sclerotherapy	CIVIQ-20	Six months	Both surgery and foam sclerotherapy produced significant, comparable improvement in disease-specific quality of life.
13	Three-year follow-up: concomitant vs staged treatment of varicosities after mechanochemical ablation of the GSV	Rahman et al. (2025) [31]	RCT	85	Concomitant phlebectomy at time of MOCA	Staged foam sclerotherapy of tributaries after MOCA (conservative/staged)	Patient satisfaction, symptom score	Three years	Concomitant treatment required fewer re-interventions; both strategies maintained good patient-reported outcomes at three years.
14	Fourteen-year outcomes of EVLA, high ligation and stripping, and UGFS for great saphenous varicose veins	Rahman et al. (2026) [32]	RCT	196	High ligation and stripping (surgery)	EVLA; UGFS (conservative/minimally invasive)	AVVSS	14 years	EVLA and surgery showed similar long-term technical success; UGFS was technically inferior, but long-term QoL was comparable across all groups.

TABLE 3: Characteristics of Included RCTs Comparing Surgical and Conservative Treatments for Lower Limb Varicose Veins

AVVSS: Aberdeen Varicose Veins Symptom Severity Score; EVLA: Endovenous Laser Ablation; UGFS: Ultrasound-Guided Foam Sclerotherapy; RCT: Randomized Controlled Trial; GSV: Great Saphenous Vein; VCSS: Venous Clinical Severity Score; AVVQ: Aberdeen Varicose Vein Questionnaire; RFA: Radiofrequency Ablation; MOCA: Mechanochemical Ablation; CIVIQ-20: Chronic Venous Insufficiency Questionnaire-20; EQ-5D: EuroQol 5-Dimension Questionnaire; QoL: Quality of Life; VAS: Visual Analogue Scale; AVSS: Aberdeen Varicose Vein Symptom Score; RVCSS: Revised Venous Clinical Severity Score; SF-36: 36-Item Short Form Health Survey; CAE: Cyanoacrylate Adhesive Embolization; PROM: Patient-Reported Outcome Measure.

Assessment of Risk of Bias

The methodological quality of the 14 included RCTs was assessed using the Cochrane RoB 2 tool across five domains: the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. The assessments were directed at patient-reported outcomes and disease-specific or generic health-related QoL results relevant to this review. For transparency, the outcome measure and follow-up time point associated with each assessment were recorded and assessed separately for each relevant result/specified for the representative outcome selected from each trial.

Eight trials were classified as having a low overall risk of bias, while six were classified as having some concerns. No trial was classified as having a high overall risk of bias. The concerns identified primarily involved missing outcome data, deviations from intended interventions, measurement of outcomes, and selection of the reported result. These judgments should be interpreted in relation to the specific outcomes and follow-up time points assessed, rather than as definitive judgments about every result reported by each trial. The detailed domain-level risk-of-bias ratings for each trial are presented in Table 4.

S.No.	Author (Year)	Randomization Process	Deviations from Intended Interventions	Missing Outcome Data	Measurement of the Outcome	Selection of Reported Result	Overall Risk of Bias
1	Venermo et al. (2016) [19]	Low Risk	Low Risk	Low Risk	Low Risk	Some Concerns	Some Concerns
2	Yin et al. (2017) [20]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
3	Vähäaho et al. (2018) [21]	Low Risk	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns
4	Vähäaho et al. (2019) [22]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
5	Holewijn et al. (2019) [23]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
6	Pihlaja et al. (2020) [24]	Low Risk	Some Concerns	Low Risk	Low Risk	Low Risk	Some Concerns
7	Onwudike et al. (2020) [25]	Low Risk	Low Risk	Low Risk	Some Concerns	Low Risk	Some Concerns
8	Tawfik et al. (2020) [26]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
9	Brittenden et al. (2019) [27]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
10	Mohamed et al. (2021) [28]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
11	Belramman et al. (2022) [29]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
12	Sakugawa et al. (2024) [30]	Low Risk	Some Concerns	Low Risk	Some Concerns	Low Risk	Some Concerns
13	Rahman et al. (2025) [31]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
14	Rahman et al. (2026) [32]	Low Risk	Low Risk	Some Concerns	Low Risk	Low Risk	Some Concerns

