Medicinal leech therapy and related case study: Overview in current medical field

Ashvin V Dudhrejiya, Shivangi B Pithadiya, Ashok B Patel, Amitkumar J Vyas, Ajay I Patel and Dhruvansi A Gol

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Abstract

Although complementary medicine practises have a long history, but recently focused on their potential mechanisms of action. Among the leeches, Hirudo medicinal is has widespread therapeutic use, although other species have also been researched and investigated internationally. More than 20 known bioactive compounds are secreted by leeches (salivary product). They have analgesic, anti-inflammatory, platelet inhibitory, anticoagulant, thrombin regulating, extracellular matrix degradative, and antibacterial activities, but with more research, the range of effects may broaden. In this instance, cultured leeches are attached to the afflicted areas and begin sucking blood after an initial, painless bite. The majority of therapeutic advantages are attributable to saliva’s diverse bioactive components. The novel Ayurveda text Sushruta Samhita devoted a complete chapter on hirudino therapy. In order to enable the fraternity to use both sources for the good of humanity, the current research highlights the numerous features of medicinal leech therapy from both Ayurvedic texts and contemporary science.

Keywords: Hirudo therapy, medical leech therapy, anticoagulant, direct thrombin inhibitors (DTIs), leech saliva

Introduction

MLT has been around for a long time, and the phrase "leech" comes from the word "laece" (physician). In the year, the first applications were observed, Egypt in antiquity [1, 2], Chinese, Arabic, Anglo, Saxon, and other languages are also available. Many references can be found in ancient Greek and Roman medical records. MLT reached its pinnacle in 17th, century Europe [3]. Leeches are segmented, hermaphrodite, predatory worms that dwell in fresh water. They are sensitive to water vibrations, touch, light, heat, sound, and other factors. Chemicals of many kinds They are split into several groups, including "Brain sections," with distinct organs in each segment, such as testicles and ganglions for crawling and adhesion, two sucker portions are used.; the anterior one has three jaws, one of which is a lot of teeth They usually bite the warmest regions of the host. sucks its blood through regular contractions and feeding takes place [4]. A leech digests 10–15mL of blood in roughly 40 minutes. For each feeding Many enzymes are involved in digestion. Aeromonas hydrophilia and other mutual microbes Pseudomonas hirudinia is a kind of Pseudomonas [5, 6]. Many investigations have discovered that leeches secrete a variety of bioactive chemicals. There are more than 20 molecules [7, 8]. And their mechanisms of action have been recognized, but there are still some that haven't been identified [9, 10]. There are many more waiting to be discovered. These compounds have analgesic properties, anticoagulant, gesci, anti-inflammatory, platelet inhibitory and thrombin regulatory roles [11, 12], and as extracellular antibacterial and degradative actions on the lar matrix—It’s true [13]. Medicinal leech is shown in figure 1.
Jaloka (leeches) in Ayurveda

The Jaloka (leeches) are classified into two primary forms in Ayurvedic literature based on their therapeutic role: Savisha (unfit for therapeutic reasons) and Nirvisha (fit for therapeutic purposes). Each of these was then separated into six different groups. Based on their distinctive qualities, these twelve different types of Jaloka were given their own names. Savisha and Nirvisha were likewise determined to be Jaloka based on their breeding habitats. While Nirvisha Jaloka’s breeding grounds were freshwater bodies of water, Savisha Jaloka’s were contaminated bodies of water.

The Therapeutic Effects of Jaloka Avacharana (JA) On Various Areas

JA has been acknowledged as an important therapy strategy for a variety of medical conditions. A graphic representation of the therapeutic advantages of JA in various settings was shown in Fig. 2. A large portion of the research was conducted using Ayurveda [14, 15].

