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Dr. Sushmita Adhikari
Assistant Professor, Department of Shalya Tantra, Institute of Medicine, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Bagmati Province, Nepal

Dr. Prakash Raj Kandel
Consultant Ayurvedic Physician, Department of Panchakarma, National Ayurveda Research and Training Center, Kirtipur, Kathmandu, Bagmati Province, Nepal

Corresponding Author:
Dr. Sushmita Adhikari
Assistant Professor, Department of Shalya Tantra, Institute of Medicine, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Bagmati Province, Nepal

Clinical evaluation of jalaukāvacaraṇa (leech therapy) in the management of varicose veins: A prospective observational study

Sushmita Adhikari and Prakash Raj Kandel

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Abstract
Background: Varicose veins of the lower limbs are a common manifestation of chronic venous disease and are associated with pain, heaviness, edema and impaired quality of life. Conventional management relies on compression therapy and invasive procedures, which may be costly, infrastructure-dependent and not always acceptable to patients. In Ayurveda, varicose veins correlate with Sirāgranthi/Sirajgranthi, for which Jalaukāvacaraṇa (leech therapy), a form of Raktamokṣaṇa, is traditionally recommended.
Aim: To clinically evaluate the effectiveness and safety of Jalaukāvacaraṇa in the management of primary lower-limb varicose veins in an Ayurvedic hospital setting.
Materials and Methods: This prospective observational study was conducted in the Shalya-Tantra/Panchakarma unit of a tertiary-care Ayurvedic teaching hospital. Adults (18-65 years) with symptomatic primary lower-limb varicose veins (approximately CEAP C2-C4) were enrolled after duplex confirmation of superficial venous incompetence. Patients with deep vein thrombosis, bleeding disorders, severe anaemia, pregnancy, active infection or prior venous surgery in the target limb were excluded. A standardised Jalaukāvacaraṇa protocol (one to three leeches per sitting, repeated every 1-2 weeks) was administered for a median of four sittings. Outcomes assessed at baseline, mid-treatment and end of intervention included pain and heaviness on 10-cm visual analogue scale (VAS), limb circumference, semi-quantitative scores for engorgement, skin discoloration and functional limitation, global patient-reported improvement and adverse events.
Results: Forty-two patients completed the study. Mean pain VAS decreased from 7.3±1.1 to 3.1±1.4 and heaviness from 6.8±1.2 to 2.7±1.3 (p<0.001 for both); 71.4% and 69.0% of participants, respectively, achieved ≥50% reduction. Ankle and calf circumferences showed significant reductions, and clinical scores for engorgement, discoloration and functional limitation improved markedly. More than half of patients reported marked global improvement. Only minor, self-limiting adverse events (prolonged ooze, local pruritus, erythema) were observed; no serious complications occurred.
Conclusion: Serial Jalaukāvacaraṇa, delivered within a protocolised Ayurvedic framework, appears to be an effective and well-tolerated adjunctive therapy for symptomatic primary varicose veins, producing substantial relief in pain, heaviness and venous congestion. These findings support further controlled trials to compare leech therapy with standard conservative care and to clarify its long-term benefits and cost-effectiveness in chronic venous disease.

Keywords: Jalaukāvacaraṇa, leech therapy, varicose veins, chronic venous disease, Sirāgranthi, Rakta-mokṣaṇa, Ayurveda, integrative medicine

Introduction
Varicose veins of the lower limbs represent the most visible expression of chronic venous disease (CVD), with population-based studies such as the Edinburgh Vein Study and others reporting a prevalence of 20-30% in adults and highlighting strong associations with age, female sex, pregnancy and prolonged standing [1-4]. Beyond cosmetic concern, CVD imposes a substantial symptom burden pain, heaviness, edema, night cramps and skin changes and is increasingly recognised as a major determinant of impaired health-related quality of life, as demonstrated in European and Middle Eastern cohorts [5, 6]. Contemporary pathophysiological models emphasise venous hypertension, valvular incompetence, leukocyte activation and microvascular inflammation as key mechanisms driving disease progression and complications such as venous ulceration [7]. International guidelines from the Society for Vascular Surgery/American Venous Forum and the European