TABLE 4: Risk of Bias Assessment of Included Randomized Controlled Trials Using the Cochrane RoB 2 Tool

RoB 2: Revised Cochrane Risk of Bias 2 tool; RCT: Randomized Controlled Trial; QoL: Quality of Life.

Discussion

This systematic review synthesized evidence from 14 RCTs published between 2016 and 2026 that compared surgical and conservative or minimally invasive treatments for lower limb varicose veins using patient-reported outcomes and disease-specific QoL measures. Across the included trials, improvements from baseline were commonly reported within treatment groups, suggesting that patients experienced symptomatic and QoL benefits following treatment. However, within-group improvements should be distinguished from between-group treatment effects, as improvement over time in an individual treatment group does not establish that the intervention is superior to its comparator. The comparative findings generally showed small or inconsistent differences in QoL outcomes between treatment modalities, although differences were reported in certain secondary outcomes, including procedural pain, anatomical durability, and the need for re-intervention [19-32]. Therefore, the findings support improvements following several treatment approaches but do not establish consistent superiority of one modality over another in terms of patient-reported outcomes.

Several trials directly comparing open surgery with endovenous thermal ablation reinforce this pattern. Venermo et al. (2016) [19] found that AVVSS improved comparably after surgery, EVLA, and UGFS at one year, although occlusion rates favoured surgery and EVLA. The same Finnish cohort, reassessed by Vähäaho et al. (2018) [21] at five years, again demonstrated durable disease-specific QoL improvement across all three treatment arms, despite surgery and EVLA maintaining superior anatomical occlusion compared with foam sclerotherapy. The most recent extension of this trial, reported by Rahman et al. (2026) [32] at 14 years, remains the longest-term randomized comparison available in the literature and confirms that quality-of-life benefit is sustained over the very long term irrespective of whether patients originally underwent surgery, EVLA, or UGFS, even though UGFS was technically inferior in terms of vein occlusion. Similarly, the CLASS trial reported by Brittenden et al. (2019) [27], the largest included trial (n = 798), found that disease-specific QoL measured by the AVVQ was slightly better after surgery or laser ablation than after foam sclerotherapy at five years, while generic QoL measures did not differ between treatment groups. Collectively, these large, long-duration trials suggest that although anatomical success may favour surgery and thermal ablation over sclerotherapy-based approaches, patient-reported QoL outcomes are more consistent across modalities than technical outcomes alone would suggest [19,21,27,32].

A second cluster of trials compared different minimally invasive and non-thermal techniques against one another rather than against open surgery directly, reflecting the ongoing shift in clinical practice away from stripping surgery. Vähäaho et al. (2019) [22] and the MARADONA trial reported by Holewijn et al. (2019) [23] both demonstrated that MOCA achieved disease-specific QoL improvement comparable to endovenous thermal ablation, while avoiding the discomfort associated with tumescent anaesthesia. Tawfik et al. (2020) [26] similarly reported that MOCA achieved superior clinical severity score improvement compared with EVLA, with comparable CIVIQ-assessed QoL. The LAMA trial (Mohamed et al., 2021) [28] extended this comparison and confirmed that MOCA produced significantly lower intraprocedural pain than EVLA while achieving equivalent occlusion rates and AVVQ-assessed QoL outcomes. The MOCCA trial (Belramman et al., 2022) [29] subsequently compared two non-tumescent techniques directly, MOCA and cyanoacrylate embolization, and again found no significant difference in pain, clinical severity, or disease-specific QoL outcomes between the two approaches. Taken together, these trials indicate that among minimally invasive, non-surgical techniques, the choice between thermal and non-thermal ablation, or between different non-thermal modalities, has relatively little impact on the QoL outcomes achieved and may therefore be guided by procedural pain, anatomical suitability, and resource availability [22,23,26,28,29].

