A REVIEW ON MODE OF ACTION OF JALAUKAVACHARANA IN MODERN PERSPECTIVE

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ABSTRACT
Medicinal uses of jalukacharana (leech application) is practiced globally, since ancient days. Details are collected from Ayurvedic traditional medical books, physicians, internet and personal experience. Detailed descriptions on this therapy is available in Sustruta Samhita. It is used in management of various diseases in all most all systems of the body. According to Ayurveda these diseases are caused by vitiation of three dosha. Leech application (Jalaukacharana); a type of blood letting therapy (Rakthamokshana) which is a procedure of Panchakarma, helps to eliminate vitiated Dosha mainly Pitta Dosha and toxins that accumulate in the blood. Bioactive substances present leech saliva also exerts a therapeutic effect in several ailments. Though despised by most, medicinal leeches can be of immense benefit that may help people to surmount numerous health disorders. so, here and attempt is made to understand mode of action of bioactive substance produced by Jalauka with modern perspective.

KEYWORD: Medicinal uses of jalukacharana (leech application) is Jalauka with modern perspective.

INTRODUCTION
As said by Acharya Susruta” One who knows the habitat, holding, types, maintenance and application of leeches controls the diseases curable by them”.1[1] There are various types of Jalaukas (Leeches) have been mentioned in Ayurveda since immemorial and it is a useful Para surgical tool for Ayurvedic Physician and using in various clinical as well as in surgical condition. Various types of enzymatic factors are proven scientifically which are essentials to...
cures the various disorders are present in saliva of leeches. So, There is need of understanding the applicability and scientific reason for selection of diseases for leech therapy for which in detailed knowledge of Jalauka (leech) is needed which is explained further.

MATERIAL AND METHODS
Data was gathered from Ayurvedic traditional medicinal text books, physicians, internet and through personal experiences.

HISTORICAL REVIEW

Vedic period
Reference of Jalouka is available in Atharvaveda. In Koushika Sutra of Atharvaveda references of Rakta Mokshana by Jaloukavacharana are found. In Skanda Purana and Mahabharata we get the reference of the word Jalouka.[2]

Samhita period
Sushruta, Vagbhata, Harita, focused on the application of Jalouka in detail in their literature, Acharya Charaka has mentioned Jalouka is best among Anushastra and according to him Jaloukavacharana is one among Shastrakarmas.[3]

Sangraha period
Bhavamisra, Sharangadhara have discussed Jaloukavacharana Vidhi. The later works like Bhaishajya Ratnavali, Yogaratnakara, Chakradatta have also dealt with Jaloukavacharana.

Ayurveda view
Synonyms
Rate, Jalauka, Jalauka, Jalaragi, Jalayuki, Jalika, Jalsika, Jalajantuka, Veni, Jalaloka, Jalookasa, Jalawkasi, Rakta Payani, Rakta Sandamshika, Teekshna, Vamini, Jalahjivani, Raktapata, Vedine, Jala Sarpini, Jala Soochi, Jalatanou, Jalauka, Jalapatatmika, Jalika, Jalaluka.[4]

Classifications of Jalouka
Based on their nature, Jalouka are classified into Savisha and Nirvisha with six subtypes in each group (Table No 1).
Table No. 1. Classifications of Jalouka

<table>
<thead>
<tr>
<th>Savisha Jalauka (Poisonous)</th>
<th>Nirvisha Jalauka (Non-poisonous)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krishna</td>
<td>Kapila</td>
</tr>
<tr>
<td>Karbura</td>
<td>Pingala</td>
</tr>
<tr>
<td>Algarda</td>
<td>Shankhumukhi</td>
</tr>
<tr>
<td>Indrayudha</td>
<td>Mooshika</td>
</tr>
<tr>
<td>Samudrika</td>
<td>Pundareekhamukhi</td>
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<tr>
<td>Gochandana</td>
<td>Savarika</td>
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</tbody>
</table>

