



Review Article

Recent Updates in Leech Therapy

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ABSTRACT:

Leech therapy (Jalauka-Avacharan) is a gift of Ayurveda to the medicinal world. Acharyas used to include leech therapy in one of a type of Raktamokshana (blood letting). Leech therapy was used to treat many diseases like skin diseases, Haemorrhoids etc. After Ayurveda, many medical cultures like Greek culture, Europeans, Romans, French cultures started use of leeches in different diseases. Leeches are annelids-segmented worms-related to the common earthworm. There are almost 650 known varieties of leeches across the world. Nowadays medicinal leeches are used in post-operative wounds of patient's undergone plastic surgery and other surgeries and also in many skin diseases like Eczema and Psoriasis.

KEY WORDS: *Raktamokshana*, Leech therapy, Hirudine.

INTRODUCTION:

Leeches are segmented worms that belong to the phylum Annelida and comprises the subclass Hirudinea. Like the oligochaetes, such as earthworms, leeches share a clitellum and hermaphrodites. Leeches can primarily be found in freshwater lakes, ponds, or rivers. From ancient times, Ayurveda recommends Raktamokshana as a strong tool in disease management and use of medicinal leeches for Raktamokshana. This procedure is included under the five bio-purificatory procedures (Panchakarma). Removal of impure blood from the body treats the root cause of the sufferings.

Introduction to Leech -

Kingdom	Animalia
Phylum	Annelida
Class	Hirudinea
Order	H. Limnodbella
Family	Hirudinae
Genus	Hirudinaria
Species	H. Medicinalis

Anatomy of Leech-

Leech is a segmented word which is likely related to the earthworm species. Leech size varies among families and can reach up to 20 cm in length. Leeches contain a true digestive system with a separate mouth and anus. They are made up of both circular and longitudinal muscles. The body of Leeches are cylindrical and flattened which is divided into thirty-three or thirty four segments. The dorsal aspect of the leech is dark brown or black coloured. Dorsal aspect bears some reddish or brown longitudinal strips which are six in numbers. The medicinal leeches have five pairs of eyes. Normal hermaphrodites have setae, septa and parapodia which helps in function of locomotion. But leeches don't have these components in there body for locomotion. Instead of that, leeches move by swimming and looping involves attachment to a substance using its posterior sucker. **Clitellum** is a thickened glandular section of the leech body wall which secretes a viscid sac in which eggs are deposited.

Suckers -

Leech equipped with three jaws and almost 300 chitin

teeth. The body of leech consists a posterior and anterior sucker which each have a specific function. The species *Hirudomedicinalis* have one characteristic that separates them from earthworm is their possession of an anterior and posterior sucker. The posterior sucker or rear suction cup helps it move and cling to a host. The medical professionals are more interested in *Hirudomedicinalis* species because of their anterior sucker which houses three sharp teeth. One more important part of anterior sucker is the leech saliva. The saliva of leech contains about 100 pharmacologically active substances like Hirudin, Anesthetics, Hyaluronidase, Vasodilators, Antibacterials and collagenase. These substances ultimately injected into the human body while sucking off the blood.

There are almost Recognized 700 species of leeches found all over the world. Most of them are freshwater animals. Leeches Don't eat often and they can leave up to a year without food. They suck the blood in a volume of 5-15 ml. It is about tablespoon of blood.

Regarding various types of Leech, only a few types of leeches considered for medical application. Leech species like-

- *Hirudomedicinalis*
- *Hirudinariamaniensis*
- *Hirudo nipponi*
- *Hirudo verbena*
- *Hirudoorientalis*
- *Haementeriadepressa*.

The salivary glands of leeches contain over *hundred* highly active biological substances - special enzymes that have the properties of preventing thrombus formation, interstitial improve metabolism, help get rid the body toxins, prevent ageing of the tissues.