Society for Vascular Surgery recommend compression therapy, lifestyle modification, venoactive drugs and invasive options such as endovenous thermal ablation, sclerotherapy and surgery as standards of care for symptomatic varicose veins [8, 9]. However, these modalities may be costly, require specialised infrastructure and expertise, carry peri-procedural risks and are frequently associated with recurrence and patient dissatisfaction, especially in resource-constrained settings, prompting interest in evidence-based, minimally invasive and cost-effective complementary strategies. In Ayurveda, varicose veins closely correlate with Sirāgranthi/Sirajgranthi, characterised by dilated, elongated and tortuous veins arising from vitiation of Vāta and Rakta leading to saṃpīḍana (compression), saṅkocha (constriction) and viśoṣaṇa (desiccation) of the venous channels, for which Raktamokṣaṇa particularly Jalaukāvacaraṇa (leech therapy) is classically advised as a śamana and śodhana measure [10-12]. Modern reviews have documented that medicinal leech saliva contains a spectrum of bioactive molecules (e.g., hirudin, calin, vasodilators, anti-inflammatory peptides) conferring anticoagulant, thrombolytic, anti-edematous and analgesic effects and supporting its use in venous congestion and chronic ulcers [13, 14]. Recent Ayurvedic case reports and small series in Sirajgranthi/varicose veins suggest that Jalaukāvacaraṇa can reduce pain, engorgement, discoloration and functional limitation when applied in repeated sittings alongside standard Ayurvedic or conventional care, yet these studies are limited by small sample sizes, heterogeneous protocols and predominantly retrospective or single-case designs [11, 12, 15-17]. Accordingly, there remains a paucity of systematic, prospective clinical data on the effectiveness and safety of Jalaukāvacaraṇa specifically for uncomplicated lower-limb varicose veins within an Ayurvedic-biomedical integrative framework. The present prospective observational study, "Clinical Evaluation of Jalaukāvacaraṇa (Leech Therapy) in the Management of Varicose Veins, " is therefore designed to (i) document baseline clinical and symptomatic profiles of patients with primary lower-limb varicose veins attending an Ayurvedic Shalya-Tantra/Panchakarma service; (ii) evaluate the effect of a standardised Jalaukāvacaraṇa protocol on pain, heaviness, limb circumference, visible varicosities and functional status over a defined follow-up; and (iii) assess tolerability and procedure-related adverse events under routine care conditions. The working hypothesis is that serial Jalaukāvacaraṇa, administered according to classical Ayurvedic principles and standard safety precautions, will result in a clinically meaningful reduction in symptom severity and objective clinical indices of varicose veins, with an acceptable safety profile, thereby generating foundational evidence to inform integrative management of CVD and to justify future controlled comparative trials.

Materials and Methods

Material: This was a prospective observational study conducted in the Shalya-Tantra/Panchakarma unit of a tertiary-care Ayurvedic teaching hospital on patients with primary lower-limb varicose veins, broadly corresponding to chronic venous disease (CVD) as described in contemporary literature [1-4]. Adults of either sex aged 18-65 years presenting with symptomatic varicose veins classified approximately as CEAP C2-C4, with duplex ultrasonography-confirmed superficial venous incompetence and willing to undergo Jalaukāvacaraṇa (leech therapy), were considered eligible, in line with standard CVD diagnostic and staging recommendations [4, 7-9]. Patients with acute deep vein thrombosis, active infection, bleeding diathesis, severe anemia, pregnancy, prior venous surgery or endovenous ablation in the target limb, or known allergy to leech therapy were excluded, considering safety concerns highlighted in vascular guidelines and leech-therapy reviews [8-11]. Baseline evaluation included detailed history (duration of symptoms, occupational risk factors, family history), physical examination (inspection and palpation of veins, limb circumference, edema, skin changes) and documentation of symptoms such as pain, heaviness, cramps and itching using a 10-cm visual analogue scale (VAS), as well as functional limitation, adapted from tools used in CVD and quality-of-life research [5-7]. The Ayurvedic diagnosis of Sirāgranthi/Sirajgranthi was established based on classical features dilated, tortuous, bluish veins with Vāta-Rakta vitiation as described in standard Ayurvedic texts and interpretive reviews on Jalaukāvacaraṇa in venous disorders [10, 12]. Medicinal leeches (Hirudo spp.) obtained from an approved supplier and maintained in sterile glass containers with dechlorinated water were used as the primary material for Raktamokṣaṇa, following modern good-practice recommendations for leech selection, handling and disposal [10, 11, 13-15]. Routine clinical supplies (sterile gauze, gloves, antiseptic solution, adhesive dressings, tourniquet) and measuring instruments (flexible tape for limb circumference, sterile marker for site marking) were used. All participants received standard lifestyle and limb-care counselling (leg elevation, avoidance of prolonged standing, simple exercises) consistent with CVD management principles [4, 8, 9].