A further set of trials examined conservative adjuncts to procedural treatment, specifically the role of post-procedural compression therapy. Pihlaja et al. (2020) [24] and Onwudike et al. (2020) [25] both conducted non-inferiority RCTs demonstrating that omission of routine post-procedural compression after radiofrequency ablation did not compromise disease-specific QoL outcomes, patient satisfaction, or vein occlusion compared with standard compression protocols. These findings are clinically important because they suggest that routine post-procedural compression may not be necessary in appropriately selected patients without adversely affecting patient-reported outcomes or vein occlusion [24,25].

The remaining trials illustrate the breadth of conservative and staged treatment strategies evaluated against surgery. Yin et al. (2017) [20] found that UGFS combined with high ligation achieved comparable clinical severity improvement to surgical stripping in patients with severe lower-extremity varicosity, while Sakugawa et al. (2024) [30] similarly demonstrated that polidocanol foam sclerotherapy produced disease-specific quality-of-life improvement equivalent to conventional surgery at six months. Finally, Rahman et al. (2025) [31] examined a staged conservative approach, comparing concomitant phlebectomy with staged foam sclerotherapy of tributary varicosities following mechanochemical ablation of the great saphenous trunk, and found that although concomitant treatment reduced the need for re-intervention, both strategies maintained good patient satisfaction and symptom control at three years. These findings reinforce that conservative, staged, and sclerotherapy-based strategies can achieve QoL outcomes that are broadly comparable to more invasive, single-stage surgical approaches, albeit sometimes at the cost of a higher re-intervention rate [20,30,31].

The methodological quality of the included evidence base was evaluated using the Cochrane RoB 2 tool. Eight trials were classified as having a low overall risk of bias and six as having some concerns, with no high-risk judgments reported in the current assessment. These findings should be interpreted in the context of

the outcome-specific nature of RoB 2. Where assessments were restricted to representative outcomes, the judgments may not fully capture potential bias affecting other patient-reported outcomes or follow-up time points reported by the same trials. In addition, heterogeneity in outcome instruments, follow-up durations, and intervention comparisons limits the certainty of direct comparisons across studies. Accordingly, the risk-of-bias findings support a cautious interpretation of the narrative synthesis rather than an unqualified conclusion that the entire evidence base is methodologically robust.

Several limitations of the current evidence base, and of this review, should be acknowledged. First, the included trials used a wide variety of PROM and disease-specific QoL instruments (AVVQ/AVVSS, CIVIQ, EQ-5D, SF-36, VAS), which limits direct cross-trial comparability and precluded pooled quantitative synthesis. Second, follow-up duration varied enormously, from 12 weeks to 14 years, meaning that short-term and very long-term QoL trajectories are not uniformly represented for every comparator. Third, blinding of patients and treating clinicians was not feasible in trials comparing visibly different interventions (surgery versus endovenous or sclerotherapy-based treatment), which may have introduced some degree of measurement or reporting bias in patient-reported outcomes despite the use of validated instruments. Fourth, several trials were single-centre or moderately sized, which may limit generalisability to broader, more heterogeneous patient populations and healthcare settings. Finally, restricting inclusion to studies published in English with an available DOI may have excluded relevant trials published in other languages or in sources without indexed digital identifiers.

Clinical Implications

Management of lower limb varicose veins should consider not only anatomical outcomes but also symptoms, functional limitations, treatment satisfaction, and quality of life [9,16]. Validated PROMs, including the AVVQ/AVVSS and CIVIQ, together with generic health-related QoL measures such as the EQ-5D and SF-36, can support assessment of treatment outcomes [9,13-15]. Evidence from randomized trials suggests that minimally invasive approaches can provide QoL outcomes comparable to conventional surgery, while differences may occur in procedural pain, recovery, anatomical durability, and the need for re-intervention [19-32]. Treatment selection should therefore be individualized according to clinical presentation, anatomical suitability, patient preference, procedural considerations, and available resources [8,19-32].