Table No. 2: General features of Jalauka

<table>
<thead>
<tr>
<th>Savisha Jalauka (Poisonous)</th>
<th>Nirvisha Jalauka (Non-poisonous)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Habitat:</strong> Originates in the decomposed urine and fecal matter of toads and poisonous fishes, in ponds of stagnant and turbid water.</td>
<td><strong>Habitat:</strong> Originates in decomposed vegetable matter, in the putrefied stems of the several aquatic plants known as Padma, Utpala, Nalina, Kumuda, Pundareeka and common zoophytes, which live in clear water.</td>
</tr>
<tr>
<td><strong>General Characters</strong></td>
<td><strong>General Characters</strong></td>
</tr>
<tr>
<td>Thick in middle portion</td>
<td>Strong and well built</td>
</tr>
<tr>
<td>Lean in both ends.</td>
<td>Strong suckers</td>
</tr>
<tr>
<td>Slow locomotion</td>
<td>Speed in sucking (Mahashana)</td>
</tr>
<tr>
<td>Ugly in look</td>
<td>Vrutta (round)</td>
</tr>
<tr>
<td>Less active</td>
<td>Blue coloured lining in dorsal side of the body, back side Kashaya in color.</td>
</tr>
<tr>
<td>Unable to catch the host</td>
<td></td>
</tr>
<tr>
<td>Delayed &amp; small quantity sucking</td>
<td></td>
</tr>
</tbody>
</table>

Table No. 3: Specific features of Jalouka

<table>
<thead>
<tr>
<th>Savisha Jalauka (Poisonous)</th>
<th>Nirvisha Jalauka (Non-poisonous)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) <em>Krishna:</em> Anjanachoornavarna i.e. Resembles black colour like Kajjala Big head (mahamastaka)</td>
<td>1) <em>Kapila:</em> Colour like Manahshila (real gar) at the sides, Dorsal surface is slimy (Snigdha) and coloured like Mudga pulse, (Greenish shade)</td>
</tr>
<tr>
<td>2) <em>Karbura</em> Ayata like vermy fish (Sarpakara) Over Udara slight elevation or depression are seen.</td>
<td>2) <em>Pingala</em> Colour – Reddish or reddish brown Shape – Round Locomotion – fast moving</td>
</tr>
<tr>
<td>3) <em>Alagarda</em> Hairy with wrinkles Big in size (Mahaparshva)</td>
<td>3) <em>Shankhumukhi</em> Colour – Blackish red like that of liver. Sucks the blood fast, Has sharp and long suckers</td>
</tr>
<tr>
<td>4) <em>Indrayudha</em> Body has different colours like rainbow. Number of linings on the body.</td>
<td>4) <em>Mooshika</em> Colour &amp; Shape – like that of Rat Foul smell comes from the body</td>
</tr>
<tr>
<td>5) <em>Samudrika</em> Blackish yellow with dotted skin and resembles many flowers Dhavalabindhuchitra (flower like white spots)</td>
<td>5) <em>Pundareekamukhi</em> Colour – like Mudga (greenish black). Its mouth resembles the full blown lotus.</td>
</tr>
</tbody>
</table>
Acharya Vagbhatta has classified Leeches as per the sex characters. as Sthree Jalouka and Purusha Jalouka

**Sthree Jalouka Features**
Delicate, having thin skin, small sized head, large lower body. Can be used in Alpa Dosha and acute disorders.

**Purusha Jalouka Features**
Hard skin, big head along with being semi lunar or Ardhachandrakara in shape with large front portion, can be used In highly vitiated Dosha and chronic diseases.

Acharya Hareeta has classified Jalouka into four types. Those are
1. Indrayudha
2. Rohini
3. Kaalika
4. Dhoomra

Among all these types except Kaalika others can be used for the purpose of Raktamokshana in different conditions.

**Geographical Distribution of Jalouka in olden days**
At the time of Sushrutas period, the Nirvisha Jalouka were available in Yavana (Turkasthana, currently it is taken as turky) Pandya (south region of the country – Deccan), Sahya (hill station near bank of Narmada river), Poutana (Mathura)\(^5\), etc.