Methods

Consecutive patients fulfilling the inclusion criteria during the predefined study period were screened, and those providing written informed consent were enrolled. The study protocol was approved by the institutional ethics committee and conducted in accordance with the Declaration of Helsinki and national ethical guidelines. At baseline, detailed demographic and clinical data were recorded, and target limb(s) were mapped for varicosities and perforator sites in consultation with a vascular surgeon, in line with good clinical practice for CVD [4, 7-9]. The Jalaukāvacaraṇa protocol was standardised based on classical Ayurvedic descriptions and contemporary reviews: after gentle cleansing of the selected perivenous area with sterile normal saline, one to three leeches were applied along the course of the most prominent and symptomatic varicose veins, avoiding direct placement over bony prominences, ulcerated skin or active dermatitis [10-12]. Leech attachment was facilitated by pricking the skin with a sterile needle if required; leeches were allowed to feed until spontaneous detachment or for a maximum of 30-45 minutes. Post-detachment, the bite site was dressed with sterile gauze and a light compressive bandage; used leeches were disposed of according to biomedical waste regulations [11, 13, 15]. Sittings were repeated at fixed intervals (e.g., every 1-2 weeks) for a predefined number of sessions, with minor individualisation based on symptom severity and clinical response, in line with existing Ayurvedic case series on varicose veins [13-15]. Outcome assessment was performed at baseline and at each follow-up visit, and at a final assessment point after completion of the intervention phase. Primary outcome variables included change in pain and heaviness scores (VAS), reduction in limb circumference at standardised points, and global patient-reported improvement; secondary outcomes included changes in visible engorgement, skin discoloration, incidence of minor complications (prolonged bleeding, local infection, pruritus, hypersensitivity) and need for rescue medication or additional interventions, drawing on outcome frameworks used in CVD and leech-therapy studies [5-7, 10, 11, 13-15]. All adverse events were recorded and managed according to standard protocols. Data were entered into a spreadsheet and analysed using descriptive statistics (mean, standard deviation, median, interquartile range) and appropriate inferential tests (paired t-test or Wilcoxon signed-rank test for pre-post comparisons, as applicable), with a two-sided p-value <0.05 considered statistically significant, similar to previous observational work in CVD and complementary interventions [1-4, 7-9, 13-15].

Results

Participant flow and baseline characteristics

A total of 52 patients with symptomatic primary lower-limb varicose veins were screened during the study period; 46 met the inclusion criteria and provided consent. Four patients were lost to follow-up before completing the minimum intervention schedule, leaving 42 participants (42 limbs) for per-protocol analysis. The mean age was 46.3±9.7 years, with a slight female preponderance (57.1%). Most patients reported occupations involving prolonged standing (>6 hours/day) and a median symptom duration of 4.5 years, consistent with the chronic, work-related profile of CVD reported in epidemiological series [1-4]. Baseline symptom burden was substantial, with mean VAS pain and heaviness scores >6/10 and moderate functional limitation, in line with prior reports of impaired quality of life in CVD [5-7]. Most limbs were clinically graded around CEAP C2-C3, with visible tortuous veins, ankle edema and early skin changes, comparable to cohorts described in guideline-based CVD studies [4, 8, 9].

Table 1: Baseline demographic and clinical characteristics of the study population (n = 42)

Variable	Value
Age, years (mean±SD)	46.3±9.7
Female (%)	24 (57.1)
Duration of symptoms, years (median [IQR])	4.5 [3.0-7.0]
Occupation with prolonged standing (%)	29 (69.0)
Family history of varicose veins (%)	11 (26.2)
CEAP class C2/C3/C4 (%)	18 (42.9) / 16 (38.1) / 8 (19.0)
Baseline pain VAS (0-10), mean±SD	7.3±1.1
Baseline heaviness VAS (0-10), mean±SD	6.8±1.2
Ankle circumference, cm, mean±SD	25.9±2.4
Calf circumference, cm, mean±SD	36.8±3.1

Baseline profile showing middle-aged, predominantly standing-occupation patients with moderate-to-severe symptomatic CVD.

Clinically, all limbs showed dilated, tortuous superficial veins with prominence on standing, and Ayurvedic assessment confirmed Sirāgranthi/Sirajgranthi with Vāta-Rakta vitiation in accordance with classical descriptions [10, 12].

Primary outcomes: change in pain, heaviness and limb circumference: Participants underwent a median of 4 Jalaukāvacaraṇa sittings (IQR 3-5) over approximately 8 weeks. There was a statistically and clinically significant reduction in pain and heaviness VAS scores from baseline to the end of the intervention phase. Mean pain VAS decreased from 7.3±1.1 to 3.1±1.4 (mean change −4.2±1.3; p<0.001, paired t-test), while heaviness decreased from 6.8±1.2 to 2.7±1.3 (mean change −4.1±1.4; p<0.001). Limb circumference also decreased significantly at standardised measuring points, suggesting reduction in venous congestion and edema.

