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The Manifold Therapeutic Applications of Leech (Jalouka) in Plastic & Reconstructive Surgery, Arthritis and Chronic Non healing wound wsr Sandhana Karma, Sandhigata Vata and Dushta Vrana – An Evidence Based Conceptual Review

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ABSTRACT

Leech therapy is experiencing revivification in health care today, primarily in pain management for knee osteoarthritis and in modern science in plastic and reconstructive surgery(Sandhana Karma) as a treatment of venous congestion which can threaten positive surgical outcomes. Similarly leech therapy in wound care is an emerging bio surgical entity which is assuring promising results in the treatment of chronic non healing wounds(Dushta Vrana). The first description of leech therapy, classified as bloodletting, was found in the text of Sushruta Samhita (dating 800 B.C.) .Diseases where leech therapy was indicated were skin diseases, sciatica, and musculoskeletal disorders like Arthritis (Sandhigata Vata)etc. Acharya Sushruta has mentioned Avsechana Karma or Raktamokshana as one of the important procedure in the treatment of Vranashopha. Leech therapy (Jallaukavacharan) is said to be of prime importance due to its multifold actions and indications being an anushastra ie a para surgical tool and which can be used in children, weak persons or in the absence of surgical instruments. Such is the legacy of bloodletting by leech in Ayurveda. It has been observed that post graduate & under graduate students and paramedical staff have had no formal training in administering the therapy or in maintaining the medicinal leeches i.e. Hirudo medicinalis, the species of freshwater amphibian worm used therapeutically. Yet students and paramedical staff are expected to participate in this therapy in a variety of clinical settings, in variety of diseases, and hence can use the guidelines given in the article for the safe and effective use of the leeches in treatment.

Introduction

Purpose

After reading this article, students and the paramedical staff will be able to-

❖Discuss the evolution of and the indications, contraindications, and precautions associated with leech therapy.

❖Summarize the characteristics and behavior of leeches

❖Plan appropriate interventions for patients undergoing leech therapy.

Although the patients who got relief with leech therapy in any forms admitted to having been "a little frightened" at first, the ultimate outcomes like pain relief, flap revivals or survival of digits, wound bed preparation and wound healing has made them advocates of this reemerging therapy. Of course, leeches were used in ancient India since the time of Suhrutacharya(800 B.C.) and were used for bloodletting since ancient times in Egypt, it reached zenith in the early 19th century.[1] But after that, leech therapy waned and was not in much use for some period; until the second half of the 20th century that medical journals began reporting the judicious use of the leech to aid in the post-surgery survival of tissue flap transplants.[2] Later since the late 90's the use of leeches in pain management in arthritis (Sandhigata Vata) and other inflammatory conditions of joints came into picture and got recognized.[3] Later use of leech therapy in the field of wound care serving wound healing and wound bed preparation (Vranashodhana) started getting foundation.[4]Since then, a rebirth has occurred to this Para surgical tool i e, Leech(Jallauka).

In a 2003 survey of 62 plastic surgery units in the United Kingdom, 80% had used leech therapy in the previous five years for postoperative "salvage of compromised free flaps or digital transplants.[5] Leeches are used to reduce that congestion by removing blood that can't exit via the venous system.

Since the year 2000, articles have been analyzed which supports leech use in relieving pain in patients with arthritis like conditions of the knee and other joints and other musculo-skeletal disorders like sciatica, traumatic neuritis, sprain, arthralgia etc.[6] Recent researches suggests that leech therapy plays a pivotal role in treating other conditions like Cellulites, Dermatitis, Thrombophlebitis, Deep vein

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thrombosis, Purpura fulminans, Peri orbital hematoma, Perianal hematoma, Sublingual hematoma, Systemic lupus erythematous, and ear infection.[7]

Since the year 2002, 30 articles have been revived on treating wounds with Leeches, Leech therapy has been estimated to promote healing in an infected wound that's resistant to antibiotic therapy. It indicated that leech therapy relieves stasis in the contaminated wounds thus relieving infection, reducing exudates, facilitating bio debridement of the wound bed and promoting wound healing.[8]

Leech Therapy: An Overview

The leech is a freshwater amphibious worm, usually black or brown and about 10 cm in length. Of the more than 650 known species in the Hirudo genus, Hirudo medicinalis is used most often in medical therapy. The mouth of the leech has three jaws, each of which has about 100 tiny teeth. It also has a posterior suction device that it uses for stability.[9]

According to Acharya Sushruta, there are two types of Jallaukas (Leeches): [10]

- Savisha (Poisonous)
- Nirvisha (non-poisonous)

Each group containing six subtypes

Features of Savisha Jalouka –Table no- 1[11].