Leeches work with secreted protein

Many scientific investigations have been conducted to far on the effective mechanisms of leeches. Despite the fact that leech secretions contain over 100 distinct proteins with various molecular weights, only a few have been discovered as having therapeutic potential and a significant active role. The effective mechanisms are classified into six groups to make them more understandable, yet Mechanisms are intertwined and should be treated as such to be assessed as a whole (Table 1). After being bitten by a leech, A sucking pathway (extracellular matrix) must be established. Adhesion, aggregation, and coagulation are all inhibited[16].
Extracellular matrix degradation:
Leeches release hyaluronidase (27.5 kDa) and collagenase (100 kDa) enzymes soon after biting to aid tissue penetration and dissemination of their bioactive compounds. Antimicrobial action is also supported by these enzymes.

Analgesic and anti-inflammatory effects
Leeches are thought to have analgesic and anti-inflammatory properties in order to avoid being detected by the host while feeding. Despite this, no analgesic molecule acting in this manner has been isolated from leech secretions till now. As a result, research has concentrated on indirect effects. A set of mechanisms for achieving this purpose Some studies have suggested that kininases and antistasins may have a role in cancer. Impede the kinin–kallikrein mechanism, which is a main kinin–kallikrein pathway of nociceptive [17].

LDTI (leech-derived tryptase inhibitor) has three isoforms (a, b, and c) and inhibits mast cell proteolytic enzymes. LDTI is a serine protease inhibitor of the Kazal-type. Mast cell tryptases particularly inhibited, but trypsin and other enzymes are also inhibited [18]. Chymotrypsin Mast cell tryptases are serine proteases that are found in mast cells. Inflammatory reactions are triggered by the release of collagen granules. These outcomes are intimately linked to the kinin–kallikrein system. Chemotaxis, leukocyte activation, vasoactive effects, system and, as a result pain-inducing interaction. Their levels are linked to allergy and inflammatory illnesses like asthma and eczema. Anaphylaxis, asthma, and arthritis are all conditions that can be life-threatening [19, 20]. LDTI is a protein kinase Factor Xa inhibitor, plasma kallikrein, and plasmin inhibitory effects, but inhibitory effects on mast cell tryptase, trypsin, chymotrypsin, thrombin, and plasmin. Neutrophil elastase are a contentious topic [21].

Human neutrophil elastase and cathepsin G are both inhibited by Eglin C. These two enzymes are immunological serine proteases from the chymotrypsin family that are found in polymorphonuclear neutrophils’ azurophil granules. As part of the inflammatory reaction, it is produced and released [22, 23].

When Eglin C is inhibited, the number of free radicals in the body decreases. In neutrophils, oxygen radicals are reduced, which reduces tissue inflammation and damage. Eglin C was found to be effective in test models. Demonstrated to be a promising shock and anxiety treatment emphysema.

Increasing blood flow
Increased blood flow is required for leech feeding and therapeutic effects. Histamine-like molecules, which promote vasodilation and derive from local vascular permeability, are primarily responsible for this. Acetylcholine is also found in a variety of foods. Endothelial muscle relaxation and Vasodilatation is caused by leech secretions [22].

Inhibition of platelet functions:
The activation of platelets and the coagulation cascade, which are lethal to the leech. Leech secretions, as a result, contain various bioactive compounds to block these effects on a local level Wall disintegration in a normal host leads the spread and release of collagen particles, which are targets of free Von Willebrand factor (vWF). This compound has a high affinity towards glycoprotein (glycoprotein) (GP) As vWF acts as a bridge, Ib on platelets. Up regulatory mechanisms are activated as a result of this binding, particularly in the case of Adenosine diphosphate (ADP) plays a crucial role, and Platelets bind to each other via GpIIb–IIIa, and fibrinogen. Stop any bleeding by making a plug. This reaction begins as well. Another chain of chemicals that release, such as thromboxane A2, platelet activation, and the coagulation cascade are all steps in the coagulation process [22]. In the leech secretions, and a variety of chemicals (saratin, calin, decorin, and others) apyrase) are enzymes that react with distinct portions of the chain.