**Length of Jalouka**
The maximum length of Jalouka has been reported 18 Anguli, big Jalouka may be used only for blood letting in animals like horse, elephant, etc. For human being 4, 5 and 6 Anguli Pramana Jalouka is preferred.\(^6\)

**Jalouka collection and preservation**
Acharya Sushruta has told that the leeches can be caught by holding a piece of wet leather, in tanks, streams and where there are lotuses. There is another method to collect the leeches i.e. the fresh meat of dead animals, fish or apply the ghee, butter or milk over thigh of an animal.
or the human being himself, and stand in the water for some time at thigh level of water by this Jalouka gets attracted and will catch the place. Then remove them from the skin of the person with the application of Saindhava Lavana and collect.

**Time of Collection**
The best time for collecting leeches is Sharad Rutu (autumn).

**Preservation and feeding of Jalouka**
After collecting the leeches, they should be kept in a wide and new earthen pot. The pure water with lotus should be filled into the pot. Feed it with leaf of lotus plants, Shaivala, and powder of stem of small plants and dry meet (Valloora). The grass and leaves of plants must be kept in the water of pot for the bed. Shringataka, Kasheruka, Shalooka, Shaivala, Mrunal (Kamala Nala), Mrutsana (mud), Pushkarabeeja Churna, sweet-cold-clean water etc. should be provided for diet to Jalouka. On every third day the water should be changed and feeding should be dropped in the pot. After seven days the pot should be changed. Vagbhata mentioned that the pot should be changed every five days.[7]

**Gunas of Jalouka**
**Guna** - Sheeta, Snigdha, Shlakshna guna, Madhura (some what Snigdha)

**Action on Doshas** – Pittahara.[8]

**Indicated persons for Jaloukavacharana**
Acharya Sushruta has advised to carryout Raktamokshana by Jalouka especially to king, rich people, children, old aged, ladies and delicate people.[9]

**Indication of Jalaukavacharana**
In non healing ulcers caused by venom or poisons, leeches are a preferred mode of blood letting to induce healing.[10]

In the treatment of abscesses, certain glandular inflammatory swellings, inflammed scrotal swellings, Acharya Sushruta has indicated Jaloukavacharana (leech therapy) as a prerequisite for incision and drainage in order to localize the abscess.[11,12,13,14,15]

In the general line of treatment of venereal disorders, the use of leeches have been emphasized and in a range of disorders of the penis, leeches acquire a prime role for treatment.[16,17]
In inflammatory conditions pertaining to oral cavity, the use of leeches have been described.[18,19]

Acharya Dalhana, commenting on Saptopakrama (7 forms of treatment for swelling) states that Avasechana includes Vamana (therapeutic emesis), Virechana (therapeutic purgation) and Raktha Mokshana (Blood letting) wherein Jaloukavacharana is one among the many forms of blood letting.

**Contraindications for Jaloukavacharana**

In cold seasons, on empty stomach, during fainting & in drowsy state, frightened, intoxicated, exhausted, who have the urge of defecation and micturation. Raktamokshana should not be attempted when there is cold and too hot season, never attempt before Swedana therapy nor after too much of Swedana.[20]

**Area of Doshanirharana by Jaloukavacharana**

Jalouka removes the Dosha’s from one Hastha area.[21]

**Jaloukavacharana Vidhi**

It is studied under three headings.

