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## Review on Leech Therapy

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### I. Abstract:

Leech therapy has been practiced for long time and it is still practiced in both human and Veterinary Medicine. Hirudotherapy is used in Veterinary Medicine, especially when traditional treatment is not effective, after surgery and when the tissue is threatened by venous congestion. The main objective of this seminar paper is to overview importance and prevalence of Leeches in Veterinary Medicine. The most common species of medicinal Leech are includes: *Hirudo medicinalis*, *Hirudo asiatica*, *Hirudomanellensis*, *Hirudo Orientals*, *Hirudo michaelsoni*, *Hirudo nipponia*, *Hirudo granulose* and *Macrobdelladecora*. Saliva of Leech contains various bioactive compounds such as: hirudin, hyaluronidase, calin, destabilase, apyrase, eglins, bdellins, decorsin, hirustatin, trypsin inhibitors, and histamine like substances, complement inhibitors, carboxypeptidase A- inhibitors and acetylcholine. Biochemical compound which secreted from saliva of Leech have various effects such as anticoagulant, vasodilator, thrombolytic, anti-inflammatory effect, analgesic properties, platelet inhibitory, increase blood flow, and thrombin regulatory functions, as well as matrix degradation and antimicrobial. Application of Leech therapy in Veterinary Medicine is primarily used to treat venous congestion during reconstructive surgery and to treat polycythemia. Leech therapy is not recommended for animals those are suffered from acute infection, anemia, and hemophilia, and immunosuppressant disease, cancer of skin, hypotension, pregnant animals and septic disorder. Prevalence of Leech infestation is higher in cattle followed by goats and sheep during dry season. Hirudianiasis is one of water associated disease which causes undetermined magnitude of socio economic losses in developing country. To sum up, Leeches are external parasite of animals which have therapeutic importance in both human and animal health, but also it has negative impacts on health of animals as well as human beings. Hirudotherapy have not been practiced in Ethiopia, therefore further studies should have to be applied on bioactive substance of Leech and its importance.

[12] As Shown in fig 1 and 2



Fig 1: Hirudo medicinalis sucking blood



Fig 2 : Medicinal Leech

**Conservation status**  
Near Threatened (NT)

**Scientific classification**

Kingdom:	Animalia
Phylum:	Annelida
Class:	Clitellata
Order:	Hirudinea
Family:	Hirudinidae
Genus:	Hirudo
Species:	<i>H. medicinalis</i>

**Binomial name**

*Hirudo medicinalis*  
Linnaeus, 1758

Fig 3 : Conservation Status

Leeches are segmented parasitic or predatory worms that belong to the phylum Annelida and comprise the subclass Hirudinea. They are closely related to the oligochaetes, which include the earthworms, and like them have soft, muscular, segmented bodies that can lengthen and contract. Both groups are hermaphrodites and have a clitellum, but leeches typically differ from the oligochaetes in having suckers at both ends and in having external annulations that do not correspond with their internal segmentation. The body is relatively solid, and the spacious body cavity found in other annelids, the coelom, is reduced to small channels.

The majority of leeches live in freshwater environments, while some species can be found in terrestrial and marine environments. The best-known, such as the medicinal leech, Hirudo medicinalis, are hematophagous, attaching themselves to a host with a sucker and feeding on blood, having first secreted the peptide hirudin to prevent the blood from clotting. A minority of leech species are predatory, mostly preying on small invertebrates.

In aquatic species, the eggs are enclosed in a cocoon which is usually attached to something solid, but terrestrial species often conceal the cocoon under a log or in a crevice. Almost 700 species of leech are currently recognised, of which some 100 are marine, 90 terrestrial and the remainder freshwater.

Leeches were used in medicine from ancient times until the 19th century to draw blood from patients. In modern times, leeches find medical use in treatment of joint diseases such as epicondylitis and osteoarthritis, extremity vein diseases, and microsurgery, while hirudin is a valuable drug for some blood-clotting disorders.

