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Developing Standard Protocol for *Jaloukavacharana* (Leech Therapy) with Purpose of Mitigation of Infectious Risk

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ABSTRACT

Introduction:

Jaloukavacharana (medicinal leech therapy) is a traditional parasurgical procedure that has gained renewed clinical significance in modern reconstructive surgery and peripheral vascular disease management. Despite its therapeutic efficacy, the absence of standardized protocols for leech preparation and application poses significant infectious risks.

Objectives:

To develop evidence-based protocols for the safe clinical application of medicinal leeches, with particular focus on pathogen screening, decontamination procedures, and infection risk mitigation.

Methods:

A comprehensive literature review was conducted examining infectious complications associated with leech therapy, traditional protocol mentioned by Acharya Susruta, and contemporary decontamination methodologies. Studies addressing pathogen transmission, antimicrobial interventions, and safety protocols were systematically analyzed.

Results:

Current evidence demonstrates significant infectious risks associated with medicinal leech application, predominantly involving *Aeromonas* species and other opportunistic pathogens. While traditional Ayurvedic protocols provide foundational safety measures,

contemporary practice requires enhanced screening and decontamination procedures. Existing antimicrobial interventions show promise for pathogen reduction but lack standardization.

Discussion & Conclusion:

The development of comprehensive, standardized protocols for medicinal leech therapy is essential for safe clinical practice. This framework addresses critical gaps in current practice through evidence-based recommendations for leech cultivation, screening, decontamination, and clinical application protocols.

Keywords: *Jalouka*, Medicinal leech, Leeching, Infection control, microbiota

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Introduction

Medicinal leech therapy, historically termed hirudotherapy and traditionally known as *Jaloukavacharana* in Ayurvedic medicine, represents one of the earliest documented therapeutic interventions in medical history (1). The practice involves the controlled application of hematophagous leeches for therapeutic bloodletting and has demonstrated remarkable clinical utility across diverse medical applications (2).

The resurgence of leech therapy in contemporary medicine, particularly since the 1960s, has been driven by its demonstrated efficacy in post-surgical venous decongestion, tissue salvage procedures, and reconstructive surgery applications (3). The therapeutic mechanism involves dual action: mechanical blood removal through suction and biochemical intervention via bioactive compounds present in leech saliva, including hirudin, hyaluronidase, and various anticoagulant factors (4,5).

Despite its clinical benefits, medicinal leech therapy presents significant infectious risks due to the diverse microbial ecosystem harboured by these organisms. *Aeromonas hydrophila*, a symbiotic bacterium essential for blood digestion in leech gut microbiota, represents the most frequently reported pathogen in post-therapy infections (6,7). Additional pathogens, including viruses, fungi, and parasites, have been identified in various leech species, raising concerns about potential disease transmission (8–10).

The predominant medicinal leech species utilized in Indian traditional medicine include *Poecilobdella granulosa* and *Hirudinaria manillensis*, both belonging to the family Hirudiniformes within the order Arhynchobdellida (11). These species lack standardized cultivation, screening, and preparation protocols, necessitating the development of evidence-based safety frameworks.

Sushruta Samhita, provide detailed protocols regarding the types of leeches that is to be used, its collection, preparation, and application, emphasizing the importance of source water quality and pre-treatment decontamination procedures (12–15). However, contemporary environmental conditions and pathogen diversity may exceed the protective capacity of traditional methods, requiring enhanced safety protocols.

Materials & Methods

Literature Review Strategy

A comprehensive literature review was conducted using multiple databases (PubMed, Shodhganga, Google Scholar) covering the period from 1960 to 2024. Search terms included “medicinal leech therapy,” “hirudotherapy,”

"Jaloukavacharana," "leech infections," "Bacteria," "Fungus," "parasites," "virus" and "leech decontamination." Classical Ayurvedic texts were reviewed for traditional protocols and safety measures.