1. Poorva Karma.
2. Pradhana Karma.
3. Paschat Karma.

**Poorva Karma** (preoperative procedure): This includes followings;

1. Preparation of patient.
2. Preparation of Jalouka.
3. Collection of other required material.

**Preparation of patient**

Indicated person for the Jaloukavacharana should be made to sit or sleep in supine position then rub with mud or cow dung over the affected area especially non ulcerated area where Jaloukavacharana is proposed. If Jaloukavacharana is planned at the site of wound one should not rub because it increases the pain, Where Jalouka gets attracted by Gandha and Kledata of the Vrana.[22]
Preparation of Jalouka
Jalouka body is smeared with a paste of Harridan and Starship. Then Jalouka is kept in clean water for period of one Maharshi (48 min). By this procedure leeches become activated and will get rid of exhaustion.[23]

Collection of required material
Jalouka, Patra, water, haridra, lavana, Shastra, pichu, plota, patta, madhu, ghrita, paya, kashaya, alepanakalka and Shire and Anurakta Parikarmi are required to be collected.[24]

Pradhana Karma
The patient is made to sit or lie on the bed. The area of the body where Raktamokshana is planned that is to be dried and allowed to bite by Jalouka. Jalouka will bite on the skin and suck the blood by itself. If Jalouka does not suck or bite the skin a drop of milk or blood is shed on the surface or a small prick is made, in spite of all these if the Jalouka does not suck then another Jalouka is to be taken for Raktamokshana. Its face appears like the hoof of a horse and it raises its neck by this we can understand that it has started sucking blood. As soon as Jalouka starts sucking, wet white gauze should be covered on it, leaving its facial region.

After taking sufficient amount of blood Jalouka leave the host by its own. If the Jalouka doesn’t leave and patient getting itching and pain at the site of Jaloukavacharana we can assess that it is sucking pure blood and if it doesn’t stop sucking, then it should be detached by sprinkling Saindhava Lavana Choorna at its mouth region.[25]

Identification of Jaloukagrahan
When Jalouka starts sucking the blood it attains shape of Ashvakhuravadanana[26] i.e. its mouth end becomes the hoof of horse by raising its neck region

Identification of Shuddharakta Pana by Jalouka
At the site of Jalouka bite if the person gets pain and itching sensation then it should be understood that it is sucking pure blood then it should be removed.

Simily for Dushtarakta Pana by Jalouka
Jalouka first sucks only Dushta Rakta from the site where Dushta and Shuddha Rakta are in combined form, like that of Hansa Pakshi who drinks only pure milk when it is in mixed form withwater.[27]
**Paschat karma** (postoperative procedure):

- Paschat Karma for Jalouka
- Paschat Karma for patient

**Paschat karma for Jalouka**

As soon as the Jalouka detaches from the host or patient body by its self or by force, a paste of Tandula Kandana is to be applied over its body and a mixture of Taila and Saindhava Lavana is smeared on its mouth. Then with the help of thumb and index finger of left hand tail end of the Jalouka should be caught then body of Jalouka is squeezed with the fingers of right hand towards its face in a reverse direction. This maneuver induces Jalouka to vomit the sucked blood. This is continued until the signs of proper Vamana are achieved.

**Modern view**

**Medicinal Leeches**[28]

Hirudo medicinalis, Hirudo verbena, Hirudo orientalis, Hirudo troctina and Hirudo verbana. Hirudinaria manillensis, Macrobdella decora Haementaria officionalis, Hirudo michaelseni, Haementeria ghillianii, are some of the leeches used in medicine.

Hirudo medicinalis is the leech used most commonly in Europe whereas Hirudinaria manillensis is the commonest leech use in Asian region. Haementeria ghillianii is the Amazonian medicinal leech and Macrobdella decora is the North American medicinal Leech. Haementaria officionalis is the medicinal leech found in Mexico. Specimen of Hirudo verbana was first observed in Stracos Valley, within the Tasad Reserve (Bihor county, north-western Romania).

**Anatomy**[29]

- **External Features: Shape & Size**
  - Leeches are small, soft, invertebrate vermiform
  - Elongated, dorso-ventrally flattened
Almost cylindrical when contracted and ribbon shaped when extended.

7 to 15 cm is length having 6 longitudinal reddish or brown strips.

Broadest near the posterior end & narrowest near the anterior end.

Dorsal surface is convex, brightly olive green in colour.

Ventral surface is more or less plane & orange yellow or black & yellow in colour.

Black stripe marks on median longitudinal at dorsal side of the body.

