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Combination of *Jalaukavacharana* with 4-Layer Compression Bandaging: Boon for non-healing Venous Leg Ulcer-A Case Study

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ABSTRACT:

Venous leg ulcers (VLUs) are late indicators of chronic venous insufficiency (CVI) and venous hypertension. They often require extended time to heal, and carry a high risk of recurrence. This case study describes our experiences with a patient of VLU, refractory to multiple treatment strategies who has been successfully treated by combination of *Jalaukavacharana* along with 4-Layer Compression Bandaging. A 52-year-old man developed 2 VLUs over medial aspect of his left leg. He experienced 2 years of unsuccessful treatments with insignificant progression towards wound healing. Imaging technology was used to confirm the diagnosis. Then started *Jalaukavacharana*, along with 4-layer compression bandaging and suggested the necessary lifestyle changes. After 28 days of treatment, Revised Venous clinical severity score (r- VCSS) has come down from 21 to 6. Patient reported clinically relevant improvement in wound-related pain in 7 days. Considerable relief of inflammation and swelling in 14 days. His 1 VLU was completely epithelialized within 21 days and second one in 28 days. There was no sign of recurrence in 6 months even after following the normal routine.

KEYWORDS: *Jalaukavacharana*, 4-layer Compression bandaging, Venous leg ulcer, Revised Venous clinical severity score.

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INTRODUCTION:

Venous leg ulcer (VLU) is the most common type of ulcer in the lower extremity. [1](. VLU accounts for 70–80% of ulcers presenting for evaluation and treatment to different professions across different specialties including primary care physicians, geriatricians, wound care specialist, phlebologist, surgical specialties, cardiologist, and vascular surgeons. The prevalence of VLU is up to 2% of the population and, importantly, increases to 5% of individuals over the age of 65 years old[2,3]. Healing rates of VLU of 76% at 16 weeks can be achieved with compression[4]. However, a major issue with VLU is the high recurrence rates, which can be significant and as high as 50–70% at 6 months. [1].

Despite compression treatment, and surgical and endovascular venous treatments, the overall healing and recurrence rates for VLU can be as high as 70%. A key reason is the poorly understood pathophysiology, molecular pathways leading to tissue injury,

persistent inflammatory responses and monocyte/lymphocyte-endothelial activation, and oxidative stress. Several pharmacologic agents including flavonoids, diosmin-based drugs, pentoxifylline, and sulodexide have been tested in RCTs as adjuvant treatments to compression for improving VLU healing[1].

In VLU, both the macro venous and micro venous components of the venous system are affected. In the macro venous component, there are several abnormalities including venous valve dysfunction and obstruction, that have a common pathway leading to venous hypertension and skin changes including venous leg ulcers. In micro venous circulation endothelial dysfunction, glycocalyx injury, and activation of chemokines (e.g., MCP-1 and MIP-1), adhesion molecules (e.g., ICAM-1, VCAM-1, and selectins) and endothelial regulators (NO) are potent molecules to allow for leukocytes migration within the venous wall and valve and eventually in the interstitium. Cellular (endothelial cells, smooth muscle cell, and fibroblasts) metabolic changes occur, leading to loss of integrity of the venous wall and valves, that is directly linked with microcirculation resulting in venous hypertension[5,6].

Jalaukavacharana has a long history in the healing of chronic wounds in the context of traditional Ayurveda medicine. Modern explanations for the principles of this therapeutic concept are found in leeches' capacity to drain blood, to reduce venous congestion, and more than twenty bioactive substances found in leech saliva. Such substances have been shown to have thrombolytic, anti-coagulant, anti-inflammatory, antimicrobial and pain-relieving effects, with an associated increase in blood flow and an inhibition of platelet functions. The impact of leech saliva on wounds' local blood and lymph microcirculation appears an essential feature of wound healing, although details of the processes involved await further exploration[7].

CASE HISTORY:

A 52-year-old man, presented with ulcers in his left leg for 2 years. He has a history of pain in left leg for 5 years which was gradual in onset and dragging in nature. The pain got worsened when he stands for a long time and was relieved when he lies down. He was working in the factory that demands a prolonged standing posture throughout the day. The pain was more towards the end of the day. He took medication and somehow managed the pain. After 3 years an ulcer developed spontaneously over the medial aspect of left lower leg. There was swelling around the ulcer with pain. After few weeks another ulcer developed adjacent to the previous one (Figure-1). He took allopathic treatment multiple times and did not get significant relief. As the pain and oedema aggravated day by day he took leave of absence from the job and sought management in our hospital.

