



Research Article

A PRE-POST STUDY TO EVALUATE THE ANTIMICROBIAL EFFECT OF *DHOOPANA* WITH *NIMBAPATHRADI CHOORNA* IN *DUSHTAVRANA* (NON-HEALING VENOUS ULCER)

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ABSTRACT

An ulcer is a break in the continuity of the covering epithelium of skin or mucous membrane. Non healing ulcers are defined as those that do not follow the normal healing process and show no signs of healing in 4weeks. One of the primary reasons for delayed healing in ulcers is microbial infection. Chronic or non-healing ulcers are often colonized by a diverse range of microorganisms, making the wound environment polymicrobial. These bacteria can release various inflammatory mediators that interfere with the natural wound healing process by prolonging the inflammatory phase and impeding tissue regeneration. The widespread emergence of antibiotic-resistant strains has further complicated the management of such wounds, reducing the effectiveness of conventional antimicrobial therapies. This study is done to evaluate the antimicrobial effect of *Dhoopana* with *Nimbapathradi choornam* in non-healing venous ulcer by assessing the microbial load. This is a pre and post clinical trial with 25 participants in a single group selected on the basis of inclusion and exclusion criteria. *Dhoopana* with *Nimbapathradi choorna* was applied for 10 days, twice daily, for 10 minutes. *Nimbapathradi choorna* is explained in *Vrana Shodhadhikara* chapter of *Bhavaprakasha madhyama khanda*. After the study period, there was significant reduction in the load of micro-organism noted.

INTRODUCTION

An ulcer is characterized by the breakdown or loss of the surface epithelial layer. When the natural healing process is disrupted, it can lead to the development of a chronic ulcer. Indian epidemiological studies indicate that chronic non-healing ulcers affect around 4.5 out of every 1,000 people^[1]. The presence of a high bacterial load within an ulcer can significantly slow down the healing process. Signs of an infected ulcer typically include increased pain, excessive wound discharge, dead or nonviable tissue at the wound base, and an offensive odour.

A venous ulcer is a type of chronic wound that results from improper functioning of the venous system, usually due to venous valve insufficiency. These ulcers typically occur in the lower legs, especially around the ankles.

They develop when increased venous pressure leads to breakdown of skin and poor tissue perfusion^[2]. If the healing process is disrupted or delayed, venous ulcers can become chronic.

Acharya Susruta mention *Dhoopana* as a treatment modality in the management of *Vrana*. It is recommended for wounds with severe pain, exudation, and predominance of *Vata dosha*. *Nimbapathradi Dhoopana* is a traditional formulation that includes ingredients like Neem leaves (*Nimbapathra*), *Vacha*, *Hingu*, ghee (*Sarpi*), salt (*Lavana*), and mustard seeds (*Sarshapa*)^[3]. These components are known for their antimicrobial, analgesic, and wound-healing properties, helping to lower microbial presence and relieve pain.

AIM

To evaluate the antimicrobial effect of *Dhoopana* with *Nimbapathradi choornam* in non-healing venous ulcer

OBJECTIVE

To evaluate the antimicrobial effect of *Dhoopana* with *Nimbapathradi choornam* in non-healing venous ulcer by assessing microbial load.

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MATERIALS AND METHODS

The diagnosis was established through clinical evaluation along with pus culture and sensitivity testing. Patients were closely monitored throughout the study, with observations documented at the beginning, during the course, and at the conclusion of the study period.

Study Setting

OPD and IPD, Department of Shalyatantra, Government Ayurveda college Thiruvananthapuram.

Study Design

Single group Pre and post interventional study

Study population-

Subjects between the age of 30-70 years having *Dhushta vrana* (non-healing venous ulcer) irrespective of their sex attending the OPD and IPD of Shalyatantra Department, Government Ayurveda College, Thiruvananthapuram.

Sampling method: Consecutive sampling

Sample Size: 25

Name of the trial drug- *Nimbapathradi choornam*

Details of drug- *Nimbapathradi dhoopana* is explained in *Vranashodhadhikara adhyaya* in *Bhavaprakasha madhyamakhandha*. *Nimbapathra*, *Vacha*, *Hingu*, *Sarpi*, *Lavana* and *Sarshapa* are the ingredients of *Nimbapathradi dhoopa*.