H. medicinalis, while applied, can grow to approximately 10 cm in length, with its resting length being approximately one third of its maximal length.

**Suckers**

Hollow muscular organs on each end of the body of leech.

1. **Anterior sucker (Oral sucker) (Cephalic sucker)**
   - Comprised of cup like hollow, pre oral chamber and the mouth.
   - It contains 3 jaws with sharply serrated edges.

2. **Post sucker (Anal sucker)**
   - It’s highly muscular disc like structure, formed by fusion of 7 body segments.
The leech crawls using a large posterior sucker.

Leeches in Medicine

Leeches have been used in medical applications for thousands of years. References of medicinal leeching can be found in the paintings of Pharaohs in the 18th dynasty (1500 BC). Talmud, Bible and other Jewish manuscripts have outlined the medical indications of leeching.\[30\]

The use of leeches during that time depended upon the humor concept of Galen (130-201 AD), which was inspired from Hippocrates (460-370 BC) hypothesis about illness caused due to imbalances in body fluids.\[31\]

Galen prescribed bloodletting by leech for almost all illnesses such as simple inflammatory conditions, mental disorders and hemorrhoids.\[32\] Avicenna recommended leeching for skin diseases Abd-el-latif al-Baghdadi (12th century) has mentioned the beneficial use of leech application after surgical operations in his texts.\[33\]

Haycraft's researches brought leeches back into the medical stream when he outlined for the first time the presence of an anticoagulant agent in leech saliva, which he called hirudin\[34\] which was later isolated and identified by Markwardt who also demonstrated its antithrombin activity.

The use of leeches for medicinal purposes has been approved by the Food and Drug Organization (FDA) in 2004 (2) The most commonly used leech is the European medicinal leech species, Hirudo medicinalis.\[35\]

Use of leeches in surgery

In plastic surgeries, venous occlusion is a serious threat that may lead to thrombus formation, stasis and eventually tissue necrosis. Thus, relieving venous congestion is a vital step in order to mitigate this risk and to salvage the transplanted tissues.\[36\] The relieving effect is the accumulated result of the leech bite-induced blood oozing, which is a consequence of many factors, including bleeding wound, secreted bioactive enzyme, anticoagulants and vasodilators.

Leeching has been reported as a successful remedy to improve blood flow after microsurgery of a severely avulsed scalp.\[37\] By the year 1984, some physicians used leech therapy to treat
seven patients with engorged skin flaps. They reported that leeching prevented flap collapse with noticeable improvement in color and minor complications. Leech application was prescribed as a postoperative care in patients who underwent a surgical operation for replantation of the fingertip.

The painkiller effects of leech application were ascertained in many trials on patients with osteoarthritis who claimed that leeching was more relieving than topical diclofenac with no adverse effects.

Components and effects of leech saliva

<table>
<thead>
<tr>
<th>Components of leech saliva</th>
<th>Effect on host</th>
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</thead>
<tbody>
<tr>
<td>Hirudin</td>
<td>Inhibits blood coagulation by binding to thrombin</td>
</tr>
<tr>
<td>Calin</td>
<td>Inhibits blood coagulation and collagen-mediated platelet aggregation by blocking the binding of von Willebrand factor to collagen</td>
</tr>
<tr>
<td>Hirustasin</td>
<td>Inhibits kallikrein, - responsible for normal level of blood pressure, in intrinsic coagulation</td>
</tr>
<tr>
<td>Hyaluronidase</td>
<td>Increases interstitial viscosity, antibiotic effects</td>
</tr>
<tr>
<td>Eglins</td>
<td>Anti-inflammatory, inhibits the activity of chymotrypsin, subtilisin, cathepsin G, chymase, elastase</td>
</tr>
<tr>
<td>Destabilize</td>
<td>Dissolves fibrin</td>
</tr>
<tr>
<td>Bdellins</td>
<td>Anti-inflammatory, inhibits plasmin, acrosin, trypsin</td>
</tr>
<tr>
<td>Factor Xa inhibitor</td>
<td>Inhibits the activity of coagulation factor Xa –conversion of prothrombin to thrombin</td>
</tr>
<tr>
<td>Histamine-like substances</td>
<td>Vasodilator, increases the inflow of blood at the bite site</td>
</tr>
<tr>
<td>Tryptase inhibitor</td>
<td>Inhibits proteolytic enzymes of host mast cells</td>
</tr>
<tr>
<td>Carboxypeptidase A inhibitor</td>
<td>Increases the inflow of blood at the bite site</td>
</tr>
<tr>
<td>Acetylcholine</td>
<td>Vasodilator</td>
</tr>
<tr>
<td>Collagenase</td>
<td>Facilitates tissue penetration</td>
</tr>
<tr>
<td>Apyrase</td>
<td>Inhibitor of platelet aggregation by inhibition of adenosine triphosphate</td>
</tr>
</tbody>
</table>