Sr. No	Savisha Jalouka	Features of Savisha Jalouka
1	KRISHNA	Resemble in black colour, Thick
2	KARBURA:	Resemble the fish of vermin type. Ventral surface is convex (Ayata).
3	ALAGARDA:	Thick Hairy Round at sides Black at the mouth
4	INDRAYUDHA	Having different colours like rainbow Number of linings on the body
5	SAMUDRIKA .	Blackish yellow with dotted skin
6	GOCHANDANA	Narrow mouth Marked by bifurcating lines. Bottom (end Part) like the scrotal sac on a bull.

Of these, Savisha Jalloukas (Poisonous Leeches) are not indicated to treat the patiemts. Practically the leeches who are bigger in size and take more time to suck blood give burning sort of pain after wards at the site of bite for 1 to 2 days,can be said to be poisonous. No other poisonous reactions are noted.

Features of Savisha Jalouka Bite

If Savisha Jalouka is applied then a person suffers from following clinical symptoms:

1. Burning
2. Itching
3. Swelling
4. Drowsiness
5. Fever
6. Delirium
7. Unconsciousness
8. Death. [12]

But, in practice, it has been found that, only burning, itching and slight swelling are reported by some patients after leech bite and drowsiness, fever, delirium, unconsciousness and death are not reported by any patient or noted after leech bite. So it can be stated with experience that mild degree of toxic symptoms is reported but not of severe nature in real life.

Nirvisha Jalouka

Nirvisha Jalouka originates in decomposed vegetable matter, as the purified stems of the several aquatic plants known as Padma, Utpala, Nalina, Kumuda, Pundarika and common zoophytes, which live in clear water.[13]

Habitat: Such Jaloukas swim about in sweet scented water, live on, nonpoisonous weeds, lie on the leaves of flowering water plants inspite of on the dark and oozy beds of pools and suck blood from the affected part of a human being without causing any discomfort.[14]

General characters of Nirvisha Jalouka: Such types of Jaloukas are characterized by following points, [15]

1) Strong and large bodied.
2) Ready suckers
3) Greedy

Table. 2 - Features of Nirvisha Jalouka: [16].

Sr,no	Nirvisha Jalouka	Features of Nirvisha Jalouka
1.	KAPILA	Colour like Manashila at the sides Dorsal surfaces are slimy and colored like Mudga pulse
2	PINGALA:	Colour – Reddish Shape – Round Locomotion – Speedy
3	SANKUMUKHI: .	Colour – blackish red like that of liver. Provided with the greatest swiftness
4	MUSHIKA:	Colour – like the common blind moles Emit a foetid smell from the body
5	PUNDARIKAMUKHI:	Colour – like Mudga pulse. Presence of resemblance of the mouth of the full blown lotus lilies
6	SAVARIKA	Marked with impressions like lotus leaves. Measured eighteen fingers in length. Directed to apply only in the lower animals.

Nirvisha jalloukas (nonpoisonous leeches) are used for leech therapy. Practically,from the above description,it can be stated that,Hirudo medicinalis has strong resemblance to Pundarikmukhi jalouka.

Table. 3-Leeches Description.

