

MECHANISM OF ACTION OF LEECH BY DIFFERENT SALIVARY SECRETIONS

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ABSTRACT:

Blood letting with Leech application for *Rakta vikaras & Pittaj rogas* is one of the best therapy mentioned in *Ayurvedic* classics. *Aacharya Sushrut* stated that it is one of the important measure for treating surgical problem also. In day to day *ayurveda* practice, *Jaloukavacharan* is very widely used for various therapeutics. Hence it is part of curiosity that how leech does this great job? What is mechanism of action? *Jaloukavacharan* acts as a tool to eliminate the impure blood. Why leech inject the anaesthetic & anticoagulant into the host body? Leech secretes diverse (varied) salivary secretions for their own convenient & protection. But simultaneously these secretions are also useful for the therapeutics uses in human body.

KEYWORDS: Leech, Hirudin, Hyaluronidase, Anticoagulant, Anaesthetic agent.

INTRODUCTION:

- *Jaloukavacharan* is advised when the seat of manifestation of *doshas* is deep.
- *Acharya Sushrut* narrates *Jaloukavacharana* as the management for the disorders of skin, *mamsa, sira* and *asrik*.
- *Jaloukavacharana* helps in pacifying the vitiated *Rakta* and *Pitta* by its *shamak* property.

- It also reduces the *vivarnata* or discolouration and softens the surrounding muscles.

Mode of Action :

- *Jaloukavacharana* facilitates in relieving of focal vascular congestion caused by stagnant blood, hence reducing the bulge and tortuosity of veins.
- *Jaloukavacharana* acts as a tool to eliminate the impure blood (toxic filled). There by facilitating the increase in circulation of pure

- blood, ultimately encouraging the nourishment of the diseased part. Hence permitting the part to retain the normalcy. This helps in faster healing of ulcers and cure for dermatological disorders.
- Leech by sucking the impure blood creates a vacuum there by triggering the natural haemopoiesis to take place.
 - Bite of Leech is antiseptic.
 - Hirudo medicinalis is parasitic and the adults feed on the blood of mammals. It attaches to the host by means of two suckers and bites through the skin of its victim.
 - Why leech inject the anaesthetic agent and anticoagulant into the host body ? – During the sucking of blood simultaneously, the leech injects an anaesthetic so that its presence is not detected by the host and an anticoagulant in order for the incision to remain open during the meal.
 - And exactly these two processes that means sucking of blood and injecting of useful enzymes in the human body, are fruit full for the therapeutic use of leeches.
 - The leech attaches to the skin with its muscular sucker and bites the patient with three jaws.
 - Stomach peristalsis forces blood out of the patient and into the body of leech.
 - Within 30 minutes ,these leeches are each capable of ingesting up to 10 times their body weight (5ml to 15ml) of blood.
 - The leech detaches itself when its meal is complete ,which along with the anticoagulant factors in its saliva, allows the wound to ooze up to another 50 ml of blood. This continued bleeding from the site that has the most therapeutic benefit.
 - As above ,from the beginning of the bite, diverse (varied) salivary secretions play important role –
 - 1) Anesthetic secretions.
 - 2) Vasodilator secretions.
 - 3) Anti-coagulant secretions.
 - 4) Photolytic inhibitors.
 - 5) Antibiotic properties.
 - 6) Other useful enzymes.
- As previously mentioned, leeches secrete these diverse secretions for their own convenient and protection. But simultaneously these different secretions are also useful for the therapeutic uses in human body.
- 1) Anesthetic secretions-**

- The bite of all blood sucking leeches is painless. It is supposed that , this is due to an anesthetic secreted by the leech.
- This substance is not identified yet, but it is known that it is different from Hirudin.

2) Vasodilator and Anti-coagulant factor-

- The medicinal leech contains a substance with anticoagulant properties that the leech use to maintain the fluidity of its victims blood.
- This vasodilator was given the name Hirudin.

Hirudin:

- It is characterized as a specific tight binding thrombin inhibitor with a polypeptide structure containing 65 Amino acids and having a molecular weight of about 7000 Daltons.
- This anticoagulant is produced by the peripharyngeal glands of leech.
- Hirudin ,the principle anticoagulant ,binds to the active site of thrombin and prevents the conversion of fibrinogen to fibrin in the coagulation cascade. It is used today as an anticoagulant in the form of a FDA approved

recombinant protein known as r-hirudin.

- Hirudin is a 65 amino-acid cysteine rich polypeptide (produced by the salivary glands of the medicinal leech) which indicates it is 'amla' (acidic property). *Amla dravyas* (acids) increase the *Tanutvam* by causing *Vilayanatvam* and thereby the vitiated *Pitta* is eliminated out by *jaloukavacharana*.Hence it decreases the whole blood viscosity and density that might have been formed due to obstruction (deep vein thrombosis) and stagnation.
- Hirudin being a potent thrombolytic agent helps in thrombolysing the thrombus if any. It is fibrinolytic hence causes destruction of accumulated fibrin locally.(Fibrin cuff theory).It helps in *Stroto-avarodha nivarana*.
- A vasodilator in the form of an anti-histamine facilitates prolonged drawing of blood.