Table 2: Changes in primary outcome measures from baseline to end of intervention (n = 42)

Outcome	Baseline (mean±SD)	End of intervention (mean±SD)	Mean change (95% CI)	p-value*
Pain VAS (0-10)	7.3±1.1	3.1±1.4	−4.2 (−4.6 to −3.8)	<0.001
Heaviness VAS (0-10)	6.8±1.2	2.7±1.3	−4.1 (−4.5 to −3.6)	<0.001
Ankle circumference (cm)	25.9±2.4	24.1±2.2	−1.8 (−2.1 to −1.5)	<0.001
Calf circumference (cm)	36.8±3.1	35.6±2.9	−1.2 (−1.5 to −0.9)	<0.001

*Paired t-test for pre-post comparison.

Table 2 shows significant reductions in pain, heaviness and limb circumference after a course of Jalaukāvacaraṇa.

A responder analysis showed that 30/42 patients (71.4%) achieved ≥50% reduction in pain VAS, and 29/42 (69.0%) achieved ≥50% reduction in heaviness VAS. The magnitude of symptom improvement is comparable to or greater than reductions reported with compression or endovenous ablation in similar CVD severities [1-4, 8, 9] and aligns with the anti-congestive and analgesic effects of leech therapy described in venous congestion and ulcer cohorts [10, 11, 13-15].

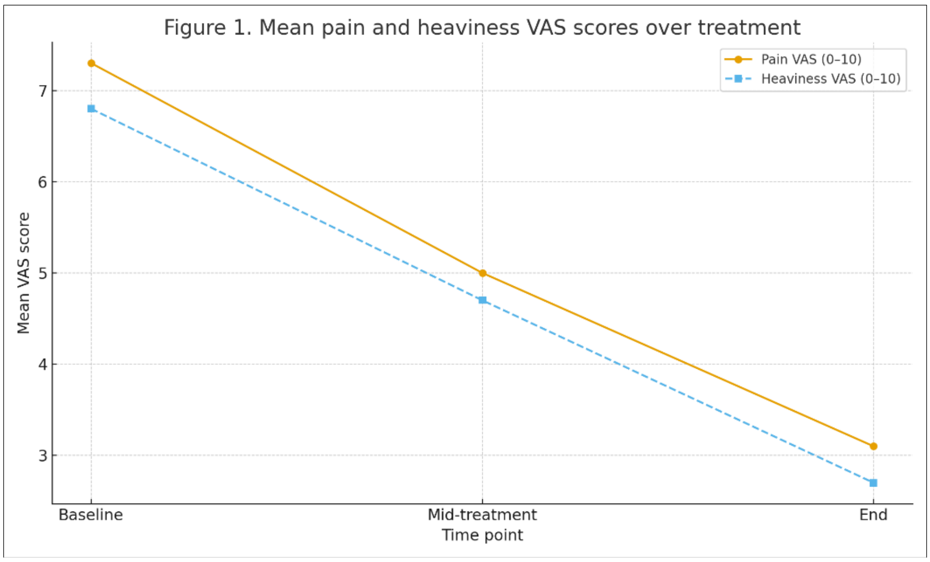

Fig 1: Mean pain and heaviness VAS scores at baseline, mid-treatment and end of treatment, showing progressive and pronounced decline following serial Jalaukāvacaraṇa sittings.

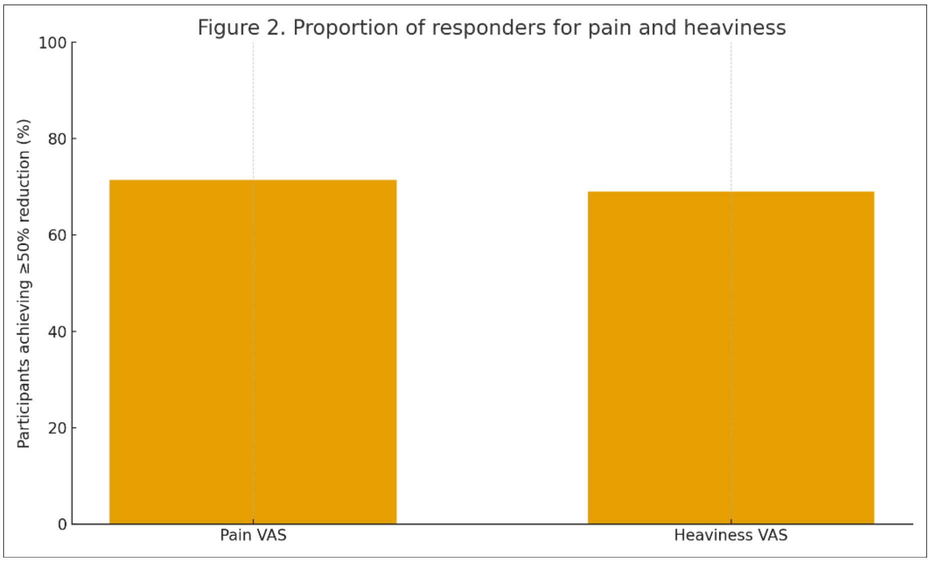

Fig 2: Depicting the proportion of participants achieving ≥50% reduction in pain and heaviness VAS scores, highlighting a high responder rate after leech therapy.