Saratin, a 12-kDa protein, affects just the first step of platelet adhesion and competes with collagen to block the collagen–vWF interaction. Some animal investigations have shown that the recombinant saratin molecule could be a promising treatment option. Anti-thrombotic therapies require a local therapeutic agent, and atherosclerosis [26].

The American medicinal leech, Macrobella decora, is structurally unique. Anticoagulant leech proteins hirudin and antistasin are related. However, it works as a GPIIb–IIIa inhibitor and operates as a GPIIb–IIIa inhibitor. Platelet aggregation may be inhibited in several cases [27, 28]. In addition, a new chemical is described by decreasing thromboxane, it inhibits platelet-activating factor and thrombin-induced platelet aggregation and Platelets’ production [29]. Collagenase is an enzyme that degrades collagen particles, which trigger all of these adhesion and aggregation events, as well as providing additional support to the inhibitory enzyme’s effects [30].

Anticoagulant effect
Factor Xa inhibitors, like thrombin inhibitors, break the chain reaction and destabilase has a fibrinolytic effect on the reaction. Thrombin has a significant impact on platelet activation and ADP release. As a result, these inhibitors may have a harmful effect indirectly. Hirudin is a 7.1-kDa protein that binds to thrombin in an irreversible manner, causing active thrombin to be consumed and antithrombin activity to be produced. This is the most interesting substance, and it has been the focus of numerous studies. Heparin is superior because it has a stronger anticoagulant action and fewer negative consequences. Gelin is a powerful Eglin analogue and Inhibitor of thrombin. Gelin inhibits chymotrypsin, cathepsin G, and neutrophil elastase, among other enzymes.

Anticoagulant effects are possible with gilantens. LDTI, C1 inhibitor, and Eglin’s, possibly by direct and/or indirect inhibition [31, 32]. Coagulation factors are a group of proteins that help the blood clot [33]. Destabilase is a glycosidase-activating enzyme. It has antimicrobial and fibrinolytic properties [34, 35]. Novel anticoagulant peptides (new leech
ran etexilate, a tiny er, ness, mechanical heart valves, a

[0x0]t Activated partial thromboplatin time
e to enhance DTI that binds reversibly to the thrombin active site and have HIT or are at risk for it, argatroban is a tiny, univalent Lepirudin, desirudin, argatroban, and bivalirudin are generation were created for oral use were created for parenteral usage, while those of the second

[0x0]e to eliminate any locally formed clots, use physiological attachment point for hours. Every 3 hours on average one hour.

Clean the region to be exposed to leeches with sterile distilled water before applying it to the appropriate location. They usually start eating right away, but in rare circumstances, the skin can be punctured with a sterile needle to stimulate the leeches to feed by spilling blood. Using a 5 ml syringe, the leech is applied to a specific area of the skin. The syringe's plunger is removed for this reason. The leech is inserted into the syringe's barrel. The syringe's open proximal end is put on the area to be treated. When the leech begins to feed, the syringe is inserted has to remove. Feeding normally lasts 45-120 minutes, and the leech is watched during this time. Various clinical indicators, infections, and allergic responses should be examined on a regular basis during treatment, After The leeches are removed via auto-detachment. Blood continues to seep from the leech's attachment point for hours. Every 3-4 hours, it has been removed the bite area is cleaned with a gauze sponge soaked in to eliminate any locally formed clots, use physiological saline and a heparin-soaked (5,000 U/ml) gauze to enhance blood flow. It's oozing blood time. leeches are not used again Even on the same patient, used. In this case, the detached leech is killed. It contains 70% ethyl alcohol and is disposed of as biological waste in bags. Leech bites can leave little blood spots (ecchymoses) on the skin, which can turn into keloids in certain people. Within 2-3 weeks, the majority of these spots will have vanished.