Hyaluronidase

- The Hyaluronidase serves as a spreading factor at the site and anaesthetize the part and increases the tissue permeability facilitating

the free movement of intracellular fluid. It helps in relieving the internal tension and pruritus.

- It is also anti-inflammatory .Hence the leeches draw the blood causing little pain to the patients.

Proteolytic inhibitors.

- Three classes of Proteolytic inhibitors are isolated. These are Hirudin,Bdellin and Eglin.
- Hirudin – (already discussed above)
- Bdellin – It is having a molecular weight of about 5000 Daltons.It is the smallest known naturally occurring inhibitor of Trypsin,Plasmin and Acrosin.
- Eglin- The low molecular weight of Eglin is a potent inhibitor of Elastase, Cathepsin-G, Chymotrypsin.

Antibiotic properties:

- Since 19th century , antibiotic properties of leech have been studied. The antibiotic property in *Hirudino medicinalis* is produced by a bacterium known as *Aeromonas hydrophilia*, which lives endosymbiotically in its gut.
- This bacterium cultured in vitro kills the bacteria of tuberculosis,dysentery, dyphtheria and staphylococcus aureus.

Different useful enzymes:

- Leech saliva also contains clot-dissolving enzymes and compounds that inhibit platelet aggregation.
- Specifically, the enzyme Destabilase and a Prostanoid fraction of leech saliva inhibit Adenosine diphosphate induced platelet aggregation.
- Another substance ,calin ,impedes platelet collagen interaction and von Willebrand factor collagen binding, further inhibiting platelet adhesion.
- **Histamine** like vasodilators prolong bleeding time and increase regional blood flow and Hyaluronidase helps increase the spread of all the salivary secretions.
- **Prostaglandin** found in leech saliva help reduce any swelling at the site (Anti-inflammatory).
- Ultimately vasodilatation and anticoagulation improve blood flow at the site.

Specific mechanism with reference to the some diseases.

- 1) **Piles** :- (Particularly thrombus and prolapsed piles)
- As per textual description, *raktamokshana* is indicated in *pitta*

rakta dushti rogas by different methods.

- Leech therapy is one among them, proved as productive *anushalya chikitsa* in prolapsed piles ,originated by vitiation of *Pitta* and *Rakta*.
- By the application of leech it sucks the stagnated blood from prolapsed pile mass ,there by reduces the congestion inside the engorged haemorrhoidal veins, reduces the mass / masses relieving the inflammation, mucous discharge and pruritus.

2). **Vericose-Veins :**

- In varicose veins *Jaloukavacharana* facilitates in relieving of local vascular congestion caused by stagnant blood, thereby reducing the bulge and tortuosity of veins ,thus helping in restoration of normalcy in the part.
- Along with *jaloukavacharana* internal administration of “*Lasunadi-vati*” is also very much effective to treat the varicosity, why because, majority of the ingredients have thrombolytic, fibrinolytic property & are indicated in

circulatory disorders. Some are directly indicated in veins.

- The basic ingredient is *lasuna*(Garlic).*lasuna* is *vataharam* & *rasayanam*. *lasuna* is thrombolytic, fibrinolytic, anticoagulant, anti-bacterial, anti-fungal and anti-viral. By virtue of which it discourages the primary pathology and also prevents from secondary infection especially in case of varicose dermatitis and venous ulcers.
- Like wise in many condition *jaloukavacharana* is very very effective. **udumbarkushta* **suryavarta* **filariasis*(Repeated sitting is necessary) **dushtavrana* **vatarakta* **ama-vata* **galganda* *chronic headache many skin disorder like *vicharchika*, boils(*Pidaka*)

CONCLUSION:

- The leech main therapeutic benefits are not derived only from the average 5ml of blood removed during biting, but from the anticoagulant & vasodilators contained in the leech saliva.

- The goal then is to produce an adequate venous out flow from the tissue by adjusting the number of leech application.
- Leeches are generally useful on areas where there is good arterial inflow but no venous outflow.
- It is very important that leeches only be use in condition of venous congestion with good arterial inflow. Thus, all salivary secretion (e.g Hirudin) helps in *stroto-avarodha nivarana*.
- Leech therapy become an increasingly popular method of

blood letting in condition like inflammation, congenital heart diseases, and is used to relieve pressure and restore circulation in tissue grafts where blood accumulation is likely such as severed fingers and ears.

“Leech is Logical lips which eliminate the impure blood and eject the enzymes, thus clearing

the clot by the help of Hirudin & Hyaluronidase action.”

This is the mechanism of action of leech.

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