1. Hirudin- the structure of Hirudin is known and the function of this is very important. The ability of leech saliva to inhibit blood coagulation was discovered over a century ago. The first anticoagulant compound in leech saliva was

isolated and identified by Markwardt in the mid-1950s. This is the protein now known as hirudin. The hirudin molecule consists of a chain of 65 amino acids with a high proportion of aspartic acid and glutamic acid, both of which are aminodicarbonic acids. It inhibits blood coagulation by selectively binding to thrombin in the human blood. Hirudin binds with thrombin to form an inactive complex with a very low dissociation constant ($10^{-10} \text{mol} \cdot \text{l}^{-1}$).

Final pathway of blood coagulation and how this is related to hirudin- Important events in blood coagulation and their relation to this thrombin inhibitor. Prothrombin is converted to thrombin through the action of the enzyme thrombokinase. The glycoprotein fibrinogen is then broken down into fibrin monomers through the action of thrombin. The fibrin monomers polymerize with thrombin to form fibrin polymers. Fibrin then forms a clot by forming new peptide bonds. When hirudin binds with thrombin, it blocks this process. It thereby inhibits fibrin production and prevents clot formation

2. Calin- a substance that keeps wound open for roughly 12 hours by binding with and ultimately inactivating the Von Willebrands factor. The bloodletting from the wounds does an additional wound cleansing effect.
3. Hyaluronidase- it acts as "spreading factor" as it facilitates the removal of mucopolysaccharides from the interstices, thus opening the door for subsequent biochemical. It also has an Antibiotic effect.
4. Carboxypeptidase- It has an inhibitor and histamine-like substances which dilates the capillaries around the leech bite site and ultimately increases the flow of blood into the bite region.
5. & 6. Eglin and Bdellin- they have an Anti-inflammatory property and thereby promotes healing.

Biological substances found in saliva of Leech and their effects on the host.

Table 2 showing : Biological substances found in saliva of Leech and their effects on the host.

Sr. No.	Substance	Effect on the host
1	Hirudin	Anticoagulant (inhibits blood coagulation by binding with thrombin)
2	Calin (Seratin)	Inhibits blood coagulation by blocking the binding of von Willebrand factor
3	Destabilase	a) Monomerizing activity, b) Dissolves fibrin, c) Thrombolytic effects
4	Bdellin	Anti-inflammatory inhibits trypsin, plasmin and acrosin
5	Hyaluronidase	"Spreading factor" -increases interstitial viscosity -Antibiotic effect
6	Hirustasin	" Serine proteinase" -Inhibits Kallikrein, trypsin, chymotrypsin, and neutrophilic cathepsin G
7	Eglins	Anti-inflammatory Inhibit the activity of α -chymotrypsin, chymase, subtilisin, elastase, and cathepsin G
8	Factor Xa inhibitor	Inhibits the activity of coagulation factor Xa by forming equimolar complexes
9	Complement inhibitors	May possibly replace natural complement inhibitors if they are deficient
10	Acetylcholine	Vasodilator
11	Anaesthetic substance	Anaesthetic effects
12	Carboxypeptidase A inhibitors	Increases the inflow of blood at the bite site

Uses of Leech Therapy in Treatment-

Since ancient times, leeches were used to treat many illnesses and disease through bloodletting, a method where blood was drawn out in the hope that removing impure blood would heal the body.

A) Cardiovascular Diseases-

Since the 20th century, people have been using leeches to treat cardiovascular diseases because of an important substance " Hirudin" enzyme in the leeches saliva, a substance which has systemic anticoagulation property. The use of leech is much beneficial in a patient suffering from a stroke or heart attack. Also, Hirudin stimulates segmental reflex mechanisms and this contributes to the treatment of cardiovascular diseases.

B) Vascular Diseases-

Leech saliva has over 100 bioactive substances that are very beneficial.

- **Hirudin** is one of those, which acts as an anticoagulation agent.
- **Calin** is another component that also inhibits

blood coagulation.

- **Destabilase** is also an important component that dissolves fibrin clots as well as inhibits the formation of thrombus.
- **Factor Xa inhibitor** restrains the coagulating effect of the coagulation Factor Xa.
- **Hyaluronidase** enhances the viscosity of the interstitial fluid.
- **Acetylcholine and histamine-like substances and Darboxypeptidase A inhibitors** these three can increase blood flow by dilating constricted vessels.