Physical examinations:

Inspection - 2 ulcers (ulcer1-2x2x0.3 cm & ulcer 2 - 3x2x0.2 cm, measured using ruler) were noted above the medial malleolus of the left ankle. Ulcers having sloping edges with healthy granulation tissue on the floor and non-viable tissues at the margin. Surrounding area was oedematous, hyper pigmented and with thick skin (Figure-1).

Palpation – skin surrounding the ulcer was tender and indurated. All peripheral pulses of lower limb were palpable normally bilaterally and no enlarged inguinal lymph nodes noticed.

The contralateral leg appeared normal.

Diagnostic imaging:

USG Colour doppler of left lower limb on 17/8/2022 s/o Left SPJ and SFJ incompetency.

Incompetent perforators were seen in left leg as described below;

1. 8.0 mm in diameter, 5 inches above ankle medially.
2. 3.0 mm in diameter, 5 inches above ankle posteriorly.
3. 4.2 mm in diameter, 4 inches below knee posteriorly.

THERAPEUTIC INTERVENTION:

A multimodal approach was initiated in this patient. The patient was advised leg elevation and simple leg exercises including daily walking and flexion exercises.

Method of *Jalaukavacharana:*

I. Materials required: Aquarium, glass jars, small glass bowls, disposable bottle of sterile water, turmeric powder, medicinal leeches, Surgical gloves, micropore, Gauze, Cotton, and Bandage.

II. Poorva karma - Preparation of leeches: At first *sodhana* of medicinal leeches (*hirudo medicinalis*) were done by putting them in turmeric mixed water for 30 minutes. [8]

III. Pradhana karma - Application of leeches (figure 2):
   a) Cleaned the site of application with sterile water or normal saline.
   b) The leeches were applied over the site of maximum congestion.
   c) A dampened square gauze piece with a hole in the middle was placed over the site of application. This formed a barrier to prevent the leeches from wandering.
   d) Then the head of leech attached to this hole, then it attached to the site quickly. In case the head of the leech was not attaching, made a needle prick over the site as a result of which a blood drop was formed which was sucked by the leech and thereby helped in attaching its head.
   e) Once the leech was attached, it remained attached safely until fully distended and then detached itself approx. after 30-35 minutes. It was made sure that the gauze piece was wet during the whole process.

IV. Paschat karma: Dealing with leeches after use: Purified the used leeches by putting them in turmeric powder and turmeric mixed water and made them vomit the blood.
   Post-bite care of wound: Cleaned the wound with normal saline and covered it with sterile gauze pieces.

Technique of 4-layer compression bandaging:

The ABPI (0.9) was assessed before starting compression therapy[9]. The 4 layers of compression bandage (figure- 3) were applied in following order,

Layer 1: Orthopaedic wool- Orthopaedic wool provided a layer of padding that protects areas at risk of high pressure, such as the foot and ankle. Also, for absorption of exudate and redistribution of pressure around limb.

Layer 2: Crepe bandage- It simply added extra absorbency and smooths down the orthopaedic layer prior to the application of the two outer compression bandages.

Layer 3: Elastic extensible bandage- It was a highly extensible bandage that provided a sub-bandage pressure of approximately 17mmHg when applied at 50% extension with a 50% overlap using a figure-of-eight technique.

Layer 4: Elastic cohesive bandage- Helped to maintain the bandage position. In fact, this layer provided the higher level of compression (sub-bandage pressure approximately 23mmHg). Bandaging was extended over the upper portion of the

gastrocnemius muscle to prevent slippage. The two outer elastic bandages, when used in combination, provided a sub-bandage pressure of approximately 40mmHg.

4-layer compression bandaging was applied on the same day as the *Jalaukavacharana*. Following a week of continued application, the bandage was removed, and the treatment was repeated. The patient was advised to decrease compression by making relaxing incisions over the bandage if there was any discomfort during the days of bandage application. The *Jalaukavacharana* treatment and 4-layer compression bandaging were performed a total of 4 times (table 1).

The patient was also given oral ayurvedic medications like *triphala guggulu, amalaki rasayana* for supporting wound healing (table 2). After epithelialization of ulcers patient was advised for using compression stockings and to follow lifestyle modifications.