Kingdom	Animals
Phylum	Annelida
Class	Clitellata
Order	Hirudinea
Family	Hirudinadae
Genus	Hirudo
Species	H.Medicinalis,

There are many other species of leeches in medicinal use. In Asia H. Manillensis is used for treatment and in Europe H. Medicinalis is used for treatment. Along with this other

species like H. Verbana, H. Orientalis are also used for treatment purpose.[17]

Leech therapy involves an initial bite, which is usually painless (it's thought that leech saliva contains a mild anesthetic);an attachment period lasting 20 to 45 minutes, and a peristalsis like movement is observed on its body surface, during which the leech sucks between 5 and 15 mL of blood; and a post attachment period, during which the site continues to bleed.[18] The final stage provides the primary therapeutic benefit; it's caused by components in the leech's saliva, including hirudin, a protein anticoagulant that inhibits thrombin in the clotting process, as well as histamine-like substances that induce vasodilation. The therapeutic effect is not from the 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, anti-inflammatory, and vasodilation properties of the secreted leech saliva.[19]

The first medicinal leeches were obtained from streams and rivers, but today they're purchased from local vendors that get n cultivate leeches which function as leech farms. It's advised that leeches be stored at a temperature (42[degrees] to 45[degrees] F [5[degrees] to 7[degrees]C] in "leech mobile homes" containing distilled water or even tap water; some recommend changing the solution every other day.[20]

Patient Assessment

Leech therapy in plastic surgery and skin grafting (Sandhana Karma)

Before leech therapy begins, a thorough assessment of the patient should be performed. Also, the attending person (Pg students, nursing staff etc) should be able to differentiate between arterial insufficiency and venous congestion. In arterial insufficiency, the tissue is pale, turgid, and cool to the touch; capillary refill is either slow (longer than two seconds) or absent. The tissue in venous congestion will have a purple appearance and be engorged, taut, and warm to the touch. Capillary refill will be brisk and instantaneous (less than one second). Although leech therapy may alleviate venous congestion, it's contraindicated in the presence of arterial insufficiency.[21]

LeechTherapy in Knee Arthritis (Sandhigatavata)-

In the conditions of inflammation of knee joints like in arthritis, the joints should be assessed for signs of inflammation and pyogenic arthritis should be ruled out. Hence if any joint with swelling is observed, fluctuation test should be performed which may or may not be negative. Pain swelling, redness, tenderness, degree of flexion and walking effect should be the assessment criteria to study the response to treatment. Hence it can be stated that leech therapy is indicated exclusively in inflammatory conditions of jointsand.[22]

While treating a Chronic non healing wound (Dushtavrana) with leech therapy for wound bed preparation, the agendas to assess should be size, shape, depth, the granulation tissue, discharge and odor. Wound bed preparation is the management of a wound in order to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures.[23] If the wound is infected, and patient is having these alleviated signs and symptoms, then T.I.M.E. principle of wound management should be followed. ,that summarizes the four main components of -1)Tissue management 2)Control of infection and inflammation 3)Moisture imbalance 4)Advancement of the epithelial edge of the wound. The TIME framework is a useful practical tool based on identifying the barriers to healing and implementing a plan of care to remove these barriers and promote wound healing. In a chronic wound, debridement is often required more than once as the healing process can stop or slow down allowing further devitalized tissue to develop, hence to advance healing of wound and to promote formation of wound bed leech therapy is advocated as a biotherapy facilitating biological debridement. The contraindications are malignant ulcers, Tubercular ulcers, Syphilitic ulcers, lepromatus ulcers, Patients having history of bleeding disorders, Burns.[24]

The medical person should also ask the patient whether she or he is taking vitamins, herbo- mineral supplements, or drugs; some of which may increase the risk of excessive bleeding or reduced immune response. For example, large doses of vitamin E can prolong prothrombin time, cause coagulopathy, and suppress immunity. Herbal supplements such as garlic, ginger, gingko biloba and dong quai (chinese medicine),and ginseng, and medications such as aspirin, heparin, warfarin, and non-steroidal anti-inflammatory drugs may increase the risk of hemorrhage.[25,26]

Caffeine (found in coffee, tea, some sodas, and chocolate) must be eliminated in order to decrease the risk of vasoconstriction. Smoking (and even exposure to secondhand smoke) is absolutely contraindicated because the carbon monoxide and nicotine in tobacco are potent vasoconstrictors.[27]