Limitations

This systematic review has several limitations. Considerable heterogeneity was observed in the PROMs used across the included studies, such as AVVQ/AVVSS, CIVIQ, EQ-5D, SF-36, and VAS, which restricted direct comparison between studies and precluded quantitative meta-analysis. Follow-up periods also differed substantially, ranging from 12 weeks to 14 years, resulting in unequal representation of short-term and long-term treatment outcomes. Furthermore, blinding of participants and treating clinicians was generally impractical because of the obvious differences between surgical, endovenous, and sclerotherapy procedures, which may have influenced subjective patient-reported outcomes. The inclusion of several single-centre studies and studies with relatively modest sample sizes may also limit the generalizability of the findings. Additionally, restricting the review to English-language publications with an available DOI may have resulted in the omission of potentially relevant evidence.

Future Scope

Future research should prioritize large, multicentre RCTs using standardized PROMs and comparable long-term follow-up periods. Uniformity in the assessment and reporting of QoL outcomes would facilitate more reliable quantitative synthesis and strengthen comparisons between treatment modalities. Future investigations should include diverse patient populations and healthcare settings while assessing factors such as patient preference, anatomical suitability, procedural pain, recovery time, recurrence, need for re-intervention, treatment satisfaction, and healthcare costs. Further comparative research on emerging thermal and non-thermal endovenous techniques, incorporating clinical, anatomical, patient-reported, and economic outcomes, may provide stronger evidence for individualized treatment decisions and support more effective patient-centred management of lower limb varicose veins.

Conclusions

The included RCTs generally reported improvements in symptoms and disease-specific QoL from baseline following surgical, conservative, and minimally invasive treatments for lower limb varicose veins. However, improvements within individual treatment groups should not be interpreted as evidence of superiority over comparator interventions. Between-group differences in patient-reported outcomes were generally small or inconsistent, although differences in procedural pain, anatomical outcomes, and re-intervention requirements were reported in some trials. The available evidence does not demonstrate consistent superiority of one treatment modality in terms of patient-reported QoL outcomes. Treatment decisions should therefore be individualized according to clinical presentation, anatomical suitability, patient preferences, procedural risks, and resource availability.

Additional Information

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All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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References