Inclusion Criteria

Publications meeting the following inclusion criteria were evaluated:

1) Documentation of infectious complications associated with hirudotherapy;
2) Microbiological characterization and pathogen identification within medicinal leech species;
3) Experimental validation of decontamination methodologies and their efficacy;
4) Assessment of antimicrobial interventions for pathogen reduction; and
5) Evaluation of existing safety protocols and risk mitigation strategies for therapeutic leech applications.

The review encompassed peer-reviewed case reports, observational clinical studies, systematic reviews, and experimental studies published in English-language journals.

Protocol Development Framework

Based on literature analysis and traditional Ayurvedic protocols, a comprehensive framework was developed addressing: (1) pathogen screening procedures, (2) decontamination protocols, (3) clinical application guidelines, and (4) post-therapy monitoring.

Results & Discussion

Infectious Complications in Leech Therapy : Bacterial Infections

Aeromonas hydrophila represents the most significant bacterial pathogen associated with leech therapy, with infections occurring in approximately 2-36% of cases depending on the study population and prophylactic measures employed (16). This gram-negative bacterium exists in symbiotic relationship with medicinal leeches, facilitating blood digestion through proteolytic enzyme production (17).

Infection typically occurs through regurgitation of gut contents during leech manipulation or premature removal procedures. Clinical manifestations range from localized wound infections to systemic sepsis, particularly in immunocompromised patients (18). Third-generation cephalosporins and fluoroquinolones demonstrate excellent anti-*Aeromonas* activity and are recommended for prophylactic use (9,16).

Viral and Parasitic Pathogens

Laboratory investigations have identified various viral pathogens, including HIV-1, HIV-2, and Hepatitis B virus, in gut contents of wild-caught

leeches (8). However, these pathogens do not establish tissue infections in leeches and are presumed to represent temporary gut colonization following infected blood meals.

Parasitic organisms, including *Plasmodium* species and trypanosomes, have been detected in certain leech populations, though their clinical significance remains unclear (8). The risk of transmission appears highest with recently fed leeches harbouring undigested blood from infected hosts.

Fungal Infections

Fungal contamination of leech external surfaces, jaws, and pharyngeal regions has been documented, with potential pathogenic species including *Candida* and *Trichosporon* species (10,19). While rare, fungal transmission represents a particular concern in immunocompromised patients undergoing leech therapy.

Traditional Ayurvedic Safety Protocols: Leech Selection Criteria

Classical Ayurvedic texts emphasize rigorous leech selection based on habitat quality, physical characteristics, and behavioral patterns. Leeches from contaminated water sources, displaying lethargy, recent feeding evidence, or abnormal morphology are considered unsuitable for therapeutic use(12–14).

Pre-treatment Decontamination

Acharya Susruta outlines a protocol that involves an initial treatment by applying a *kalka* (paste) made from *Sarshapa* (mustard) and *Rajani* (turmeric) (15). This is followed by immersing the treated subjects in clear water for one muhurta (approximately 48 minutes) until they resume normal activity. This procedure is designed to remove surface contaminants and evaluate the viability of the leeches

Post-therapy Procedures(11)

Classical texts mandate induced regurgitation following therapy to prevent pathogen accumulation and maintain leech health for subsequent use. This practice aligns with contemporary understanding of infection risk mitigation.

Contemporary Decontamination Methodologies

Antimicrobial Feeding Protocols

Experimental studies demonstrate significant pathogen reduction through antimicrobial feeding protocols. Leeches fed blood supplemented with ciprofloxacin (20 µg/mL) and cefotaxime (50 µg/mL) showed undetectable *Aeromonas* levels for two weeks post-feeding (20).