## I. INTRODUCTION

Leeches have been used in medicine long time before BC. In recent years medical leech therapy has gained increasing interest in reconstructive surgery and pain management and other medical fields. The possible indications and success rates of this treatment are discussed. There is a special interest in salvage of flaps and grafts by the use of medical leeches. Retrospective analysis indicates a success rate of >80%. Randomized controlled trials have been performed in osteoarthritis. Case reports and smaller series are available for the treatment of chronic wounds, post-phlebotic syndrome and inflammatory skin diseases. The most common adverse effects are prolonged bleeding and infection by saprophytic intestinal bacteria of leeches. Medical leech therapy is a useful adjunct to other measures wound management. *Hirudo medicinalis*, the **European medicinal leech**, is one of several species of leeches used as "**medicinal leeches**". Other species of *Hirudo* sometimes also used as medicinal leeches include *H. orientalis*, *H. troctina*, and *H. verbana*. The Asian medical leech is *Hirudo manillensis*, and the North American medical leech is *Macrobdella decora*. Many studies have found that leeches have various bioactive molecules in their secretions. More than 20 molecules and their modes of action have been identified, but there are many more awaiting exploration. These molecules have analgesic, anti-inflammatory, platelet inhibitory, anticoagulant, and thrombin regulatory functions, as well as extracellular matrix degradative and antimicrobial effects. It is believed that with further studies, more indications may emerge due to recently elucidated effect mechanisms. In this article, we aim to gather information about MLT, provide an overall vision, and to take a broad look at modes of action.

## 2. History:

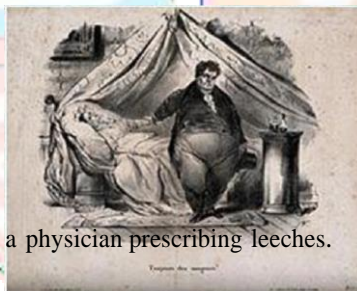


Fig 1: A caricature of a physician prescribing leeches.



Fig 2: Earthenware jar for holding medicinal leeches The first

description of leech therapy, classified as **blood letting**, is found in the *Sushruta Samhita*, an ancient Sanskrit medical text. It describes 12 types of leeches (6 poisonous and 6 non-poisonous). Diseases where leech therapy was indicated include skin diseases, **sciatica**, and musculoskeletal pains. As Shown in fig 1 and 2. In medieval and early modern medicine, the medicinal leech (*Hirudo medicinalis* and its congeners *H. verbana*, *H. troctina*, and *H. orientalis*) was used to remove blood from a patient as part of a process to balance the **humors** that, according to **Galen**, must be kept in balance for the human body to function properly. (The four humors of ancient medical philosophy were blood, **phlegm**, **black bile**, and **yellow bile**.) Any sickness that caused the subject's skin to become red (e.g. **fever** and inflammation), so the theory went, must have arisen from too much blood in the body. Similarly, any person whose behavior was strident and sanguine was thought to be suffering from an excess of blood. Leeches were often gathered by leech collectors and were eventually farmed in large numbers. A unique 19th century 'Leech House' survives in **Bedale, North Yorkshire** on the bank of the Bedale Beck, used to store medicinal leeches until the early 20th century. <sup>[1]</sup> A recorded use of leeches in medicine was also found during 200

B.C. by the Greek physician **Nicander** in **Colophon**. Medical use of leeches was discussed by **Avicenna** in *The Canon of Medicine* (1020s), and by **Abd-el-latif al-Baghdadi** in the 12th century. The use of leeches began to

become less widespread towards the end of the 19th century. [Manchester Royal Infirmary](#) used 50,000 leeches a year in 1831. The price of leeches varied between one penny and threepence halfpenny each. In 1832 leeches accounted for 4.4% of the total hospital expenditure. The hospital maintained an aquarium for leeches until the 1930s.