1. Béliard S, Mourot L, Thomas H, Tordi N, Ferreira D: Comparison of venous morphology, chronic venous disease stage, and venous symptoms in high-impact activities versus low-impact activities. J Vasc Surg Venous Lymphat Disord. 2026, 14:102559. 10.1016/j.jvsv.2026.102559
2. Lee E, Salih M, Tan M, Onida S, Davies A: A systematic review of gender and ethnicity in varicose vein and venous leg ulcer management. J Vasc Surg Venous Lymphat Disord. 2026, 14:102519. 10.1016/j.jvsv.2026.102519
3. Alsheekh A, Hingorani A, Aurshina A, Kibrik P, Marks N, Ostrozhynskyy Y, Ascher E: Demographic and clinical features do not affect the outcome of combined endovenous therapy to treat leg swelling. Vascular. 2018, 26:472-6. 10.1177/1708538118760742
4. Kamaev AA, Kalinin RE, Pshennikov AS, Suchkov IA: Sulodexide and micronized purified flavonoid fraction in the pharmacotherapy of varicose vein disease: a focus on vein-specific inflammation (Article in Russian). Angiol Sosud Khir. 2026, 32:92-103.
5. Zhu R, Li Y, Zhang L, et al.: Safety and efficacy of microwave versus laser ablation in the treatment of varicose veins of lower extremities (MOST trial): a multicenter, open-label, non-inferiority, randomized controlled trial. Int J Surg. 2026, 112:3751-61. 10.1097/JS9.0000000000003941
6. Zhang Y, Lin X, Wang Z, Li W, Wang Y, Bian J, Liang Y: Surgical outcomes of above-knee versus full-length endovenous laser ablation for great saphenous vein varicose veins. J Vasc Surg Venous Lymphat Disord. 2026, 14:102342. 10.1016/j.jvsv.2025.102342
7. Yie K: Symptom improvement after cyanoacrylate glue adhesion and endovenous laser ablation in low-grade CEAP clinical classes. J Vasc Surg Venous Lymphat Disord. 2022, 10:360-369.e2. 10.1016/j.jvsv.2021.07.002
8. Matei SC, Nikolov N, Popović M, et al.: Optimizing the management of venous disease: expert consensus from a multinational panel of phlebology specialists. J Vasc Surg Venous Lymphat Disord. 2026, 14:102593. 10.1016/j.jvsv.2026.102593
9. Garratt AM, Macdonald LM, Ruta DA, Russell IT, Buckingham JK, Krukowski ZH: Towards measurement of outcome for patients with varicose veins. Qual Health Care. 1993, 2:5-10. 10.1136/qshc.2.1.5
10. Rutherford RB, Padberg FT Jr, Comerota AJ, Kistner RL, Meissner MH, Moneta GL: Venous severity scoring: an adjunct to venous outcome assessment. J Vasc Surg. 2000, 31:1307-12. 10.1067/mva.2000.107094
11. Vasquez MA, Munschauer CE: Revised venous clinical severity score: a facile measurement of outcomes in venous disease. Phlebology. 2012, 27 Suppl 1:119-29. 10.1258/phleb.2012.012s16