Leeches may not bite if:
- The skin is cold
- Older humans
- Smokers
- Perfumed skin

Advances in direct thrombin inhibitors research-A brief overview
The hirudin derivatives known as direct thrombin inhibitors (DTIs) were created and investigated for use in the prophylaxis and treatment of venous thromboembolism (VTE), heparin-induced thrombocytopenia (HIT), acute coronary syndromes (ACS), and secondary prevention of coronary events following ACS. DTIs of the first generation were created for parenteral usage, while those of the second generation were created for oral use.

Parenteral direct thrombin inhibitors
Lepirudin, desirudin, argatroban, and bivalirudin are examples of parenteral DTIs. In patients undergoing PCI who have HIT or are at risk for it, argatroban is a tiny, univalent DTI that binds reversibly to the thrombin active site and is used to treat the condition. It has recently been used successfully and safely for therapeutic anticoagulation in patients with coronavirus-induced coagulopathy and hyperinflammation for heparin resistance associated with SARS Cov-2 infection. Bivalirudin has recently been found to be an effective substitute for unfractionated heparin in patients receiving extracorporeal membrane oxygenation (ECMO) for severe respiratory failure brought on by SARS-CoV-2 infection. In order to maintain target Activated partial thromboplatin time (aPTT) values, patients on ECMO with acute respiratory distress syndrome from COVID-19 required greater rates of bivalirudin than patients without COVID19; nevertheless, the COVID-19 group more consistently maintained target aPTT values.

Oral direct thrombin inhibitors-DOACS-and a look to the future
Ximelagatran was the first oral DTI to be created and studied, however it was taken off the market in 2006 due to hepatotoxicity. Thrombin targeting research continued despite the discontinuation of ximelagatran, leading to the development of another oral DTI, dabigatran etexilate, a tiny (472 Da) peptidomimetic that binds to the thrombin active-site by ionic interactions. Orally-active synthetic small compounds, including as rivaroxaban, apixaban, and edoxaban, that inhibit this factor were developed as a result of structure-function research on the FX, protein. All of these medications, or DOACs, are simple to take at a fixed dose without the requirement for anticoagulation monitoring, and they have all come to be the patients' preferred long-term treatment for Non-valvular atrial fibrillation (NVAF) and Venous thromboembolism (VTE). According to recent research, DOACs may also be a viable substitute for Low molecular weight heparin (LMWH) in the treatment of cancer-related VTE. Although DOACs have advantages over Vitamin K Antagonists (VKAs), their usage is restricted or contraindicated in some situations, and bleeding is still their most common side effect. DOACs should be used with extreme caution or avoided in patients with advanced renal or liver illness, mechanical heart valves, rheumatic atrial fibrillation, or the antiphospholipid antibody syndrome. Additionally, they have not been studied during pregnancy or nursing, and there is no proof of their usefulness in treating unclear source embolic strokes.

Contraindications of Hirudotherapy
- Anaemia
- In extreme ages i.e., in children and old age.
- Weak patients
- Allergic patients
- In extreme hot or cold climate
- Diseases like haemophilia
- Pregnancy

Identification of Non-poisonous Leech
Non-poisonous Jalokas, sometimes known as 'Nirvish Jalokas,' can be distinguished by their absence of poison. They have the characteristic

- Wide lotus- bud like mouth. (Jalokas: - ‘Jal’ i.e., Water, the ‘Leeches’ are known as ‘Jaloka’.)
Case study
Case study 1: Leech therapy in treatment of cutaneous leishmaniasis
A case Report
Two patients participated in this study.
First, we obtained the patients' permission to take part in the study and allow us to publish their lesion images. A 56-year-old man who had a wound on his left hand went to see a doctor in a private clinic. The injury had grown following a visit to Kherameh, a region of Fars Province where pervasive cutaneous leishmaniasis was present (CL). On the basis of the smear test results and clinical presentation, the chronic wound was identified as CL. Azithromycin (250 mg capsules) and metronidazole (250 mg tablets), two drugs used to treat CL in Iran, were also administered to the patient, along with four months of cryotherapy. But the wound didn't get better. The patient changed to a different doctor as a result. Following a clinical diagnosis, the second doctor recommended leech therapy. Before each session of leech therapy, a picture of the patient's hand was taken.

