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Hirudotherapy

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Annotation: Hirudo medicins have been used in human medicine to treat many diseases hundreds of years ago, such as vascular diseases, muscle and joint diseases, migraines, eye diseases, impotence , hemorrhoids and depression. Treating varicose veins is also among the common therapeutic applications of leeches. Leech treatment is also considered a type of complementary or alternative medicine, as there are 650 types of leeches around the world. Perhaps one of the most important diseases of the blood vessels is venous congestion after surgical operations. In the world of reconstructive surgery, which has witnessed a renaissance in recent years, medical leeches have been used. In particular, it reduces venous congestion and restores venous drainage after performing amputated finger transplants, in addition to the subsequent anticoagulant effect of leech enzymes within 5-6 hours after performing such operations. Previous studies indicated that treatment with medical leeches has benefits for persons with venous congestion in the tissues and skin, reimplantations skin flaps , inflammation of the salivary glands, swelling, excessive lingual swelling , and osteoporosis, in addition to various types of

ulcers. also It has been proven that this treatment has anti-inflammatory and pain reliever, anticoagulant effects , It is a blood and lymphatic enhancer, . Hirudin is one of the most important substance in leech saliva , which prevents blood clotting and acts as an anti-coagulant agent.

Keywords: Hirudo medicins, leech therapy, leeche, shuizhi, Hirudin.

Introduction

Cardiovascular diseases (CDs) are the leading cause of death worldwide (1), with more than 17.3 million cases recorded, or 31.5%, in 2013 (2). Also, most cardiovascular diseases, such as myocardial infarction and strokes, are caused by the formation of pathological clots, and it has been proven through reports that traditional Chinese medicines (TCMs) are effective in protecting the body from diseases related to blood clotting (3), and Hirudo is considered a medicine. (Shuizhi in Chinese) is an important Chinese medicine for treating diseases related to clotting. It has many therapeutic properties for treating brain hemorrhage, which contains some biologically active peptides in addition to many compounds, including phosphatidylcholine, glycosphingolipids, and sterols (4) extracted from 3 animal species belonging to leeches. Legally listed medical drug (3), pharmacological studies have revealed that shuizhi has an anticoagulant, anti-platelet aggregation, antiatherosclerosis, anti-tumor and anti-inflammatory effect. It also improves bleeding and has preventive effects against cerebralischemia and re-perfusion injury.

Shuizi was first registered in China and has been widely used to treat cardiovascular in addition cronic diseases (3). For 2000 years more than 300 prescriptions containing shuizi have been used in clinical practice , and many Chinese pharmaceutical manufacturers have been manufacturing shuizi alone or with combination preparations in China since 1963, until shuizi was included in the List of the Constitution of Chinese Medicine (5). Treatment with leeches is part of alternative medicine or complementary medicine. In Egypt, the first use of medical leeches, but in the seventeenth century its use spread throughout the world (6). There are 650 types of leeches(7) , and Hirudo medicinalis contains substances : Hirudin, Saratin, Hyaluronidase, Calin, Destabilase-lysozyme,, γ-Glutamyl transpeptidase, Tryptase inhibitor and Bdellastasin (bdellin A) (8). In leech saliva there is most important substance , which acts as an anticoagulant agent and prevents blood clotting is hirudin (9). studies research has shown that leeches have anti microbial ,analgesic, and anti-inflammatory effects, enhance blood flow, and prevent platelet aggregation. And anti-coagulant effects, (6). In addition to anti-cancer effects, effects against cell deterioration, application of skin flaps, improvement of wound healing, and use in reconstructive surgeries (10), the use of leeches has been widely recognized and accepted in the world within community of medicine in 2004, when the US Food and Drug Administration officially encourage the marketing of medical leeches. (7).

Materials and Methods

The methodology for this study on hirudotherapy follows a qualitative approach based on a systematic literature review. The research is conducted by analyzing existing studies, scientific reports, and clinical trials that explore the therapeutic applications of medicinal leeches (Hirudo medicinalis). Data collection involves reviewing academic databases, medical journals, and regulatory guidelines from sources such as the World Health Organization, integrative medicine research, and traditional Chinese medicine literature. The study examines the bioactive compounds

present in leech saliva, such as hirudin, saratin, and hyaluronidase, and their anticoagulant, anti-inflammatory, and analgesic effects. The selection criteria for studies include research published within the last two decades that provide clinical evidence on the efficacy of leech therapy in treating cardiovascular diseases, venous congestion, wound healing, and osteoarthritis. The validity and reliability of the data are ensured by cross-referencing findings from multiple peer-reviewed sources. Ethical considerations include reviewing safety protocols, contraindications, and the potential risks associated with leech therapy, such as infection and excessive blood loss. The methodology also involves a comparative analysis of traditional and modern medical perspectives on hirudotherapy, assessing its integration into contemporary healthcare systems. Data synthesis is conducted by identifying recurring themes, clinical outcomes, and therapeutic advancements related to medicinal leech applications. This structured approach ensures a comprehensive evaluation of the role of hirudotherapy in medical practice, providing insights into its effectiveness, safety, and future research directions. The findings contribute to a broader understanding of leech therapy as a complementary treatment option, supporting its relevance in modern integrative medicine.