All the substances which described above work together to decrease the viscosity of the blood, making its consistency thinner so as to promote better blood flow. Blood that has a thick consistency makes it prone to clot formation as well as increases the blood pressure of an individual. These clots can travel to different parts of the body and block a vessel, which could then cause a stroke or heart attack. Thick blood poses a risk that the distal extremities, especially the tips of the fingers and toes, will not receive adequate oxygenated blood and the

nutrients they need. Therefore, the anticoagulation component in leeches saliva is vital as it naturally makes the blood thinner and works to inhibit platelet coagulation.

Patients with cardiovascular disease like peripheral vascular disease can get very beneficial results by leech therapy in different areas of their body.

C) Arthritis-

In Arthritis, leech therapy has been a treatment since ancient times. The Leech has a natural property to remove infected blood from the bite site and at the same time, releases therapeutic components and enzymes from its saliva, which reduces inflammation and pain in the joint.

D) Diabetes-

Diabetes patients have a tendency of viscous blood, which creates a higher risk of developing blood clots. Development and dislodgment of such clots into the systemic circulation can cause serious threats to life and can cause instant death, therefore suppression of blood clotting is essential.

One of the most important substances recognised in leech salivary glands is Hirudin, a substance that suppresses the blood clotting mechanism.

Hirudin also has a blood diluting effect, so apart from preventing blood clots; it also thins the blood, allowing the blood to circulate more easily, relieving pressure on the heart and blood vessels.

E) Ear and Hearing Problems-

Leech therapy can help cure the three most common ear and hearing problems –

- 1) Sudden Hearing Loss
- 2) Tinnitus
- 3) Otitis Media.

Patients suffering from the above three major hearing problems can get benefit from leech therapy, particularly when the ear and hearing problem is caused by an infection or a vascular problem. Firstly, leeches secrete an anaesthetic enzyme to desensitize the area and will then release beneficial enzymes and components into the bloodstream which prevents the coagulation of blood and dissolve blood clots. Blood vessels will be dilated by the enzymes, bringing good circulation. Antibacterial enzymes will also be released to kill the bacteria that are causing the ear problem; these anti-bacterial agents will also boost the immune system and fight off further infection.

F) Alopecia -

As the Leech therapy is known to increase blood circulation, therefore when therapy is applied to thinning or bald areas, the increase of blood circulation helps enhance the concentration and delivery of nutrients that assist in making hair follicles strong, thereby assisting in the promotion of hair growth.

People suffering from alopecia caused by fungal infections or dandruff can also benefit through the antibacterial component in the leeches saliva, which helps combat fungal infections.

G) Eye Diseases-

-Prevent Progress of Glaucoma

Glaucoma is a condition in which there is excessive production of vitreous humor or very slow reabsorption of vitreous humor. Vitreous humor is a transparent, jelly-like substance that gives nourishment to the eyes. This excessive vitreous can become harmful as the intra-ocular pressure can increase, causing compression of the eye structures. This may lead to a gradual blurring of vision and slowly loss of sight.

Leech Therapy slows down the progression of this disease. The use of leeches to reduce the rate of blood flow to the eye which reduces the production of vitreous humor and ultimately reduces the intra-ocular pressure. Leech therapy can greatly help patients with glaucoma as this procedure should be done in regular and frequent intervals and with supportive medications.

Preventing Eye Inflammation-

Inflammation of structures in the eye can be very dangerous and may cause problems in normal vision. Leech therapy can be beneficial in eye inflammation.

Some of the inflammatory conditions of eye mentioned below-

-Chorioretinitis [an inflammation of the choroid and retina of the eye]

-Conjunctivitis [inflammation of the conjunctiva of one or both eyes]

-Keratitis [a condition in which the Cornea, the front part of the eye, becomes inflamed]

-Scleritis [an Inflammatory disease that affects the outer white coating of the eye, known as the sclera] are just some of eye inflammation disorders.

These are some inflammatory conditions in which leech therapy can be very useful.

During Leech Therapy, blood is sucked out and simultaneously some components in the saliva of Leech injected into the bloodstream. Heparin and Hyaluronidase are the most useful components in leech saliva having Anti-inflammatory property.

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