In the clinic, a 43-year-old lady also saw a doctor. She had had a facial cut six months previously in Estahban, a region of Fars Province without an endemic CL outbreak. When she arrived at the clinic, she hadn't taken any medication for her CL. After receiving a CL diagnosis, she underwent leech therapy. Before and after the therapy, pictures of her face were taken. It should be highlighted that neither patient was allergic to bug bites nor were they using any medications for hemodilution. Additionally, none of the patients had any systemic conditions or other illnesses including type 1 diabetes, anaemia, or haemophilia. Leeches (Hirudo orientalis) utilised in the clinic were also unlikely to spread an infection because they were supplied by Iran's Institute of Research on Hejamat. 5 leeches were applied during the intervention over the course of 4-5 sessions, spaced 2–4 weeks apart. Each time, the leeches were left on the wounds for 30 to 45 minutes in order to draw 5 to 6 mL of blood. Before beginning leech therapy, the lesions were photographed.

Result
Figures 3A–3D show that the male patient underwent leech therapy four times at 1-, 2-, 3-, and 4-week intervals. After two months, the lesion was fully cured (Figure 3E). Five months following the initial leech therapy session, the healing process was monitored again, and the lesions showed no signs of relapsing (Figures 3F and 3H).
Leeches were applied to the woman five times, at intervals of two weeks (Figures 4A–4D) and one month (Figure 4E), and her case was monitored for 1.5 years following the initial leech therapy (Figures 4F–4I). After six months (Figure 4G), the lesion was fully cured, and one and a half years later it showed no signs of recurrence (Figures 4G–4I) [51].
Case study 2  Case study of leech application in diabetic foot ulcer

Ayurvedic Prospective

Diabetic foot ulcer can be correlated with ‘Madhumehaj Vrana’ described in Sushrut Samhita.

References of indication of Leech Therapy from Wounds Sushrut has argued that bloodletting with a leech can be used to treat all inflammatory, suppurative, and painful illnesses to reduce inflammation and prevent suppuration, including that of diabetic ulcerative lesions, in Sushrutsamhita Chikitsa sthan, chapters 12 and 16.

RESULT

With “Leech Therapy,” the wound healed entirely in 30 days, curing the patient. Likely mode of action for leech therapy Due to the presence of Carboxypeptidase A inhibitors, histamine-like compounds, and acetylcholine, leech treatment increases blood circulation and lowers congestion, correcting diabetic microangiopathy. Leech application has anti-inflammatory action on nerves due to substance like Bdellins and Eglins in the saliva hence corrects Diabetic Neuropathy. Leech application has peripheral vasodilator effect due to presence of vasodilator constituent in the saliva which improves blood circulation and corrects "Ischemia" due to Diabetic Atherosclerosis. Shown in fig 5.

Probable mechanism of Action (Ayurvedic Perspective)

Vran Shodhan Effect: Following leech treatment, impure blood is expelled, which removes local vitiated doshas (toxins and undesirable metabolites).

Vran Ropan Effect: The application of leech aids in the formation of "Healthy Newer Tissues" and fresh blood supply.

Madhumeh Pacifying Effect: In other words, bloodletting with leech application stops the pathogenesis of "Madhumeh" at the cellular level, inhibits infection (Diabetic tissues are glucose-laden, which encourages propensity of bacteria to multiply), and speeds up the healing of wounds. Oil from "Nimb Haridra" possesses both "Shodhan" and "Ropan" qualities. As a result, it aids in the concurrent cleaning and healing of infected wounds. To assess the effect of "Leech Therapy" on enhancing wound healing with respect to diabetic foot ulcers, further research with a large sample size is necessary.