Fig 3 : Treating mastitis of a cow with leech

Therapy with leeches is one of the oldest minor invasive procedures in medicine that was already mentioned 1,500 BC in Egypt. Sanskrit writings described leech therapy from 1,300 BC on. Hippocrates introduced leech therapy in Greece but the method was also known to ancient Mesopotamians, Egyptians and Aztecs, and Mayans. Medical leech therapy is part of the concept of the Greko- Arab Unani System of Medicine .

The procedure has seen a first renaissance in the 18<sup>th</sup> and early 19<sup>th</sup> century when it became extremely popular again. This has led to an eradication of naturally occurring leeches in Ireland where leech export was an important trade .Medical leech therapy reemerged in the 70ies of the last century as an adjuvant to surgery. In 2004 the FDA approved medical leeches as medical devices in plastic and reconstructive surgery.<sup>[4]</sup>

### 3. Today:

Medicinal leech therapy (also referred to as *Hirudotherapy* or *Hirudin therapy*) made an international comeback in the 1970s in microsurgery, used to stimulate circulation to salvage skin grafts and other tissue threatened by postoperative venous congestion articularly in fingerreattachment and reconstructive surgery of the ear, nose, lip, and eyelid. Other clinical applications of medicinal leech therapy include varicose veins, muscle cramps, thrombophlebitis, and osteoarthritis, among many varied conditions. The therapeutic effect is not from the small amount of blood taken in the meal, but from the continued and steady bleeding from the wound left after the leech has detached, as well as the anesthetizing, antiinflammatory, and vasodilating properties of the secreted leech saliva. The most common complication from leech treatment is prolonged bleeding, which can easily be treated, but more serious allergic reactions and bacterial infections may also occur. Leech therapy was classified by the US Food and Drug Administration as a medical device in 2004. <sup>[11]</sup> Because of the minuscule amounts of hirudin present in leeches, it is impractical to harvest the substance for widespread medical use. Hirudin (and related substances) are synthesised using recombinant techniques. Devices called "mechanical leeches" that dispense heparin and perform the same function as medicinal leeches have been developed, but they are not yet commercially available.

### 5. Morphology :

The general morphology of medicinal leeches follows that of most other leeches. Fully mature adults can be up to 20 cm in length, and are green, brown, or greenish-brown with a darker tone on the dorsal side and a lighter ventral side. The dorsal side also has a thin red stripe. These organisms have two suckers, one at each end, called the anterior and posterior suckers. The posterior is used mainly for leverage, whereas the anterior sucker, consisting of the jaw and teeth, is where the feeding takes place. Medicinal leeches have three jaws (tripartite) that look like little saws, and on them are about 100 sharp teeth used to incise the host. The incision leaves a mark that is an inverted Y inside of a circle. After piercing the skin, they suck out blood whilst injecting anticoagulants (hirudin) and anaesthetics. Large adults can consume up to ten times their body weight in a single meal, with 5–15 ml being the average volume taken. These leeches can live for up to a year between feeding.

Medicinal leeches are hermaphrodites that reproduce by sexual mating, laying eggs in clutches of up to 50 near (but not under) water, and in shaded, humid places.



Fig 1 : Hirudo Medicinalis

## 5. Range and Ecology :

Typical habitat with a large population of *Hirudo medicinalis*, in Germany. Their range extends over almost the whole of Europe and into Asia as far as Kazakhstan and Uzbekistan. The preferred habitat for this species is muddy freshwater pools and ditches with plentiful weed growth in temperate climates. Over-exploitation by leech collectors in the 19th century has left only scattered populations, and reduction in natural habitat through drainage has also contributed to their decline. Another factor has been the replacement of horses in farming (horses were medicinal leeches' preferred food source) and provision of artificial water supplies for cattle. As a result, this species is now considered near threatened by the IUCN, and European medicinal leeches are legally protected through nearly all of their natural range.