Selection criteria

Inclusion Criteria

1. Participants with ulcer having positive swab test.
2. Participants with non-healing venous ulcer in leg with severe pain and discharge

Exclusion Criteria

1. Those ulcers which need mechanical desloughing were excluded.
2. Participants known to have uncontrolled Diabetes mellitus, Diabetic foot, Carcinoma, Leprosy, Tuberculosis,

Method of Preparation

Analysis of Data

Data Related to Change in Microbial Load

Comparison of Microbial Load in Pus Culture (Day 0 vs. 11th Day)

Category	Day 0 n (%)	11 th Day n (%)	p value
Heavy growth of <i>Pseudomonas aeruginosa</i>	5 (20.00)	0 (0.00)	<0.001
Heavy growth of <i>Staphylococcus aureus</i>	2 (8.00)	0 (0.00)	<0.001
Heavy growth of <i>Staphylococcus aureus</i>	1 (4.00)	0 (0.00)	<0.001
Heavy growth of <i>Pseudomonas aeruginosa</i>	1 (4.00)	0 (0.00)	<0.001
Moderate growth of <i>Kleibsiella</i>	1 (4.00)	0 (0.00)	<0.001
Moderate growth of <i>Pseudomonas aeruginosa</i>	2 (8.00)	3 (12.00)	<0.001

Equal quantities of *Nimbapathra*, *Vacha* (rhizome), *Hingu Niryasa*, *Lavana* and *Sarshapa* are powdered well and taken to a *Sarava*. Sufficient quantity of *Ghritha* (*Go ghritha*) added to the mixture and burnt and the non-healing venous ulcer of the participant was subjected to *Dhoopana*.

Intervention

Participants were subjected to *Vrana dhoopana* with *Nimbapathradi choorna* for 10 minutes, twice a day for a period of 10 days.

Poorva karma

Procedure was explained to the participants in detail and consent was taken. Ulcer and its surrounding area cleaned using sterile distilled water.

Pradhana karma

Mixture of medicines are lighted to produce fumes and is directed to the ulcer with the help of a paper cone. Procedure was continued for 10 minutes

Paschath karma

Ulcer was covered with a sterile pad and gauze bandage was done to avoid exposure of the ulcer.

Assessment Period

Dhoopana was done for 10 minutes, twice a day for a period of 10 days.

The outcome measures, microbial load was assessed before and after the *Dhoopana* that is 0th day and 11th day.

After the assessment period, participants were given standard treatment until healing of ulcer.

Assessment Efficacy

Outcome Variable

Effect of the treatment is assessed by parameters based on the findings by grading method.

Objective Parameters

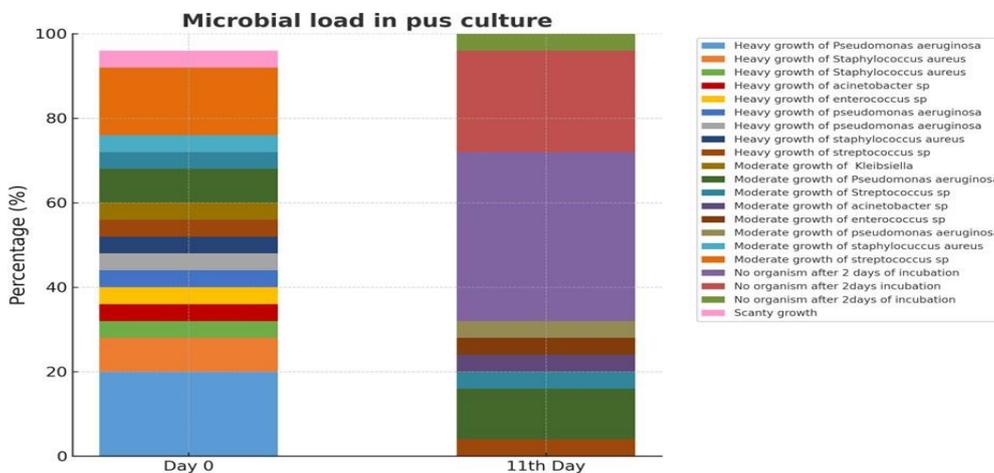
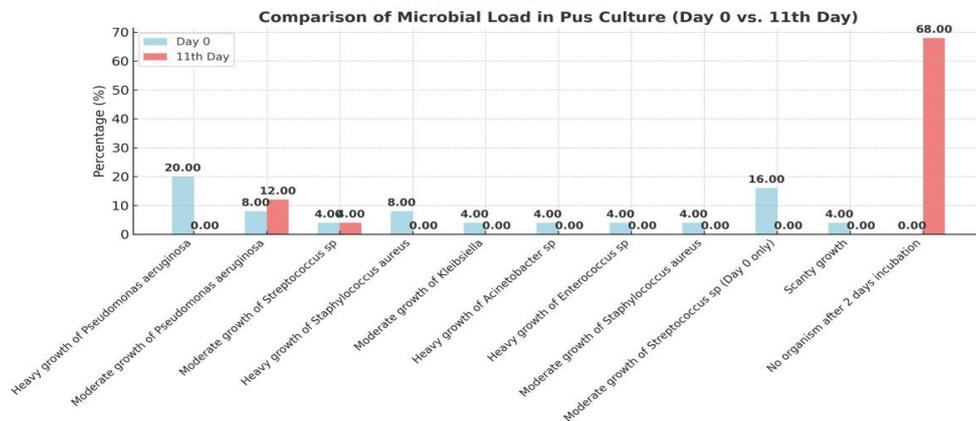
Microbial load

Discharge from ulcer was collected by a swab for culture before and after *Dhoopana* (0th day and 11th day).