RESULT

Leech therapy caused the wound to heal fully in about 30 days, compared to the 20 weeks needed for normal treatment to repair roughly 30% of diabetic neuropathic ulcers. Therefore, "Leech therapy" shows to be a successful, time-saving, cost-effective, and acceptable treatment. Although treating "Diabetic foot" is challenging, we have been successful in treating it using "Leech Therapy" in addition to traditional (Ayurvedic) wound care techniques [52].

Fig 5: The photograph of patient’s DIABETIC FOOT ULCER, (A): Clinical Presentation on day-1, (B): leech application in diabetic foot ulcer, (C): prognosis on day 7, (D): prognosis on day 14, (E): Prognosis on day 21, (F): Showing complete healed ulcer after 30 days
Case Study 3: A Case Study of Leech Therapy (Jalaukavcharana) in Khalitya W.S.R. Alopecia

History of the Present Illness
A 28-year-old woman reported hair loss, thinning hairs with a receding hairline in the temporal and frontal regions, dandruff, itchy skin, and roughness around six years prior. At the time, the person was in good health. Later, the first signs of hair thinning appeared, followed by hair loss. She was experiencing both sleep disturbances and signs of mental stress at the same time. She received allopathic medicine for two years, but the results were unsatisfactory. First, we conducted a complete blood count, blood sugar level, liver function test, renal function test, routine urine examination, and thyroid function test when she visited the O.P.D. centre to rule out any potential associated disorders, but the results of these tests were found to be within normal limits. There was no substantial prior history of the patient having any other chronic illnesses. There was no evidence of past addiction of any kind.

Treatment Plan
The Jalaukavcharana Samshodhana Karma method of treatment was used. On days 1, 15, 30, 45, and 60, a total of five sittings of Jalaukavcharana were performed while taking oral medication on a regular basis for two months. Saptamrita Loha, Manjista Churna, Bringaraja Churna, Nimbhadi Churna, Abhraloha, and Asthiposhaka Vati made up the oral medication delivery formula. The preparation and execution of Jalaukavcharana is regarded as the most distinctive and potent method of bloodletting.

On both sides, the frontotemporal area is covered with two leeches. Leech-created minor wounds are treated with a dressing of Haridra (turmeric powder) and Jathyadi taila once the leeches have left the area on their own (after sucking blood for around 30 minutes). After emesis of the blood they had sucked, the removed leeches were then preserved and reused after 15 days. The patient was checked for the presence of hair follicles and the growth of hair over the afflicted area after two months. Digital photography and the clinical existence of hair on the afflicted scalp region were used as assessment criteria. There were before and after recordings. Observation period on days 75 and 90.

Result
Jalaukavcharana is best alternative therapy which can be used to treat Khalitya with oral medication. Leeching can be learned relatively quickly and can reduce the complication arising from the excessive use of synthetic drugs. In addition it is economical and cost effective therapy for this common aliment with no short term side effects. The result of this case study has shown a potential for treating alopecia. Shown in fig 6 [53].

Case study 4: A clinical success in the management of kotha (digital gangrene) by leech therapy and panchtiktaghritaguggulu - a single case study

Case Report
A 45-year-old woman complained of mild pain, slight swelling, and blackening of the distal index, middle, and ring fingers of the left hand when she went to the Shalya Tantra outpatient clinic of Govt. AkhandanandAyurved Hospital in Ahmedabad [Figures 7]. More than a month ago, the proximal portion of the finger began to show the aforementioned signs and symptoms. For the treatment, she had sought physicians in modern medicine.

The Ayurvedic treatment of PanchtiktaghritaGuggulu three times daily before meals with water and Jalaukavcharana was carried out for six weeks after the diagnosis of Kotha (dry gangrene) was confirmed. The clinical presentation of the Kotha (dry gangrene) condition and the therapeutic qualities of the medicine with potential for modification were taken into consideration while choosing the therapy strategy.