Table-1: Timeline:

Date	Intervention / Clinical event
17/8/2022	Initial assessment and diagnosis
21/8/2022	*Jalaukavacharana* followed by compression bandaging
28/8/2022	*Jalaukavacharana* followed by compression bandaging
5/9/2022	*Jalaukavacharana* followed by compression bandaging
12/9/2022	*Jalaukavacharana* followed by compression bandaging
20/3/2023	Follow up

Table -2: Ayurvedic medications:

Drug	Formulation	Route	Dose & Time	Duration
Triphala guggulu	Tablet/ *Gutika*	P/O	2 BD	17/8/2022– 12/10/2022
Amalaki rasayana	Powder/ *Choorna*	P/O	5g BD	17/8/2022– 12/10/2022

Figure 1: First consultation status of VLU

Figure 2: Application of leeches

Figure 3: 4-layer compression bandaging

Figure 4: Status of VLU after 28 days

RESULTS:

Pain was relieved in 7 days, swelling and inflammation considerably reduced in 14 days, one ulcer (no.2) epithelialized in 21 days & other one (no.1) in 28 days.

Before treatment (Figure-1), Revised Venous clinical severity score was 21.[10]

[pain or ulcer discomfort - 2, varicose veins - 1, venous oedema - 2, skin pigmentation - 2, inflammation - 2, induration - 2, no. of active ulcers - 2, active ulcer duration - 3, active ulcer size - 2, compression therapy - 3]

After 28 days of treatment (Figure-4), r-VCSS score became 6.

[pain or ulcer discomfort - 0, varicose veins - 1, venous oedema - 0, skin pigmentation - 2, inflammation - 0, induration - 2, no. of active ulcers - 0, active ulcer duration - 0, active ulcer size - 0, compression therapy - 1]

DISCUSSION:

A reduction of r-VCSS from 21 to 6 within 28 days was a remarkable outcome. Along with that patient reported clinically relevant improvement in wound-related pain in 7 days. The hirustastin of the leech saliva inactivates kinins which activates the nociceptive nerve cells to induce or enhance pain sensations in host tissues. This property of hirustastin establishes it as a potential analgesic. [11]

In this patient, considerable reduction of inflammation and swelling observed in 14 days. Researches shows that Bdellins and eglins in leech saliva have anti-inflammatory and antibiotic effects.[12]Acharya Sushruta while mentioning *Raktavisravana* in *Shashti Upakrama,* mentioned *Jalaukavacharana* on ulcers associated with edema(*sopha*), pain(*vedana*), hardness or induration (*katina*) hyper pigmentation (*dhyama*), erythema (*sarakta*), uneven surface(*vishama*) and which are deeply seated(*samrabdha*).[17] The mechanism of action of leeches in decreasing inflammation and edema can be explained by their anti-inflammatory action as well as its effect in correcting venous hypertension and thereby normalising the transcapillary pressure.

His 1 ulcer was completely epithelialized within 21 days and second one in 28 days. This may be due to action of acetylcholine in saliva of leech which fastens the wound healing. As per recent study, Topical application on skin of Acetylcholine (SKA 1 pg/mL) accelerates wound closure

stimulating non-neuronal cholinergic system. This result demonstrated for the first time the importance in an in vivo model of highly diluted SKA Ach during wound healing, suggesting a potential use in skin disease. [13]

There was no sign of recurrence in 6 months even after following the normal routine.

Previous studies showed that natural and recombinant hirudin can increase VEGF expression in random skin flaps, which can potentially improve random skin flap survival in rats through angiogenic mechanisms. Natural hirudin demonstrated more pronounced effects than recombinant hirudin. [14]

Hirudin is one of the key factors among the chemical constituents in saliva of leech. [15] Considering the previous study, the hirudin in the leech saliva may be the factor which promotes angiogenesis by inducing VEGF expression.

In addition to angiogenesis, VEGF has been shown to stimulate keratinocyte migration and collagen production via fibroblasts. VEGF secretion also induces release of other growth factors, which further stimulate healing. [16] So, VEGF expression stimulated by application of leeches might have helped not only in angiogenesis, but also significantly improved other aspects of wound healing.

These results are undoubtedly significant and it shows that the efficacy of compression therapy has improved by combining with *Jalaukavacharana*. Bioactive substances in the saliva of leeches contains anti-inflammatory, anti-microbial, and various other factors which improves neovascularization which might be the reason for faster healing. Venous congestion and oedema were relieved by suction of leeches and pain significantly reduced by its analgesic properties. One of the major reasons for non-healing and recurrent nature of VLU is the persistent inflammatory responses in and around the ulcer, which can be well managed by application of leeches.

CONCLUSION:

Jalaukavacharana along with 4 Layer Compression Bandaging has shown significant efficacy in the management of this case of venous leg ulcer. It has good healing rate, low recurrence, and significant reduction of associated symptoms. Before surgery is chosen as a management option for VLU, this approach may be a less invasive and affordable alternative.

Consent of patient: The written informed consent has been obtained from the patient for treatment and publication of data.

Limitation of study: The biochemical changes during *Jalaukavacharana* may be analysed in further studies and used in more number of such cases.

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