Moderate growth of Streptococcus sp	1 (4.00)	1 (4.00)	<0.001
Heavy growth of Acinetobacter sp	1 (4.00)	0 (0.00)	<0.001
Heavy growth of Enterococcus sp	1 (4.00)	0 (0.00)	<0.001
Heavy growth of Pseudomonas aeruginosa	1 (4.00)	0 (0.00)	<0.001
Heavy growth of Pseudomonas aeruginosa	1 (4.00)	0 (0.00)	<0.001
Heavy growth of Staphylococcus aureus	1 (4.00)	0 (0.00)	<0.001
Heavy growth of Streptococcus sp	1 (4.00)	1 (4.00)	<0.001
Moderate growth of Staphylococcus aureus	1 (4.00)	0 (0.00)	<0.001
Moderate growth of Streptococcus sp	4 (16.00)	0 (0.00)	<0.001
Scanty growth	1 (4.00)	0 (0.00)	<0.001

The table compares microbial load in pus cultures between Day 0 (baseline) and the 11th day of observation. On Day 0, there was a predominance of heavy growth of *Pseudomonas aeruginosa* (5, 20.00%), followed by moderate growth of *Pseudomonas aeruginosa* (2, 8.00%), and various other organisms including *Staphylococcus aureus*, *Klebsiella*, *Streptococcus sp*, *Acinetobacter sp*, and *Enterococcus sp*, each accounting for smaller proportions (4.00–8.00%). By the 11th day, there was a complete absence of heavy growth of any organism, with only moderate growth of *Pseudomonas aeruginosa* (3, 12.00%) and *Streptococcus sp* (1, 4.00%) persisting. A notable finding was the significant increase in sterile cultures (no organism detected), rising from 0 (0.00%) at baseline to 17 (68.00%) on the 11th day, indicating a substantial reduction in microbial growth ($p < 0.001$).

Comparison of microbial load grading



DISCUSSION

The study was mainly aimed to evaluate the antimicrobial effect of *Dhoopana* with *Nimbapathradi choorna* in non-healing venous ulcer in reducing the microbial load in 25 participants for a treatment period of 10 days.

Dhoopana, an Ayurvedic therapeutic modality, refers to the external application of medicated herbal smoke to a targeted area, primarily for its antimicrobial and wound-healing benefits. This technique works by creating an aseptic local

environment, by reducing the microbial burden and supporting the natural healing process of chronic wounds. Scientific and traditional literature supports that the therapeutic efficacy of *Dhoopana* largely depends on the pharmacological properties—particularly the antibacterial and anti-inflammatory effects of the herbs used in the fumigation process. They also take part in the pH modulation, through *Dhoopana* it alters the pH environment, making it unfavourable for microbial growth and the volatile compounds released during *Dhoopana* may induce oxidative stress in microorganisms, leading to their inhibition or death. These herbs, when burned, release volatile compounds that interact with the wound surface and the surrounding atmosphere, contributing to a cleaner and less infection-prone environment. One of the major clinical challenges in the management of chronic ulcers, including non-healing venous ulcers, is the presence of biofilms. Biofilms are structured microbial colonies embedded in a self-produced extracellular matrix composed mainly of proteins, polysaccharides, and nucleic acid^[4]. These biofilms not only shield the microbes from the host immune response but also render conventional treatments like antibiotics less effective. The herbs used in *Dhoopana* are believed to possess properties that inhibit biofilm formation, disrupt the microbial colonies, and prevent further microbial colonization on the ulcer surface. From an Ayurvedic perspective, the therapeutic effects of these herbs are explained in terms of *Rasa* (taste) and *Guna* (qualities). The primary Rasas of the herbs used in *Dhoopana*- *Katu* (pungent), *Tikta* (bitter), and *Kashaya* (astringent)- play a significant role in reducing *Kledatva*, or excessive moisture, which is often a contributing factor to microbial proliferation. By absorbing excess moisture, these *Rasas* help create a dry and inhospitable environment for pathogens, thereby assisting in reducing *Krimi*, or microbial load.