They are particularly sparsely distributed in France and Belgium, and in the UK there may be as few as 20 remaining isolated populations (all widely scattered). The largest (at Lydd) is estimated to contain several thousand individuals; 12 of these areas have been designated Sites of Special Scientific Interest. There are small, transplanted populations in several countries outside their natural range, including the USA.

## 1. Beneficial Secretions :

Medicinal leeches have been found to secrete saliva containing about 60 different proteins. These achieve a wide variety of goals useful to the leech as it feeds, helping to keep the blood in liquid form and increasing blood flow in the affected area. Several of these secreted proteins serve as anticoagulants (such as hirudin), platelet aggregation inhibitors (most notably apyrase, collagenase, and calin), vasodilators, and proteinase inhibitors. It is also thought that the saliva contains an anesthetic as leech bites are generally not painful.

## 2. Therapeutic Importance Of Leech :

Leeches are widely used in medicine for drawing of blood from swollen area and also to reduce fluid pressures in damaged tissues of animals. Recently, Leeches have been used as therapy in Veterinary Medicine to treat disease of domestic animals. The most common indications of Leech therapy are including diseases which concerned with inflammation, hip and elbow dysplasia, disease of tendons, ligament and fascia, disease of vertebrae and treatment of scar, and also other indications of Leech therapy.

Technique and procedure of Leech application Before application of Leech, the skin of animals should be prepared by shaving densely hair from application site and stimulate bloodflow and soften skin by hot sponge or hot water (nonchlorinated) which entice Leech to feed more quickly. Wetting skin with water may enhance attachment of Leech to body of animals and facilitate feeding. During shaving of skin, antiseptics should not be used because Leeches are sensitive to strong odors and may not bite the skin. After application site is prepared, medicinal Leech is attached to wound area. Number of Leech needed for wound (one phase of treatment) depending on species of patient, its size and its clinical response to treatment. One Leech is applied per 10 kg of body mass of animals; while 5 to 15 Leeches are used per animals in case of horse. A gauze barrier around the intended site will prevent the Leech from wandering away from the site where its attachment is desired. It can be carried to the site by hand, or it can be placed within a 5 cc plastic syringe (plunger removed) and then applied to the wound site, containing the Leech until it is attached. Application of Leech therapy starts with initial bite which is usually painless and attachment period lasting 20 to 45 minutes, within this minutes Leech can suck about 5-15ml of blood. Anatomically Leech has three rows of jaws with about 300 teeth within cranial sucker, while Therapeutic importance of leech and impact of leech in domestic animals Leech is attached to host with its

cranial suckerthe wound produced by Leech is characteristic Y shaped skin incision. After attachment, Leech releases powerful bioactive compound which facilitate flow of blood and inhibit blood coagulation and also histamine like substance is released to wound area from saliva of Leech to prevent collapse of adjacent capillaries.



Fig 1 : Biotherapy with leeches

Patients with arthritis of the knee joint are in constant pain and sometimes even have to take morphine. The regular use of leeches could free 60% of these individuals from pain for at least a few months. To treat such a patient with leeches the doctor places three to 12 of these little vampires on the painful sites and waits until, after about a half an hour, the animals are satiated and fall off. As shown in fig. 1 Are leeches just disgusting or are they useful ?

### 3. Interaction with Humans :



Fig 2 : Leeches can be removed by hands, since they do not burrow into the skin or leave the head.