12. Marston WA, Vasquez MA, Lurie F, et al.: Multicenter assessment of the repeatability and reproducibility of the revised Venous Clinical Severity Score (rVCSS). J Vasc Surg Venous Lymphat Disord. 2013, 1:219-24. 10.1016/j.jvsv.2012.10.059
13. Launois R, Reboul-Marty J, Henry B: Construction and validation of a quality of life questionnaire in chronic lower limb venous insufficiency (CIVIQ). Qual Life Res. 1996, 5:539-54. 10.1007/BF00439228
14. Rabin R, de Charro F: EQ-5D: a measure of health status from the EuroQol Group . Ann Med. 2001, 33:337-43. 10.3109/07853890109002087
15. Ware JE Jr, Sherbourne CD : The MOS 36-item Short-Form Health Survey (SF-36). Med Care. 1992, 30:473-83. 10.1097/00005650-199206000-00002
16. Gilbride CJ, Wilson A, Bradley-Gilbride A, Bayfield J, Gibson K, Gohel M, Bradley C: Design of a treatment satisfaction measure for patients undergoing varicose vein treatment: Venous Treatment Satisfaction Questionnaire (VenousTSQ). Br J Surg. 2023, 110:200-8. 10.1093/bjs/znac387
17. Page MJ, McKenzie JE, Bossuyt PM, et al.: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021, 372:n71. 10.1136/bmj.n71
18. Sterne JA, Savović J, Page MJ, et al.: RoB 2: a revised tool for assessing risk of bias in randomised trials . BMJ. 2019, 366:l4898. 10.1136/bmj.l4898
19. Venermo M, Saarinen J, Eskelinen E, et al.: Randomized clinical trial comparing surgery, endovenous laser ablation and ultrasound-guided foam sclerotherapy for the treatment of great saphenous varicose veins. Br J Surg. 2016, 103:1438-44. 10.1002/bjs.10260
20. Yin H, He H, Wang M, et al.: Prospective randomized study of ultrasound-guided foam sclerotherapy combined with great saphenous vein high ligation in the treatment of severe lower extremity varicosis. Ann Vasc Surg. 2017, 39:256-63. 10.1016/j.avsg.2016.06.027
21. Vähäaho S, Halmesmäki K, Albäck A, Saarinen E, Venermo M: Five-year follow-up of a randomized clinical trial comparing open surgery, foam sclerotherapy and endovenous laser ablation for great saphenous varicose veins. Br J Surg. 2018, 105:686-91. 10.1002/bjs.10757
22. Vähäaho S, Mahmoud O, Halmesmäki K, et al.: Randomized clinical trial of mechanochemical and endovenous thermal ablation of great saphenous varicose veins. Br J Surg. 2019, 106:548-54. 10.1002/bjs.11158
23. Holewijn S, van Eekeren RR, Vahl A, de Vries JP, Reijnen MM: Two-year results of a multicenter randomized controlled trial comparing Mechanochemical endovenous Ablation to RADiOfrequeNcy Ablation in the treatment of primary great saphenous vein incompetence (MARADONA trial). J Vasc Surg Venous Lymphat Disord. 2019, 7:364-74. 10.1016/j.jvsv.2018.12.014
24. Pihlaja T, Romsi P, Ohtonen P, Jounila J, Pokela M: Post-procedural compression vs no compression after radiofrequency ablation and concomitant foam sclerotherapy of varicose veins: a randomised controlled non-inferiority trial. Eur J Vasc Endovasc Surg. 2020, 59:73-80. 10.1016/j.ejvs.2019.08.020
25. Onwudike M, Abbas K, Thompson P, McElvenny DM: Editor's choice - role of compression after radiofrequency ablation of varicose veins: a randomised controlled trial. Eur J Vasc Endovasc Surg. 2020, 60:108-17. 10.1016/j.ejvs.2020.03.014
26. Tawfik AM, Sorour WA, El-Laboudy ME: Laser ablation versus mechanochemical ablation in the treatment of primary varicose veins: a randomized clinical trial. J Vasc Surg Venous Lymphat Disord. 2020, 8:211-5. 10.1016/j.jvsv.2019.10.025
27. Brittenden J, Cooper D, Dimitrova M, et al.: Five-year outcomes of a randomized trial of treatments for varicose veins. N Engl J Med. 2019, 381:912-22. 10.1056/NEJMoa1805186
28. Mohamed AH, Leung C, Wallace T, Smith G, Carradice D, Chetter I: A randomized controlled trial of endovenous laser ablation versus mechanochemical ablation with ClariVein in the management of superficial venous incompetence (LAMA trial). Ann Surg. 2021, 273:e188-95. 10.1097/SLA.0000000000003749
29. Belramman A, Bootun R, Tang TY, Lane TR, Davies AH: Pain outcomes following mechanochemical ablation vs cyanoacrylate adhesive for the treatment of primary truncal saphenous vein incompetence: rhe MOCCA randomized clinical trial. JAMA Surg. 2022, 157:395-404. 10.1001/jamasurg.2022.0298
30. Sakugawa LS, Portela FS, Louzada AC, et al.: Polidocanol-foam treatment of varicose veins: quality-of-life impact compared to conventional surgery. Clinics (Sao Paulo). 2024, 79:100346. 10.1016/j.clinsp.2024.100346
31. Rahman T, Noronen K, Vähäaho S, Heinola I, Venermo M, Halmesmäki K: Three-year follow-up of a randomized controlled trial comparing concomitant and staged treatment of varicose veins following mechanochemical ablation of the great saphenous vein. J Vasc Surg Venous Lymphat Disord. 2025, 13:102255. 10.1016/j.jvsv.2025.102255
32. Rahman T, Noronen K, Vähäaho S, Halmesmäki K, Venermo M: Fourteen year outcomes of a randomised controlled trial comparing endovenous laser ablation, high ligation and stripping, and ultrasound guided foam sclerotherapy for great saphenous varicose veins. Eur J Vasc Endovasc Surg. 2026, 72:533-40. 10.1016/j.ejvs.2026.01.056