In addition to these general effects, the specific pharmacodynamic properties of the *Dhoopana* herbs include *Krimihara* (antimicrobial action): aimed at eliminating pathogenic organisms, *Vranahara* (wound healing): promotes tissue repair and regeneration. *Dushtavrana Shodhana* (cleansing of infected or non-healing wounds): Facilitates the removal of dead tissue and toxins from the ulcer. *Dourgandhyahara* (deodorizing effect): Helps to control foul-smelling discharge, often associated with infected ulcers. These multiple properties act synergistically to cleanse the wound, reduce infection, and enhance the local tissue's capacity to heal. The combined action of moisture reduction, microbial inhibition, and anti-inflammatory effects not only prevents the spread of infection but also accelerates the wound healing process by maintaining an optimal environment for tissue regeneration.

Probable Mode of Action of Trial Drug

Nimba Patra^[5] (Neem Leaves)

Neem possesses *Tikta* and *Kashaya rasa*, *Rooksha guna*, and *Sheeta veerya*, which help in drying excess moisture, reducing pus, and cleansing the wound. Its *Krimihara*, *Vranaghna*, and *Rakta Shodhaka* properties aid in microbial elimination and wound healing. Neem leaves contain volatile phytochemicals such as nimbidin, nimbin, nimbinene, azadirachtin and essential oils which are released into the atmosphere during *Dhoopana*, allowing them to interact directly with the wound environment. Their mode of action against microbes includes:

1. Cell Wall Disruption: Volatile oils can penetrate microbial membranes, causing leakage of cellular contents and eventual cell death.
2. Inhibition of Enzyme Systems: Active compounds like nimbidin interfere with microbial metabolic enzymes, halting growth and replication.
3. Antioxidant Activity: Volatiles neutralize free radicals and reduce oxidative stress, which supports healing and limits infection.
4. Broad-Spectrum Action: Neem volatiles are effective against bacteria, fungi, and viruses, making them useful for managing mixed infections in chronic wounds.

Probable Mode of Action of Vacha

Vacha possess *Katu*, *Thiktha rasa*, *Laghu*, *Theekshna guna*, *Ushna veerya* and *Katu vipaka*. Due to its *Ushna veerya* contributes to its analgesic effects. *Katu rasa* has *Krimighna* and *Kandu prasamana* and *Kapha nisaraka* properties which helps in the removal of microorganisms and enhance *Vrana sodhana*. *Thiktha rasa* having *Kleda upashoshana* and *Pooya upashoshana* thereby reduce the discharge of wound^[6]. As per the modern studies, reveals Asarone present in *Vacha* exhibits an antibacterial effect and potentiates ampicillin activity.^[7]

Probable Mode of Action of Hingu

Hingu has *Kaphadurgandhihara*, *Kapha nisaraka* and *Krimighna* properties. Due to its *Ushnaveerya* and *Theekshna guna* which helps in *Kleda Meda vilayana* as well as *Srothosodhana*. Research studies have proven, foetithiophene F from *ferula asfoetida* has antibacterial activities. Recent studies show it has antioxidant and antispasmodic activities.^[8]

Probable Mode of Action of Sarshapa

Sarshapa has *Krimighna* and *Kandughna* properties because of its *Katu thiktha rasa* predominance. During *Dhoopana* the contents of the drug released into the atmosphere due to its volatile nature, which affects the microbial growth. AITC is one of the chemical compounds seen in *Sarshapa* which has potent antimicrobial activity.^[9]

Probable Mode of Action of Lavana

Saindhava has a *Sookshma* property so that it can penetrate through minute spaces. In addition to that it can be able to change the osmotic conditions which results in the weakening of microbes. Recent studies have proven the antimicrobial activity.

Probable Mode of Action of Sarpi (Go Ghritha)

Ghritha possess *Madhura rasa, Snigdha mridu Soumya gunas* and *Seetha veerya madhura* in *Vipaka*. It has *Visahara, Twachya* and *Vathapitha prasamana vrana sodhana ropana* properties which results in *Vedana samaka* as well as *Krimi nashana*^[10]. Research studies have proven that ghee has antioxidant antibacterial anti-inflammatory antiseptic and detoxifying properties which helps in wound healing. Presence of Saturated and unsaturated fatty acids in ghee plays an important role in wound healing by promoting cell proliferation, enhancing tissue regeneration, and facilitating the absorption of herbal extracts, which accelerate wound closure and contraction

As per the study, *Staphylococcus aureus* and *Klebsiella pneumoniae* were the most eliminated bacteria, showing complete response to fumigation. *Pseudomonas aeruginosa* was the least affected, with partial or no response in several participants, indicating higher resistance.

CONCLUSION

The trial drug was found to be effective in reducing the microbial load in non-healing venous ulcer. No adverse events of the drug were noted during the course of treatment. Hence it can be concluded that *Nimbapatradi choorna* is effective in the management of non-healing venous ulcer with delayed healing due to heavy microbial load.

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