### 4. Bites :

Leech bites are generally alarming rather than dangerous, though a small percentage of people have severe allergic or [anaphylactic reactions](#) and require urgent medical care. Symptoms of these reactions include red blotches or an itchy rash over the body, swelling around the lips or eyes, a feeling of faintness or dizziness, and difficulty in breathing. An externally attached leech will detach and fall off on its own accord when it is satiated on blood, which may take from twenty minutes to a few hours; bleeding from the wound may continue for some time. Internal attachments, such as inside the nose, are more likely to require medical intervention. Leeches can be removed using a fingernail or other flat, blunt object to break the seal of the oral sucker (at the front end), repeating at the other end, then flicking the leech away. Common, but medically inadvisable, removal techniques are to apply a lit cigarette, salt, soap, or vinegar to the leech. These cause the leech to detach quickly, but also to regurgitate its stomach contents into the wound, with a risk of infection. Leeches normally carry parasites in their [digestive tracts](#), which cannot survive in humans and do not pose a threat; however, bacteria, viruses, and parasites from previous blood sources can survive within a leech for months. Nevertheless, only a few cases of leeches transmitting pathogens to humans have been reported. Leech saliva is commonly believed to contain [anesthetic](#) compounds to numb the bite area, but this has never been proven. Although [morphine](#)-like substances have been found in leeches, they have been found in the [neural tissues](#), not the salivary tissues. They are used by the leeches in modulating their own [immunocytes](#) and not for anesthetizing bite areas on their hosts. Depending on the species and size, leech bites can be barely noticeable or they can be fairly painful.

### 5. In Human Culture :

The leech appears in [Proverbs](#) 30:15 as an archetype of insatiable [greed](#). More widely, a leech is a persistent [social parasite](#) or [sycophant](#).

The medicinal leech *Hirudo medicinalis*, and some other [species](#), have been used for clinical [bloodletting](#) for at least 2,500 years: [Ayurvedic](#) texts describe their use for bloodletting in ancient India. In [ancient Greece](#), bloodletting was practised according to the theory of [humours](#) found in the [Hippocratic Corpus](#) of the fifth century BC, which maintained that health depended on a balance of the four humours: blood, phlegm, black bile and yellow bile. Bloodletting using leeches enabled physicians to restore balance if blood was present in excess.<sup>1</sup> [Pliny the Elder](#) reported in his [Natural History](#) that the horse leech could drive elephants mad by climbing up inside their trunks to drink blood. Pliny also noted the medicinal use of leeches in [ancient Rome](#), stating that they were often used for [gout](#), and that patients became addicted to the treatment. [As shown in fig. 1 and 2.] In [Old English](#), *læce* was the name for a physician as well as for the animal, and *læcecraft*, leechcraft, was the art of healing.<sup>105</sup>



Fig 1 : Pharmacy jar, 1830-1870



Fig 2 : Leech Finders

[William Wordsworth](#)'s 1802 poem [Resolution and Independence](#) describes one of the last of the leech-gatherers, people who travelled Britain catching leeches from the wild, and causing a sharp decline in their abundance, though they remain numerous in [Romney Marsh](#). By 1863, British hospitals had switched to imported leeches, some seven million being imported to hospitals in London that year. In the nineteenth century, demand for leeches was sufficient for hirudiculture, the farming of leeches, to become commercially viable. The use of leeches in modern medicine made a small-scale comeback in the 1980s after years of decline, with the advent of [microsurgery](#), where venous congestion can arise due to inefficient venous drainage; leeches can reduce swelling in the tissues and promote healing. They are used to help restore circulation after microsurgery to reattach body parts. Other clinical applications include [varicose veins](#), muscle cramps, [thrombophlebitis](#), and joint diseases such as epicondylitis and [osteoarthritis](#).<sup>[10]</sup> Leech secretions contain several bioactive substances with [analgesic](#), [antiinflammatory](#), [anticoagulant](#) as well as antimicrobial effects. One active anticoagulant component of leech saliva is a small protein, [hirudin](#). The drug is manufactured by [recombinant DNA](#) technology.

### 1. Medical applications for leech therapy :

During a session, live leeches attach themselves to the target area and draw blood. They release the proteins and peptides that thin blood and prevent clotting. This improves circulation and prevents tissue death. The leeches leave behind small, Y-shaped wounds that usually heal without leaving a scar.