Contraindications

Leech therapy should not be used in patients who are immunocompromised, those with bleeding disorders such as hemophilia, and those with preexisting arterial insufficiency; all of these conditions pose an extreme risk of infection or excessive blood loss. A patient who is severely anemic and a patient's refusal to accept blood transfusions is another contraindication, as is unstable medical status. And of course, patients who refuse leech therapy should not receive it.[28]

Patient education

Few patients are not willing to have contact with leeches without understanding the benefits of treatment. This issue is usually overcome with educating the patient with the usefulness of the slimy parasite. The superiority of leech therapy over other available treatment options should be highlighted. Leeches should not be handled with instruments**.** Rather, handling the leeches easily, calmly and friendly like pets in front of patients also makes the patient feel good about leech therapy making them forget about the squeamishness of the worm.

Initiating Therapy

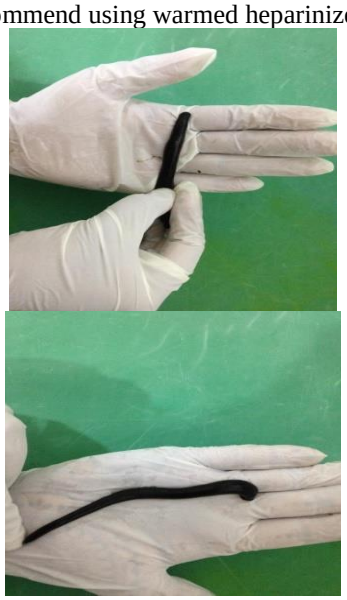
An order for leech therapy should contain the following information:

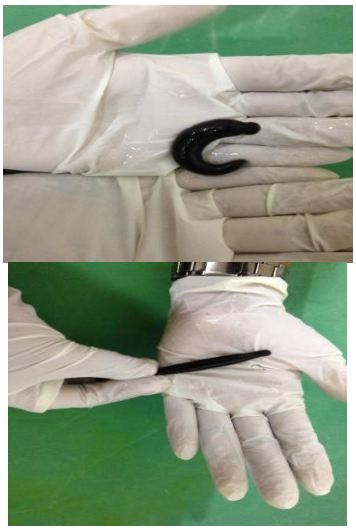
- ❖the number of leeches to be applied
- ❖the specific placement of the leech or leeches
- ❖the frequency of the therapy

In addition, orders often include antithrombotic such as aspirin, heparin, or low-molecular-weight dextran (dextran 40; others) to decrease the risk of venous thrombosis. The physician may also prescribe chlorpromazine (Thorazine) for its specific vasodilation effect on small blood vessels[29]

Attaching the leech

Before attaching the leech, wash the area with water and rinse it with distilled, non-chlorinated water; Whitaker and colleagues recommend using warmed heparinized saline.[30]





Images displaying Handling of leeches like pets

Wearing gloves, gently grasp one leech. Use of forceps should be prohibited as we've found that this can injure the leech. It's helpful to have a small, dry gauze pad in the nondominant hand because the leech may attach itself to a wet glove and can be difficult to remove because it is wet; dry gauze allows you to gently grip the leech and pull it off the glove and direct the head toward the therapy site.

There are several ways to encourage attachment. One is to use a syringe to direct the leech to the site. Remove the piston from a 5- or 10-mL syringe, place the leech in the barrel, and invert the barrel, holding the open end in place until the leech attaches. The head, the smallest part of the leech, should attach first. Gently withdraw the syringe, allowing the other end of the leech to come free and attach.[31] Leeches usually attach with both ends placed closely together in a U shape. If the leech resists attaching, encourage it by placing a drop of glucose or sucrose at the desired site. Leeches are attracted to the sweet taste. Alternatively, gently prick the patient's skin with a sterile needle at the desired site so that a drop of fresh blood appears. Sometimes, it is observed that merely placing the leech over the affected site with 2 or 3 wet cotton pads over it facilitates its attachment without disturbance.