Hirudo medicinalis

Leeches belong to one of the animal phyla known as the annelid phylum. Medical leeches live in the aquatic environment, especially clean fresh water. They swim in the water freely with their undulating movements and feed on the blood of vertebrates such as frogs and fish (11). Leeches are considered external parasites that feed on blood, as their meal One blood supply is sufficient for several months, and it may remain alive for a whole year without food in the absence of a vertebrate host. Leeches are hermaphrodites, and pollination occurs through cross-fertilization. Temperatures of 0-30 degrees Celsius are appropriate for its survival, but rapid changes in temperature may lead to death. These organisms also breathe oxygen dissolved in water or atmospheric air through the general surface of the body, leechs demand oxygen in small amounts, evev put in completely closed containers they do not be stifled . unfavorable substances and even with low doses as chlorine which present in water causes the death of leeches (12).

Application of leech

The area that will be exposed to the leech must be cleaned with sterile distilled water before application. The leech is also rinsed well with deionized water, and a thick layer of gauze or adhesive plastic film is placed around the leech to prevent it from separating and sticking to other parts of the skin or even decline into bandage all over the wound or parts of the body or bed, that may cause discomfort to the patient or people close to him. for each treatment from 1to 10 leeches usually are used , at the beginning the patient daily need two or more treatments (16). The attachment period lasts from 20-45 minutes, and reactions must be monitored. For the patient regularly during treatment and for various clinical indications, infections or allergies (13) .After the leech is taken away the wound may be bleeding up to 24 hours, so patient may lose from5 to 15 ml of blood per leech (14) , (15) .and the treatment of pain with leeches varies. From one person to another, the pain disappears immediately for some after the first session, while others need several sessions. The leeches should be applied to the dark spots in the area of pain. First, they should be pricked so that they can bite the area quickly. After they have established themselves, the teeth should be inserted into the skin and before they absorb the blood, they should be applied to the wound with saliva containing hirudin, which has an anti-inflammatory effect. It also reduces tumors and stimulates lymphatic secretions. Leech remedy is used up till the get back of venous capillaries is construct over the wound edge by the development of new blood vessels.. Leech therapy usually continues for 2-6 days and hematology evaluations must be performed every 4 hours. Blood is also transfused to the patient when the hemoglobin level in the blood is Less than 8 gm/dL, and signs of inflammation of the local lymph nodes appear, slight swelling, and may occur fever (17).

The role of medical leeches in wound healing

Leeches have generally been used during the critical period of surgery when venous congestion occurs as a result of a mismatch between venous flow and arterial flow. It is determined clinically

by the dark purple appearance of the skin. When these complications are neglected, it may result in cell death and an organ may be lost, such as a finger. Therefore, medical leeches are used to save tissues. Small blood vessels are at risk for organ transplants and replanting of fingers, ears, lips, and nose tips until venous drainage is improved (18). Medical leeches were also used to save soft tissues in the facial structure in the ears, nose, lip and scalp of four patients (19).

There are also many studies that show the use of medical leeches to treat blood tumors and re-implant the penis, the entire scalp, and skin flaps (20). Also, venous obstruction causes platelet retention, and stagnation, coagulation of the microcirculatory system, , and the re-implanted tissue can remain alive arterial shortness for a period of up to 13 years, while venous obstruction can cause failure of the blood supply within 3 hours, so medical leeches may be useful in deal with tissues with venous undersupply by creating a nonpermanent vein (21).

A survey of more than sixty plastic surgery section in the Republic of Ireland and the United Kingdom showed that they used medical leeches postoperatively (22). In many studies, Redi et al (23) found that medical leeches were used in re-constructive surgery for 23 patients with Necrotic skin fold and a solid swelling of clotted blood within the tissues occurred at an average of 2.6 days after surgical intervention for these patients, and at an average of 1.7dealings with sessions per patient. It was inform that 87% of these patients observed clinical improvement after an average of 101 days, despite the occurrence of bleeding, and no reverse response or other complexity were noticed . Haj Talebi et al. (24) also describe a instance condition on the use of medical leeches in the case of a 12-year-old boy who was injured in the right lower extremity in a motorbike misfortune. After dealing with the correction of deformities surgery, the leg go on become bloated with severe venous cong, and when he did not rejoin to treatment sessions, the congestion decreased. His veins were severely swollen, and after two months, he completely recovered.