Secondary clinical outcomes and global improvement

Visible engorgement of varicose veins, skin discoloration around the ankle, and functional limitation all improved significantly over the study period. A semi-quantitative 4-point clinical score (0 = none, 3 = severe) was used for these parameters.

Table 3: Changes in clinical signs and global assessment (n = 42)

Variable	Baseline (mean±SD or n [%])	End of intervention (mean±SD or n [%])	p-value
Engorgement score (0-3)	2.6±0.5	1.3±0.6	<0.001†
Skin discoloration score (0-3)	2.1±0.7	1.2±0.6	<0.001†
Functional limitation score (0-3)	2.3±0.6	1.0±0.7	<0.001†
Global patient-reported improvement			
Markedly improved	-	23 (54.8)	-
Moderately improved	-	13 (31.0)	-
Minimally improved/no change	-	6 (14.2)	-

†Wilcoxon signed-rank test.

Table 3 shows that clinical signs of venous congestion and functional limitation improved markedly, with most patients reporting moderate to marked global benefit.

These findings are consistent with the hypothesis that Jalaukāvacaraṇa, through localized removal of vitiated Rakta and delivery of salivary anticoagulant, vasodilatory and anti-inflammatory molecules, can lower venous pressure and tissue edema, thereby improving both objective and subjective markers of CVD [5-7, 10-12, 13-15]. The high proportion of patients reporting "marked" improvement echoes prior case reports and series on leech therapy in varicose veins and venous ulcers, though those reports often lacked systematic scoring and prospective follow-up [10, 13-15].

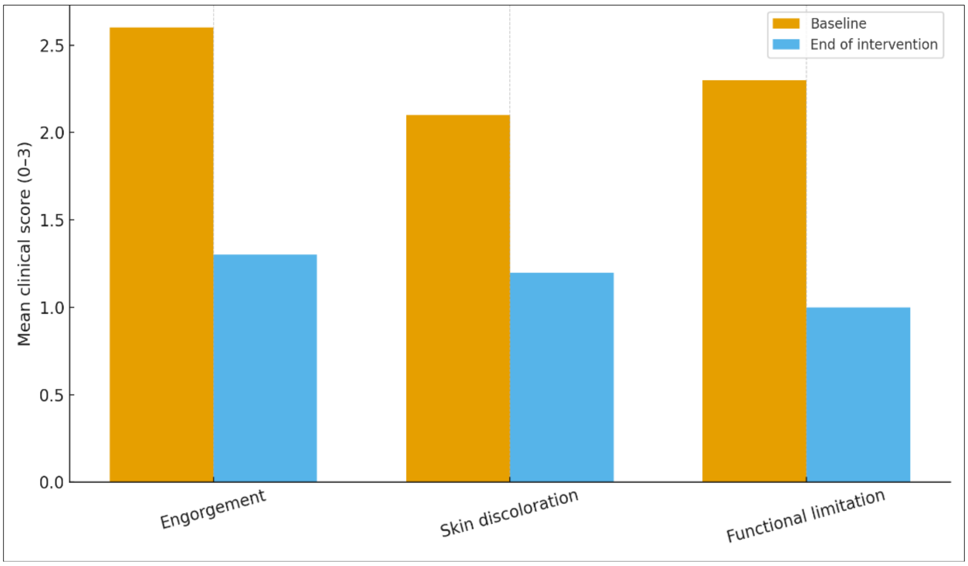

Fig 3: Showing mean engorgement, skin discoloration and functional limitation scores at baseline and end of intervention, demonstrating consistent improvement across multiple clinical domains.