Leeches are effective at increasing blood circulation and breaking up blood clots. It should be no surprise that they can be used to treat circulatory disorders and cardiovascular disease. Chemicals derived from leech saliva have been made into pharmaceutical drugs that can treat:

- [hypertension](#)
- [varicose veins](#)
- [hemorrhoids](#)
- skin problems
- arthritis

Clinical trials suggest [Trusted Source](#) that leech therapy is an appropriate treatment for the common joint disease [osteoarthritis](#). The anti-inflammatory and anesthetic properties in the leech's saliva reduce pain and tenderness at the site of the affected joint.

## 2. **Heart Disease :**

People with heart disease use leech therapy because of [its potential Trusted Source](#) to improve inflammation and blood flow. In the past few years, leech therapy has become an acceptable alternative therapy for people with vascular disease and disorders.<sup>[08]</sup>

## 3. **Cancer :**

Cancer treatments using leech therapy are being [explored Trusted Source](#) because of the platelet inhibitors and special enzymes contained in leech saliva. While people with certain cancers are not advised to use leech therapy, it has been shown to slow the effects of lung cancer. Animal testing also shows that directly injecting leech saliva into [mice](#) helps prevent the colonization of cancer cells.

## 4. **Can Leech help with Diabetes :**

The progression of diabetes can cause numerous problems. These problems can lead to vessel diseases that limit or prevent blood from reaching the toes, fingers, hands, and feet. When blood flow becomes severely restricted, the affected tissue can die. This is the leading cause of amputation among people with diabetes. Losing a digit or limb due to complications from diabetes is a major concern for millions of people worldwide. The most effective way to stop this process is to increase circulation to the affected tissues without the risk of blood clots. [Research Trusted Source](#) has shown that leech therapy can play a role. The Hirudin substance in leech saliva thins the blood and keeps it from clotting. Since people with diabetes tend to have thicker blood, Hirudin can help relieve the pressure on the heart and cardiovascular system by thinning the blood. Researchers have [observed Trusted Source](#) positive outcomes in cases where Hirudin has been used for treat diabetes.

## 5. **Leech therapy for Cosmetic use :**

Leeches have become popular for preserving soft tissue and promoting healing after facial reconstructive surgery. In both [old](#) and [new](#) case studies, leech therapy has been shown to increase the chance of positive outcomes in reconstructions affecting the:

- nose
- forehead
- breast
- cheek
- digits (fingers and toes)

Leech therapy's effect on blood clotting during and after these surgeries helps the body to heal more naturally and completely. Leech therapy's benefits for blood circulation has also led some people use leech therapy to treat baldness and hair loss on the scalp.



**6. Movement :**



Fig 1 : Leech Looping

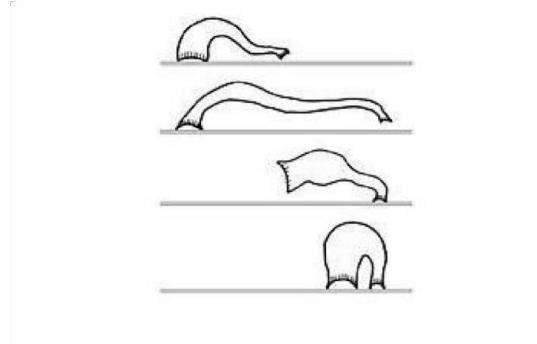


Fig 2 : Leech moving by looping using its front and back sucker.

Leeches move using their longitudinal and circular muscles, which other annelids such as earthworms use for peristalsis, with the addition of the use of their posterior and anterior suckers (one on each end of the body) to enable them to progress by looping or inching along, in the manner of geometer moth caterpillars. The posterior end is attached to the substrate, and the anterior end is projected forward peristaltically by the circular muscles until it touches pulled forward by the longitudinal muscles, and reattached; then the anterior end is released, and the cycle repeats. Leeches explore their environment with head movements and body waving.<sup>[7]</sup> [As shown in fig. 1 and 2]

**7. Feeding and Digestion :**

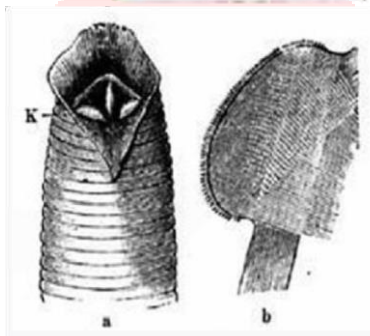


Fig 1 : Feeding and Digestion.