Additionally, leeches can move from the desired treatment site to another, an action often called "leech migration" in the literature. One of the simplest ways to prevent migration is to wrap the treatment area with gauze and leave only the desired attachment site exposed-creating a sort of "leech corral." A clear, occlusive dressing (such as those used to cover IV insertion sites) can also be used to cover the area, with a small hole cut in the center that is large enough to allow the leech to attach. A plastic cup is another solution.[32,33] The cup can be used in two ways; in both a hole large enough for the leech to have access to the site of attachment is cut into the base of a clear plastic cup. For digits with venous congestion, a slit is cut up the side of the cup and it is placed around the gauze-wrapped digit. For flaps, the cup is placed over the desired site and covered with transparent stretch film secured with strips of tape. The leeches will attach to the flap through the hole.

VID-20180729-WA0025 (1).mp4

Video displaying blood sucking and peristalsis movement on Leech body surface

Monitoring Leech Therapy

Monitor the site at least every 10 minutes to check for detachment and ensure that the leech hasn't migrated. If the latter does occur, don't forcibly remove the leech. Force could cause the teeth to be left in the patient, becoming a source of infection. Instead, put a small amount of turmeric powder at site of leech bite or, some say alcohol, saline, or vinegar on a pad or a cotton swab and stroke the head of the leech. This will usually cause spontaneous detachment.[34,35] Be careful to use only minimal amounts of these liquids, however, because they're noxious to the leech, and large amounts may cause it to regurgitate into the bite site, increasing the risk of infection.[36]

During leech therapy, it's common to measure and record skin temperatures every three hours, with the goal of keeping the temperature of the area at or above 86[degrees]F (30[degrees]C), or as indicated in a physician's orders (David Zehr, MD, written communication, January 27, 2009). A reduction in temperature below 86[degrees] F may indicate problems with either arterial or venous circulation and should be reported immediately to the physician. Keeping the room temperature slightly warm and the surrounding area wrapped lightly in gauze and a light blanket can also help in maintaining the desired therapeutic temperature. These coverings should not be tight enough to restrict circulation and are usually removed only during assessment or while measuring temperatures or changing dressings. This is a specific indication for post plastic surgery, or post digit revival surgery leech therapy.[37]

Leech therapy on chronic non healing wound and arthritis like conditions require patient and other conditions at normal room temperature.

Post leech Therapy Patient Assessment

The medical person should perform a detailed evaluation of the site at least every four hours, assessing the appearance of the patient's skin for signs or symptoms of infection and checking nearby pulses.[38] Baseline laboratory values should also be checked, including a complete blood count, partial and Prothrombin time. The physician should be notified of abnormal values such as a drop in the hemoglobin level or hematocrit, increased bleeding times, or changes consistent with infection or risk of infection.

When the leech detaches, satiated leeches usually detach spontaneously. Feeding times vary; researchers have reported feeding times ranging from 20 to 120 minutes.[39]

Generally, a single leech will extract 5 to 15 mL of blood during each attachment. The greater benefit of leech therapy is the blood loss after the detachment, because of the slow oozing at the site of the bite.

After use, the leech should be destroyed by placing it in 70% alcohol solution. Many nurses use a small plastic cup with a screw-on lid, such as a urine specimen container, with 20 mL of alcohol. The leech dies within 10 minutes and is then treated as bio hazardous waste, disposed of in an appropriate waste receptacle. Because of the risk of blood-borne infection, the leech should never be reused on another person.[40] Nor is it useful to reuse a leech on the same patient: after feeding leeches usually don't want to feed again for several weeks.

Leech therapy is commonly required for three to seven days or until angiogenesis (new blood vessel formation) occurs. Success will be evidenced by changes in the tissue-it will change from a purplish or darkish hue to a more normal skin color, from engorged to non-engorged, and from a very fast capillary refill (less than one second) to a more normal

one (one to two seconds).[41] Once angiogenesis is established, the tissue will have sufficient venous drainage and no longer require therapy. As long as venous congestion persists between leech applications, therapy should continue.

Similar are the rules for inflammatory conditions of joints where the redness and swelling over the joint is remarkably reduced and patient tells significant relief in pain.[42]

Patients of chronic non healing wound gives significant results with formation of wound bed by reducing discharge from the ulcer base, formation of healthy granulation tissue, reduction in undermining of edges, and reduction in inflammation at the ulcer site, thus facilitating wound bed preparation.[43]

During leech therapy, remember to document the estimated blood loss; the appearance of the site before and after leech application;[44] the time, location, and duration of each leech application; any significant hematologic laboratory results; patient education and the patient's response to therapy; and the presence of signs or symptoms of infection.