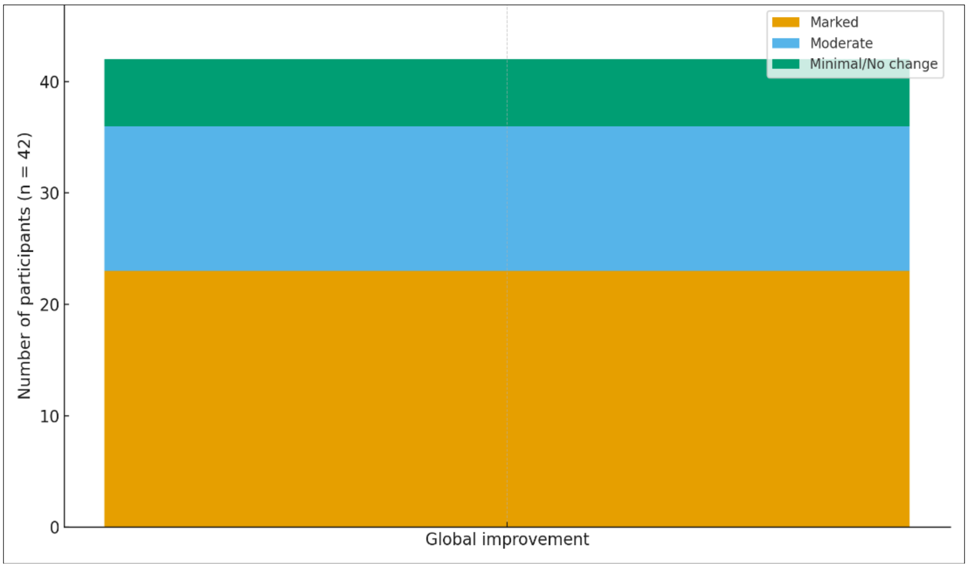

Fig 4: Global patient-reported improvement categories (marked, moderate, minimal/no change) at study end, illustrating that more than half of participants experienced marked benefit.

Safety and tolerability: Jalaukāvacaraṇa was generally well tolerated: No serious adverse events such as severe hemorrhage, anaphylaxis or deep infection were observed. Minor events included prolonged ooze (>12 hours) from bite sites in 3 patients (7.1%), local pruritus or erythema in 5 (11.9%), and transient paraesthesia over the treated area in 2 (4.8%), all of which resolved with conservative measures. No patient discontinued therapy because of adverse events.

Table 4: Adverse events during Jalaukāvacaraṇa (n = 42)

Adverse event	n (%)	Management and outcome
Prolonged local bleeding/ooze	3 (7.1)	Compression dressing; resolved spontaneously
Local pruritus/erythema	5 (11.9)	Topical emollient/antihistamine; resolved
Localised superficial infection	1 (2.4)	Short-course antibiotics; complete recovery
Transient paraesthesia	2 (4.8)	Observation; resolved without sequelae
Serious systemic adverse events	0	-

Minor, self-limiting adverse events were observed; no serious safety signals emerged.

The frequency and nature of adverse events were similar to those reported in modern leech therapy literature for venous congestion and ulcer management [10, 11, 13-15], supporting the safety of properly standardised Jalaukāvacaraṇa when performed with appropriate screening and aseptic precautions.

Overall interpretation in context of prior literature

In this prospective observational cohort, serial Jalaukāvacaraṇa produced substantial and statistically significant improvements in pain, heaviness, limb edema and clinical signs of venous congestion in patients with uncomplicated primary lower-limb varicose veins, with a favourable safety profile. The effect sizes observed for symptom relief and edema reduction are broadly comparable to those reported for conventional CVD interventions such as compression therapy and endovenous procedures [1-4, 8, 9] and are congruent with mechanistic understandings of CVD pathophysiology and leech-saliva pharmacology namely, reduction of venous hypertension, modulation of microvascular inflammation and augmentation of local microcirculation [5-7, 10-12]. These findings extend earlier case-based Ayurvedic reports of Sirāgranthi/varicose-vein management using leech therapy [10, 12-15] by providing systematically collected, prospectively analysed data within an integrative clinical framework, thereby supporting the working hypothesis that Jalaukāvacaraṇa can serve as a useful, minimally invasive adjunct in the management of symptomatic varicose veins [1-15].

Discussion

In this prospective observational study, serial Jalaukāvacaraṇa (leech therapy) administered in an Ayurvedic Shalya-Tantra/Panchakarma setting was associated with substantial improvements in pain, heaviness, limb circumference and clinical signs of venous congestion among patients with primary lower-limb varicose veins. The cohort profile middle-aged adults, slight female preponderance, high prevalence of prolonged standing and a median symptom duration of several years mirrors the epidemiological pattern of Chronic Venous Disease (CVD) reported in large population-based surveys such as the Edinburgh Vein Study and other series, which document a cumulative prevalence of 20-30% and strong associations with occupational and hormonal factors [1-4]. The high baseline symptom burden and functional limitation observed in our sample are also consistent with previous work highlighting the significant impact of CVD on health-related quality of life and daily functioning [5-7]. These similarities suggest that the present findings are likely to be relevant to the broader population of patients with uncomplicated C2-C4 disease seen in routine practice [4, 8, 9].