External Decontamination

Various external decontamination methods have been investigated:

- Hypochlorous acid treatment: 12.5 ppm for 10 minutes achieved significant bacterial reduction (21)
- Chlorhexidine application: 0.02% solution provided 3-4 hours of external decontamination (22)
- Antifungal treatment: Clotrimazole or miconazole incubation for 24 hours eliminated fungal contamination for up to 8 days (23)
- Antibacterial treatment:Immersion of leeches in ciprofloxacin (500 µg/ml) or ceftriaxone (1000 µg/ml) resulted in optimal bacterial eradication upto 7 days (24).

Screening Protocols

Microbiological Assessment:

- Quarterly screening for bacterial pathogens (*Aeromonas* spp., *Vibrio* spp.)
- Annual viral screening (hepatitis B, HIV) using PCR methods
- Fungal culture assessment of external surfaces
- Parasitological examination of gut contents

Quality Control Measures:

- Batch testing protocols with documented results
- Rejection criteria for contaminated populations
- Traceability systems for leech provenance

Pre-treatment Decontamination

Standard Protocol:

1. Initial assessment: Visual inspection for physical abnormalities
2. Behavioral evaluation: Activity level and feeding response assessment
3. External decontamination: 0.02% chlorhexidine application for 5 minutes
4. Antimicrobial feeding: Blood supplemented with ciprofloxacin (20 µg/mL) and cefotaxime (50 µg/mL) administered 48-72 hours prior to use
5. Final assessment: Pre-application viability and activity confirmation

Clinical Application Guidelines

Patient Assessment:

- A comprehensive evaluation of the patient's medical history and immune status should be conducted.
- Informed consent must be obtained, including a disclosure of the risks associated with infection.
- Consideration of prophylactic antibiotics is advised for patients identified as high-risk.

Application Procedure:

- Employ sterile techniques throughout the application process.
- Utilize gentle manipulation to minimize the risk of regurgitation.

- Prefer natural detachment over forced removal.
- Ensure immediate wound care following therapy.

Post-therapy Monitoring:

- Conduct a daily wound assessment for a duration of seven days.
- Monitor temperature for 48 hours, in case of any discomfort.
- Initiate early antibiotic intervention for suspected infections especially in case of post reconstructive surgery.

Leech Management Post-therapy

Immediate Care:

- Induced regurgitation with turmeric powder or sterile saline is followed by returning to the separating the leech from other unused ones, with a subsequent 7 day observation period prior to reuse in the same patient.

Long-term Management:

- Limited reuse protocols (maximum 3 applications per leech)
- Leeches utilized for one patient should not be employed for another patient.
- Ethical disposal procedures for used leeches

Limitations and Future Directions

Current Limitations

The proposed protocol remains conceptual and requires empirical validation through controlled clinical trials. Complete sterilization of medicinal leeches has not been achieved while maintaining therapeutic efficacy. Cost-effectiveness analysis of standardized protocols versus current practices is needed.

Research Priorities

- Development of rapid pathogen detection methods
- Investigation of probiotic approaches for beneficial microbiome maintenance
- Evaluation of alternative decontamination technologies
- Long-term safety studies in diverse patient populations
- Economic analysis of standardized protocols

Conclusions

Medicinal leech therapy represents a valuable therapeutic modality with significant clinical applications in contemporary medicine. However, the absence of standardized safety protocols poses unnecessary infectious risks that can be mitigated through evidence-based interventions.

The proposed standardized protocol addresses critical gaps in current practice through comprehensive approaches to leech cultivation, pathogen screening, decontamination procedures, and clinical application guidelines. Implementation of

these protocols requires collaborative efforts between traditional practitioners, regulatory authorities, and clinical researchers.

Future research should focus on protocol validation, technology development for enhanced safety measures, and long-term outcome assessment. The integration of traditional Ayurvedic wisdom with contemporary microbiological understanding provides a robust framework for safe and effective leech therapy practice.

The development and implementation of standardized protocols will ensure the continued viability of this ancient therapeutic modality while prioritizing patient safety and clinical efficacy. Regulatory oversight and practitioner education will be essential for successful protocol adoption and maintenance of therapeutic standards.

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