Complications

Excessive bleeding

Bleeding can occur with leech therapy; it can be controlled by applying direct pressure, limb elevation or topical thrombin. Excessive blood loss may necessitate blood transfusion, so patients should be informed of the possibility.[45]Allergic responses, including anaphylaxis, can also occur. Patients and their families should be alerted to watch for and report allergy symptoms. Scarring may also occur but is usually minimal.

Infection

The most serious complication of leech therapy is infection. The leech's digestive system contains Aeromonas hydrophila, a Gram-negative bacillus that enables the breakdown of ingested blood. Although most infections involving leech therapy are caused by A. hydrophila, infections with Serratia marcescens, A. sobria, and Vibrio fluvialis have been reported.[46] Infections can arise from 2 to 11 days after therapy begins and can result in abscesses and cellulitis, which can progress in some cases to sepsis.[47] In a five-year retrospective study, Sartor and colleagues found that infections arose in 4.1% of patients who received leech therapy.[40] Prophylactic antibiotics are usually given: double coverage (two antibiotics) during therapy and single coverage (one antibiotic) for two weeks afterward.[48]Established infection is treated with antibiotics such as third-generation cephalosporins,along with aminoglycosides, fluoroquinolones, tetracycline, or trimethoprim.[49] Because infection is a serious adverse effect of leech therapy, the patient and family should also be instructed to observe for and report early signs and symptoms.

Conclusion

From the whole of the above description of leech therapy it can be concluded that medicinal leeches are used in medical practice since antiquity and it can be used in various surgical diseases right from cysts, tumors, cellulites to abscess, musculoskeletal disorders, and this article highlights the judicious use of leech therapy in certain specific diseases like chronic non healing wounds, arthritis affecting the knee joints and plastic and reconstructive surgeries with élan,. Selection of patients in the triad of diseases requires certain criteria to be fulfilled which are highlighted in indications and contraindications. Application of leeches should be done with expert hands and with the standard precautions to be taken while applying the leeches. After the leeching is over .it should be vomited of the blood with some turmeric powder sprinkled over it. All these procedures require exposure to patients' blood and hence should be done with utmost care. Pre and post leech therapy patient assessment should be done properly with patient's general condition assessment, Pathological investigations like Hb%, Tlc, Dlc, ESR, HIV, Hbsag, PT should be done as baseline investigations in every patient prior to leech therapy. Leech can be applied in a patient who is retro virus positive with all the universal precautions and the single use fundamental is advocated in every patient in this article. Leech therapy may induce complications like infection and abscess formation in some patients but in practice burning sensation around the bite area and later on itching were the commonly observed side effects. No patient with symptoms of infection was reported. It was found that once the patient understands the benefits of leech therapy, they demand for this one of its kind biotherapy for its uniqueness in rendering pain relief, wound healing effect and acceptance of grafts. Further studies on large number of patients are required for more accuracy of results.

In this way this article is a sincere attempt to sensitize the post graduate students and the other para medical staff about the behavior of leeches, its availability, the technical aspects, handling, leeching process and care of the leech and patient care post leech therapy. The article is provided with ample of photographs on the said diseases, leech behavior and handling, and a video displaying the peristalsis movement in the body of leeches while sucking blood. Similarly the retrospective study revealing the positive outcome measures in this article makes the students understand the conceptuality of leech therapy in the diseases ie Arthritis in knee joints, the students will have confidence level boosted up after having a novel treatment approach in wound care while treating Chronic non healing Wound and Plastic and reconstructive Surgery. I do accept that this is the conceptual and retrospective study on a small sample and may require further elaborations in the field of leech and its multifold functioning, but I am sure this is definitely going to help the researchers and scholars to go in this field with the scientific knowledge brushed up than before, with the evidence based data. Hence this is a sincere attempt to establish concepts as a landmark study on the standardized approach on performing the traditional leech therapy with a more scientific approach rendering aspired results.

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