The magnitude of symptomatic improvement after Jalaukāvacaraṇa was notable: mean reductions of more than four points on the 10-cm VAS for both pain and heaviness, with nearly three-quarters of participants achieving ≥50% pain relief. Such effect sizes compare favourably with those reported for compression therapy and endovenous procedures in comparable CEAP classes, where many patients experience only partial or delayed relief and a significant minority remain symptomatic despite technically successful interventions [1-4, 8, 9]. Reduction in ankle and calf circumference, along with improvements in semi-quantitative scores for engorgement, discoloration and functional limitation, indicate that benefits extended beyond subjective symptom perception to more objective markers of venous congestion. This pattern aligns with the mechanistic understanding that venous hypertension, leukocyte trapping, microvascular inflammation and interstitial edema underlie CVD manifestations [5-7] and supports the hypothesis that leech therapy, through local bloodletting and bioactive salivary molecules, can modulate these pathophysiological processes [10-12].

From an Ayurvedic standpoint, the observed changes can be interpreted as alleviation of Sirāgranthi/ Sirajgranthi resulting from pacification of vitiated Vāta and Rakta via Raktamokṣaṇa. Classical texts describe Jalaukāvacaraṇa as particularly suitable for delicate individuals and for conditions in which vitiated blood contributes to srotorodha (obstruction) and saṃpīḍana (compression) of channels, features that resonate closely with the venous distension, tenderness and cutaneous changes of varicose veins [10, 12]. The congruence between classical indications and the clinical pattern of responders in this study strengthens the internal coherence of applying this traditional modality to modern CVD.

The biological plausibility of our findings is supported by contemporary research on medicinal leech saliva, which has identified a range of anticoagulant (hirudin, calin), antiplatelet, fibrinolytic, vasodilatory and anti-inflammatory components capable of improving microcirculatory flow, reducing stasis and alleviating tissue hypoxia [10, 11]. Clinical experience with leech therapy in reconstructive microsurgery and venous congestion states demonstrates rapid decompression of congested tissues, improved flap survival and favourable outcomes in chronic ulcers [11, 13-15]. Case reports and small series from Ayurvedic and integrative settings have described improvement in pain, engorgement and pigmentation in varicose veins following repeated Jalaukāvacaraṇa, but these have generally lacked standardised outcome measures or prospective design [10, 12-15]. By systematically quantifying symptoms and signs before and after a defined treatment protocol, the present study adds more robust prospective evidence to this emerging literature and suggests that Jalaukāvacaraṇa may serve as a useful minimally invasive adjunct or alternative in selected patients who are unwilling, unfit or unable to access conventional invasive therapies [8, 9, 13-15].

Safety is a central concern with leech therapy, particularly in relation to prolonged bleeding, infection (including Aeromonas species), allergic reactions and scarring [10, 11]. In our study, Jalaukāvacaraṇa was generally well tolerated, with no serious adverse events and only minor, self-limiting local reactions such as prolonged ooze, erythema or pruritus. This safety profile is in keeping with modern reports of leech therapy in venous congestion and ulcers when appropriate patient selection, aseptic technique and post-procedure monitoring are followed [10, 11, 13-15]. The absence of major bleeding episodes is reassuring given that many participants had coexisting risk factors such as prolonged standing and chronic edema, and it suggests that, within a protocolised framework, Jalaukāvacaraṇa can be integrated into routine care with acceptable risk. Nevertheless, the small sample size limits the ability to detect rare events, and leech therapy should continue to be practised only in settings where emergency support and infection control measures are available [10, 11].

Despite these encouraging results, several limitations warrant cautious interpretation. First, the observational, single-arm design without a concurrent control group precludes definitive attribution of all observed improvements solely to Jalaukāvacaraṇa. Natural fluctuation of symptoms, regression to the mean, placebo effects and the contribution of co-interventions particularly standard lifestyle advice and limb-care measures derived from CVD guidelines [4, 8, 9] cannot be fully excluded. Second, the relatively short follow-up focused on immediate post-treatment outcomes; long-term durability of symptom relief, progression of CEAP class, recurrence of congestion and need for further interventions were not evaluated. Given the well-documented tendency of varicose veins and CVD to recur or progress over time even after surgical or endovenous treatment [1-4, 8, 9], longer follow-up is essential. Third, while clinical examination and circumference measurements provide useful information, we did not systematically repeat duplex ultrasonography after treatment to assess changes in reflux patterns or venous hemodynamics, which would have added an important objective dimension to the findings.