About three quarters of leech species feed on blood extracted from a host while the remainder are Mouthparts and sucker. Leeches either have a protusible pharynx, commonly called a proboscis, or a nonprotusible pharynx which may or may not be armed with jaws. In the proboscisless leeches, the jaws of Arhynchobdellids are at the front of the mouth, and have three blades set at an angle to each other. In feeding these slice their way through the skin of the host, leaving a Y-shaped incision. Behind the blades is the mouth, located ventrally at the anterior end of the body.

It leads successively into the pharynx, a short oesophagus, a crop (in some species), a stomach and a hindgut, which ends at an anus located just above the posterior sucker. The stomach may be a simple tube, but the crop, when present, is an enlarged part of the midgut with a number of pairs of ceca that stores ingested blood. The leech secretes an anticoagulant, hirudin, in its saliva which prevents the blood from clotting before ingestion. A mature medicinal leech may feed only twice a year, taking months to digest a blood meal.



Fig 2 : Leech bites on a cow's under



Fig 3 : Leech attacking a Slu

The bodies of predatory leeches are similar, though instead of jaws many have a protrusible [proboscis](#), which for most of the time they keep retracted into the mouth. Such leeches are often [ambush predators](#) that lie in wait till they can strike prey with the proboscises in a spearlike fashion. Predatory leeches feed on small invertebrates such as snails, earthworms and insect larvae. The prey is usually sucked in and swallowed whole. Some Rhynchobdellida, however, suck the soft tissues from their prey, making them intermediate between predators and blood-suckers. When they are hungry, leeches use their anterior suckers to connect to hosts for feeding. Once attached, leeches use a combination of mucus and suction to stay in place while they inject hirudin into the hosts' [blood streams](#).<sup>[9]</sup>In general, sanguivorous leeches are non host-specific, and do little harm to their host, dropping off after consuming a blood meal. Some marine species, however, remain attached until it is time to reproduce. If present in great numbers on a host, these can be debilitating, and in extreme cases, cause death.

Leeches are unusual in that they do not produce [amylases](#), [lipases](#) or [endopeptidases](#). This lack of endopeptidases means the mechanism of protein digestion cannot follow the same sequence as it would in all other animals in which endopeptidases first split proteins into [peptides](#), and the exopeptidases then degrade the peptides. However, they do produce intestinal [exopeptidases](#) which remove amino acids from the long protein molecules one by one, possibly aided by [proteases](#) from endosymbiotic bacteria in the intestine. This evolutionary choice of exopeptic digestion in Hirudinea distinguishes these carnivorous clitellates from oligochaetes, and may explain why digestion in leeches is so slow. Deficiency of [digestive enzymes](#) and of B complex vitamins is compensated for by enzymes and vitamins produced by [endosymbiotic](#) microflora. In *Hirudo medicinalis*, these supplementary factors are produced by an obligatory [symbiotic relationship](#) with two bacterial species, *Aeromonas veronii* and a still-uncharacterised *Rikenella* species. Nonbloodsucking leeches, such as *Erpobdella punctata*, are host to three bacterial symbionts, *Pseudomonas*, *Aeromonas*, and *Klebsiella* spp. (a slime producer). The bacteria are passed from parent to offspring in the cocoon as it is formed.