In a study, Babat and his colleagues evaluated the effectiveness of medical leeches in give treatment to 19 patients suffering from ethnical leg sores . The whole number of leeches used in this work ranged from one to four and 2-20 sessions for each patient, rely on the region of the ulcers and their force . At the end of the study, they showed an improvement in the treatment of venous ulcers (25), Prakash et al also described the case of a patient with a history of leg ulcers for 16 months who had treatment with medical leeches (26). In a study to evaluate the preventive effects of leech treatment on cerebral ischemia, programmed cell death and neuronal necrosis were significantly reduced (5). Medical leeches were also used for several purposes, including the treatment of venous congestion in the epigastric flaps of mice (27), congestion of the glans penis (28), and disorders. Skin, diabetic ulcers and osteoarthritis (29-30), and in another study it was shown that treatment with medical leeches reduces the damage to testicular substance after warp due to its anti-inflammatory ,anti-oxidant and anti-apoptotic effects, as it can be believed beneficial treatment for testicular an inadequate blood supply and restoring the flow of blood to an organ or tissue, and protects testicular tissue From ischemic damage detorsion.(31). The anti-oxidant activity of leech saliva release was estimate by Ghawi et al (32). The presence of a well-known element in leech saliva is hirudin, which is an anticoagulant compound. It is a compound with a protein structure and contains 65 amino acids with a high level of glutamic acid and aspartic acid, and the effect occurs through adherence to thrombin in the blood (33). The preservative effects of parasite product on damage resulting from brain ischemia have been proven (5), and leech remedy can be used as ainterrelated treatment in patients with polycystic ovary syndrome, as it reduces ovarian swelling (34). Leech saliva helps in treating arthritis, and its saliva contains an anesthetic that reduces Pain It also contains a substance similar to histamine that acts as a vasodilator (36) and there are a number of material and compounds in its spittle that help decrease inflammation (35).

Situation for management of medical leech

- Once venous obstruction is recognize , written consent must be obtained from the patient before starting treatment with Hirudo (37), and it is important to notify the patient of the benefits and possible danger of handling of . Also, preventive treatment with antibiotics must begin before

treatment, as antibiotic prophylaxis is used against Aeromonas bacteria, which are commensal bacteria in leeches that lead to complications (38-39), as types of Aeromonas bacteria are susceptive of the second and third generation of tetracycline ,cephalosporins, trimethoprim, tetracycline, aminoglycosides and sulfamethoxazole.

- **Antihistamines should be prescribed (17).**
- However, Aeromonas bacteria are resistant to pencillin, ampicillin, and the first generation of cephalosporins and erythromycin (40-41), and treatment is carried out daily with an antibiotic at a dose of 500 mg of ciprofloxacin (42).

Contraindications to treatment with medical leech

- Hirudin causes blood to flow from the wound for 24 hours, which means that treatment with leeches may have side effects for patients with hemophilia or lack of blood clotting if they do not take the necessary precautions (37).
- Includes arterial inadequacy, anemia,hemorrhage, hemophilia, hematological malignancies, anemia, low blood pressure, and sepsis.
- Treatment with leeches is not bespoke during gestation and breastfeeding, in patients who suffer from an movable medicinal condition, those who have an allergy to leeches or a severe allergy and a tendency to form keloid scars, as well as in those who use anticoagulants and immunosuppressants (17).

Influence technique are split into six sorts to make them more easy to understand , but these techniques are carefully regarding to each other and should be estimated as a whole in Table (1).

Table 1. Probable bioactive materials in leech discharge.

Materials	The activity
Hirudin,50 , 49, 36, gelin,49 , 36 factor Xa inhibitor,49 , 43, 36 destabilase,49 , 36, new leech protein-1, whitide, and whitmanin5	Anticoagulant effect
Antistasin,43 , 36, 44 hirustasin,43 , 36 ghilantens,45 , 46 eglin C,36 LDTI,47 complement C1 inhibitor,48 guamerin and piguamerin,43 , 36 carboxypeptidase inhibitor,36 bdellins and bdellastasin,36 , 45	Analgesic and anti-inflammatory effect
Acetylcholine,43 , 36 histamine-like molecules50, 43, 36	Increasing blood flow
Hyaluronidase and collagenase49, 43, 36	Extracellular matrix degradation
Destabilase,49 , 36, chloromycetyn,49 , 43, 36 theromacin, theromyzin, and peptide B53, 54	Antimicrobial effect
Saratin,49 , 43, 36, 51 calin,49 , 43, 36 apyrase,49 , 43, 36 decorsin49, 43, 36, 52	Inhibition of platelet function

Conclusions

The findings of this study emphasize the therapeutic significance of *Hirudo medicinalis* in modern medicine, particularly in addressing venous congestion, cardiovascular diseases, wound healing, and osteoarthritis. The bioactive compounds present in leech saliva, including hirudin, saratin, and

hyaluronidase, demonstrate potent anticoagulant, anti-inflammatory, and analgesic properties, reinforcing their clinical applications in reconstructive surgery and complementary medicine. The evidence reviewed suggests that while leech therapy offers notable benefits, its use must be carefully regulated to mitigate risks such as infection and excessive blood loss. These findings imply that medicinal leeches can serve as an effective adjunctive treatment in integrative healthcare settings, particularly in cases where conventional therapies are limited. However, further research is required to establish standardized treatment protocols, optimize dosage and application methods, and explore novel bioactive compounds within leech saliva for broader pharmacological applications. Future studies should also investigate the long-term efficacy and safety of hirudotherapy through large-scale clinical trials, enabling its wider acceptance in evidence-based medical practice.

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