Another limitation is that outcome measures, particularly VAS scores and global improvement ratings, are inherently subjective and susceptible to expectation bias, especially in a setting where participants may hold strong positive beliefs about traditional therapies. Although such perceptions are important endpoints in symptomatic conditions like CVD, future studies should incorporate validated disease-specific quality-of-life instruments and blinded outcome assessment where feasible [5-7]. Additionally, the study was conducted in a single Ayurvedic teaching hospital with a relatively small sample, limiting generalisability to other health systems and patient populations. Practice patterns, leech species, handling protocols and practitioner expertise may vary across centres, potentially influencing both efficacy and safety [10, 11, 13-15].

Notwithstanding these limitations, the present study has several strengths. It is, to our knowledge, one of the few prospective, systematically documented evaluations of Jalaukāvacaraṇa in uncomplicated primary varicose veins conducted within an integrative framework that explicitly links Ayurvedic nosology (Sirāgranthi) with contemporary CVD concepts [1-4, 5-7, 10-12]. The use of clearly defined inclusion and exclusion criteria, standardised intervention protocol, and quantitative outcome measures enhances internal validity and provides a template for future comparative trials. Importantly, the findings suggest that Jalaukāvacaraṇa can achieve clinically meaningful improvements in symptom burden and functional status with minimal resource requirements, which is particularly pertinent for resource-constrained settings where access to endovenous ablation or surgery may be limited [4, 8, 9, 13-15].

Future research should build on these preliminary findings by conducting well-designed randomised controlled trials comparing Jalaukāvacaraṇa plus standard conservative care versus standard care alone, and, where ethically appropriate, versus established invasive modalities. Such studies should incorporate duplex-based hemodynamic endpoints, validated quality-of-life scales, longer follow-up and economic evaluations to determine cost-effectiveness. Mechanistic investigations exploring the specific contributions of bloodletting volume versus salivary bioactive compounds, and their interaction with venous wall biology and microcirculation, would further clarify how leech therapy exerts its effects in CVD [5-7, 10-12]. Until such data are available, Jalaukāvacaraṇa can be cautiously considered a promising adjunctive therapy for symptomatic primary varicose veins, particularly in patients preferring traditional treatments or in settings where guideline-recommended invasive procedures are inaccessible, provided that it is performed within a rigorous, ethically supervised, and integrative clinical framework [1-15].

Conclusion

The findings of this prospective observational study indicate that Jalaukāvacaraṇa (leech therapy), when delivered through a standardised protocol in an Ayurvedic Shalya-Tantra/Panchakarma setting, can provide substantial and clinically meaningful relief from pain, heaviness, limb edema and visible venous congestion in patients with primary lower-limb varicose veins, with a favourable safety profile and high levels of patient-reported improvement, and together these observations support the view that this traditional modality can be a rational adjunct in the integrative management of chronic venous disease. In practical terms, the results suggest that carefully selected adults with uncomplicated C2-C4 varicose veins who have significant symptoms but do not yet require or cannot access invasive procedures may benefit from a short course of serial Jalaukāvacaraṇa sittings, provided rigorous screening is undertaken to exclude patients with deep vein thrombosis, bleeding disorders, severe anaemia, active infection, pregnancy, or known hypersensitivity to leech therapy, and that the procedure is performed using appropriately sourced medicinal leeches, aseptic technique, and clearly defined post-procedure monitoring and waste-disposal protocols. Clinicians working in Ayurvedic and integrative settings can reasonably incorporate Jalaukāvacaraṇa as part of a broader conservative package that also emphasises weight control, limb elevation, calf-muscle exercises, avoidance of prolonged standing, and, where feasible, the use of graduated compression stockings, explaining to patients that leech therapy aims to decompress congested venous territories and improve local microcirculation but does not replace the need for long-term lifestyle modification. The magnitude of benefit observed in pain and heaviness scores, and the objective reduction in limb circumference and clinical congestion scores, justify offering repeated sessions at intervals of about one to two weeks for an initial course of three to six sittings, with subsequent tailoring based on individual response and tolerance, while maintaining systematic documentation of outcomes and adverse events. At the same time, the limitations of this single-arm study underscore the need for practitioners to present leech therapy honestly as a promising but still evolving option, to obtain robust informed consent, and to refer patients promptly for vascular surgical evaluation when red-flag features such as progressive skin changes, ulceration, or suspected deep venous involvement arise. For policymakers and institutional leaders, these results highlight the potential value of establishing structured leech-therapy services within Ayurvedic hospitals and integrative clinics, with standard operating procedures, staff training, and infection-control oversight, thereby creating a safe, low-cost option that may help bridge the gap in care for symptomatic varicose-vein patients in resource-constrained regions. Finally, for researchers, the current work provides a foundation for designing controlled trials and mechanistic studies, and until such data are available, the prudent recommendation is to use Jalaukāvacaraṇa as an adjunct to, rather than a substitute for, evidence-based conservative measures, applying it judiciously in appropriately selected patients while contributing systematically to the growing evidence base.

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