### 8.11 Mechanism of action of Leech :

Leeches have various proteins in their saliva, which have different properties responsible for carrying out the desired medical effect. They have evolved highly specific mechanisms to feed on their hosts (both cold and warm blooded organisms) by blocking blood coagulation. Its anticoagulant property is the most potent action which was explained in 1884 when John Berry Haycroft, a Birmingham chemist, discovered an anticoagulant, called "hirudin," from the saliva of leech. It is known to act at different points in the coagulation cascade, thereby preventing blood from clotting by inhibiting conversion of fibrinogen to fibrin. It is also known to inhibit platelet aggregation, which further contributes to the process. In addition to this, it also has antiseptic qualities. There are also other proteins present in leech saliva which are other bio-active substances including prostaglandins, vasodilators and proteins like calin, apyrase, hyaluronidase, eglin, destabilase, piyavit and kollaginase. The therapeutic benefit of leeches is achieved in series of events which first includes stimulation of blood flow by injecting salivary anticoagulants into the dermis. Then the mechanical application of leeches maintains active suction of blood with a negative pressure of up to 1/10 atm, followed by passive oozing of the bite wound after leech detachment. Hence, the evacuation of venous blood from engorged area is allowed and results in a temporary restoration of the capillary blood flow and thereby improved tissue viability. Kubo in their

study have postulated that VEGF (vascular endothelial growth factor) when used in combination with blood exanguination technique such as leeching and hyperbaric oxygen therapy, may increase the survival of flaps by manyfold with respect to the use of medicinal leeches in acute trauma, medicinal leeches became common place in assisting revascularization of amputated fingers and toes after replantation procedures.

#### 9. **Complications :**

Although leech therapy is an innovative approach in medical science, its use is accompanied by no serious complications, the most common being prolonged bleeding. Other reported complications are allergic reactions and bacterial infections. The bacteria aeromonas hydrophila present in gut of leech can cause pneumonia, septicaemia or gastroenteritis. Allergic reactions such as itching followed by burning and blister formation due to toxins present in leech saliva have also been reported after leech therapy. Transmission of certain infections from concept of subject to the other is another probable complication of leech therapy. However these complication occurs when savisha leeches are selected for treatment. Hence, it is mandatory to rule out the selected cases for certain conditions by performing a series of required haematological or serological investigations. Few such conditions include various blood borne infections like HIV, viral Hepatitis and blood disorders like haemophilia, thrombocytopenia and conditions like pregnancy .

#### 10. **Discussion :**

Application of leeches removes blood from the body and also injects biologically active substances which help to manage various ailments. According to Ayurveda diseases are caused due to vitiation of dosha. Vitiated dosha get accumulated in srotas(channels) causing srotoavarodha(blocking of channels) and lead to many diseases. Jalukavacharana 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. Jalukavacharana increases blood flow by their anti-coagulant properties which enhance the local circulation and also suffices the nutrient. The anti-coagulant property of jalauka was discovered in 1980 by modern scientist but our acharyas had the knowledge during the vedic periods. Our acharyas treated many diseases by jalukavacharana successfully during Vedic period even before scientific discovery. It is useful in treating various clinical conditions like, atherosclerosis, hyper coagulation, varicose veins, and peripheral vascular disorders in lower limbs like TAO, Gangrene, Non healing ulcers. So, jalukavacharana can be considered as an important treatment modality from scientific background and not just a mere assumption.

#### 11. **Conclusion :**

To conclude, leeching has been a popular therapeutic practice for a long period of time for a wide range of diseases and it was applied as an unscientific way by classical therapists. Nowadays, leech came back to the contemporary medicine with fewer applications, which has been proven and supported by a large number of scientific studies and case reports. Leech therapy in the field of plastic and reconstructive surgery is expected to be of paramount importance due to the ease of leech application and reduced side-effects. Leech therapy as indicated by Unani physicians can be safely and effectively used to evacuate the blood and morbid humors from deeper structures. On the other hand, surgeons who practice plastic operations consider leeching as a promising remedy, since they observed that the Y-shaped wounds caused by leech bites usually heal without scars or complications. Furthermore, modern biochemistry has been able to point out so many substances in the leech saliva as well as their mode of action.

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