Mechanisms of bloodletting

Hirudotherapy depends on the following main properties of medicinal leeches

The blood-letting action during active suction of blood Passive oozing of the wound, and injection of biologically active substances with the saliva into the host. The saliva of leech contains more than 100 bioactive substances, including coagulation inhibitors, platelet aggregation inhibitors, vasodilators, anaesthetic, antimicrobial and anti-inflammatory agents.
Contraindications of leech therapy\(^{[42]}\)

Arterial insufficiency, Haemophilia, Hemorrhagic diathesis, Haematological malignancies, Expressed and firm anaemia, Expressed and firm hypotension, Sepsis, HIV-infection, HBsAg infection, Decompensated forms of hepatobiliary diseases, Any form of cachexia, Individual intolerance to leeches, Leech therapy is also not recommended in pregnancy and lactation, History of allergy to leeches or severe allergic diathesis, Disposition to keloid scar formation, patients on Anticoagulant therapy, Immunosuppressants patients

DISCUSSION

Application of leeches (jalukacharana) removes not only blood from the body but also injects biologically active substances which help to manage various ailments. According to Ayurvedic view diseases are occurred by vitiation of dosha. Vitiated dosha can get accumulated in srotas (physiological channels), cause blockages and may lead to diseases. Jalukacharana is one of the oldest methods used in purification of the body by removing deeply seated toxins and pacifying vitiated dosha.

A healthy cell gets sick when it is deprived of needed oxygen and nutrition and is unable to remove toxins accumulated during metabolism. Biologically active substances in leech saliva help the cells to absorb necessary nutrition and eliminate toxins. Therefore, many diseases could be treated with leech application.

Probable mode of action\(^{[43]}\)

The anti-inflammatory and analgesic properties of leeches in many aspects are associated with the blockage of amidolytic and kininogenase activities of plasma kallikrein, resulting in prevention of pain or pain relief during leech sessions.

Leeches may also secrete a vasodilative, histamine-like substance, which increases the inflow of blood after a leech bite and reduces local swelling.

Hyaluronidase, which is known as the “spreading factor,” can degrade tissue hyaluronic acid, thus facilitating the infiltration and diffusion of the remaining ingredients of leech saliva into the congested tissue.

Tissue permeability, restored with the help of hyaluronidase, promotes the elimination of tissue- and circulatory-hypoxia as well as local swelling.
The persistent bleeding largely potentiates tissue decongestion and also relieve capillary network which decrease venous congestion. positive changes of local hemodynamic and improvement of hemorheology will increase oxygen supply, improve the tissue metabolism, and eliminates the tissue ischemia.

CONCLUSION

Leech therapy is a simple method of blood letting. It is also a convenient para surgical procedure that can be employed in varying instances. With modern tools of investigations better understanding of mode of action of Jalauka has become possible. Jalauka are a great boon to cosmetology and plastic surgery for their use which ensures better acceptability of grafts, flaps and reduces edema around the wounds. Leech therapy is a good alternative in inflammatory conditions as there are no systemic side effects as in the use of conventional medication. There is potential for further investigative study in the role of leeches in the different conditions.

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