Result
After the second week, the patient showed just a slight improvement, so the same medications were continued each week, and clinical improvements were seen [54].
Human Applications

Venous congestion:
It has been shown to aid patients with venous disorders by reducing pain and swelling caused by varicose veins, as well as dissolving blood clots. It doesn't work for disorders caused by a lack of valves or insufficient vessel dilation. The saliva of leeches provides helpful enzymes that protect the body from infection. Preventing the blood from coagulating Aside from that, there is an enzyme that dissolves thrombi. These two characteristics role to thin the blood so that it can travel freely through the veins Another enzyme contributes to this function as well. improves blood flow by acting as a vasodilator The saliva of a leech also possesses antimicrobial qualities, which can aid those with open sores caused by venous illness. Leech therapy works best when combined with compression stockings, weight loss, a healthy diet, and regular exercise \[55, 56\].

Skin flap
They are used in the transplantation of skin flaps. The leeches begin sucking blood as soon as they attach themselves to the skin flap site. They secrete hirudin, which is essential for platelet aggregation and the coagulation cascade to be inhibited. If these two issues continue to manifest themselves in a negative way, Sather helps to relieve venous congestion and improve blood flow to the skin flap. After a long period of medical leech use, following therapy, the skin flap becomes warm and rosy, indicating sufficient blood circulation to the flap \[57, 58\].

Arthritis
The saliva of a leech aids in the treatment of arthritis because it contains a variety of chemicals and components that serve to minimise joint inflammation. Anti-inflammatory compounds include bdelsins and Eglin's. Aside from that, its saliva has an analgesic component that helps to relieve joint pain. There's also a histamine-like molecule in there those functions as a vasodilator. Another component of the brain is acetylcholine. The saliva of a leech is likewise a vasodilator. This is significant in the treatment of arthritis because when the arteries dilate, it causes the joints to dilate as well. improves blood flow, therefore eliminating the chemicals from the location, alleviating pain and discomfort inflammation \[59, 60\].

Complications of leech therapy:
According to research results, articles were divided into five categories: allergies, persistent bleeding, infection, migration, and other problems. Fig. 5 illustrates \[61, 62\].

According to our research, bacterial infection is the most common side effect of leech therapy (51%). The most frequent microorganism found at the site of leech bites is Aeromonas spp., specifically A. hydrophila, a symbiotic Gram-negative bacterium in their stomach. Without preventive antibiotics, infection is unavoidable, however the genus Aeromonas is renowned for its levels of resistance to lactam antibiotics linked to the development of various -lactamases. They are effective against penicillin, carbapenems, and first-generation cephalosporins \[63-65\].
Benefits of leech therapy:
The scientific literature shows that leeches may be beneficial in very wide ranges of disease states, including the following:
- Chronic skin diseases (such as, psoriasis, eczema, cutaneous leishmaniasis hard-to-heal wounds)
- Phlebitis and gout
- Ischaemic heart disease
- To prevent post-surgical blood clotting
- In the treatment of asthma
- For pain relief, in conditions such as osteoarthritis (ankle, hip, knee, shoulder, small joint).
- To treat localised infections such as abscesses, mastitis, paronychia.
- To treat hypertension and migraines

Discussion
The medicinal leech has been utilised for more than 3500 years, according to the present article. More than 100 proteins and peptides have been found in leech saliva, all of which have been linked to therapeutic effects. The many therapeutic properties of these substances are a result of their bacteriostatic and extracellular matrix degradative properties, as well as their anti-inflammatory, anaesthetic, vasodilator, antiplatelet, anticoagulant, and thrombin regulating effects. HT is rather quick compared to other alternative and natural therapeutic methods, and it can lessen the difficulties brought on by excessive use of synthetic medications. MLT is a supplemental and/or integrative therapeutic option, not a replacement, for some disorders. Multidisciplinary treatments include MLT.

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