

## Medicinal Leeches and their Therapeutic Applications.

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### Abstract:

The blood-sucking annelids, leeches have been used for therapeutic purposes since the beginning of civilization. Ancient Egyptian, Indian, Greek and Arab physicians used leeches for a wide range of diseases starting from the conventional use for bleeding to systemic ailments, such as skin diseases, nervous system abnormalities, urinary and reproductive system problems, inflammation, and dental problems. Recently, extensive researches on leech saliva unveiled the presence of a variety of bioactive peptides and proteins involving antithrombin (hirudin, bufrudin), antiplatelet (calin, saratin), factor Xa inhibitors (lefaxin), antibacterial (theromacin, therozymin) and others. Consequently, leech has made a comeback as a new remedy for many chronic and life-threatening abnormalities, such as cardiovascular problems, cancer, metastasis, and infectious diseases. In the 20<sup>th</sup> century, leech therapy has established itself in plastic and microsurgery as a protective tool against venous congestion and served to salvage the replanted digits and flaps. Many clinics for plastic surgery all over the world started to use leeches for cosmetic purposes.

**Keywords:** Bloodletting, cardiovascular diseases, hirudin, leech, microsurgery.

### Introduction:

The leech has been used extensively among people for bloodletting since ancient times in the treatment of various disorders. *Hirudo medicinalis*, has also proven effects in medicine and pharmacology. Medicinal leeches secrete saliva containing about 60 different proteins. Baskova et al., (2004)

Amongst the blood-sucking organisms, leech is a distinct example of an invertebrate, which possesses a highly-developed mechanism by which they prevents blood clotting. Through centuries, leeches have attracted the attention of therapists who employed leech therapy for a wide range of diseases. For various therapeutic purposes, the European medicinal leech species, *Hirudo medicinalis*, also known as the healing leech was preferred by the majority of physicians compared to the American species, *Hirudodecora*, which can suck less blood due to a smaller and superficial incision on its prey skin, (Whitakar et al., 2004; Smith, 1833). In addition, many other species were also considered as medical tools, such as *Hirudinaria manillensis*, *Hirudo nipponia* Jung et al 1995, *Hirudo verbena*, *Hirudo orientalis*, and *Haementeria depressa*, (Chudzinski et al., 1958).

The scientific interest of leech continued as a result of Haycraft's researches that brought leeches back into the medical stream when he outlined for the first time the presence of an anticoagulant agent in leech saliva, which he called hirudin. Haycraft (1883) which was later isolated and identified by Markwardt who demonstrated its antithrombin activity. The effectiveness of leech saliva in cardiovascular diseases is the results of specific thrombin inhibitors, hirudin, which was first isolated from *H. medicinalis* and was shown to possess a potent inhibitory effect on both free and clot-bound thrombin. Furthermore, other thrombin inhibitors were identified from different leech species, (Walsmann, 1985; Markwardt, 1970). Another physician stated about the beneficial usage of leeches in the management of coronary thrombosis. Hirudin discovery was the motive for developing many new promising anticoagulants using recombinant technology methods. For example, two analogs, lepirudin, and desirudin have been approved by FDA and are currently in use under the trade names, Recludan and Iprivask respectively, (Sohn et al., 2001). Thus, hirudin became the drug of choice for patients with a disseminated intravascular coagulation syndrome (antithrombin III deficiency). Hirudin can be used safely in patients with platelet abnormalities or heparin-induced thrombocytopenia because it has no immune effects on erythrocytes. Furthermore, and unlike heparins, hirudin has a promising prophylactic activity in patients who are at a high-risk of developing cardiovascular events because it can hinder



thrombus growth due to its ability to block thrombin-fibrin binding. Consequently, it was reported that hirudin can reduce DVT, pulmonary embolism and the spread of venous thrombosis, (Markwardt, 2002) The effectiveness of leech therapy in combination with the traditional Unani herbal formulation was also assessed. It was observed that patients who received the combined treatment displayed less pain and stiffness with better working ability, (Zaidi et al., 2009). Other reports indicated leech therapy as an analgesic for ilio-sacral joints pain and cervicobrachialgia syndrome. The benefits of the treatment lie not in the amount of blood that the leeches ingest, but in the anti-blood clotting (anticoagulant) enzymes in the saliva that allow blood to flow from the bite for up to six hours after the animal is detached, effectively draining away blood that could otherwise accumulate and cause tissue death.

The present work summarizes the importance of leeches as a complementary source of medical therapy for a large number of ailments, including cardiovascular diseases (CVDs), plastic surgery, cancer and metastasis, diabetes mellitus (DM), and its complication and infection disorders.

## Material and method:

The present study was carried out on starved medicinal leeches weighing about 2.5 to 3 gm. Seven male and female volunteers from age ranged 20 to 50 years with weight ( range 54 to 80 kg.) were selected for the present study. Disinfected and starved adult medicinal leeches of similar size were applied to the fore arm volar surface of drug free male and female volunteers (n=7). The head (biting end) of the animal can be recognized by its searching movement, while the tail end is used mostly as a sucker for fixation. 1-mm deep incision is made on the finger tip of the volunteer. The length of time required for bleeding to cease is by using the stopwatch. The blood was allowed to flow freely, without squeezing the finger. After 30 seconds the drop of blood was collected at one corner of the filter paper without touching the skin to the paper. After 30 seconds. Step no. 3 was repeated. When bleeding ceased, the stopwatch was stopped and time was noted.

## Result and discussion:

In all the healthy male and female volunteers, before application of leech, bleeding time was measured by Duke's Method. All the volunteers were having normal bleeding time i.e. in the range of 1 to 5 minutes but after leeching significant prolonged bleeding time was noted in all volunteers. In all the volunteers, it was more than two hours with a maximum of four hours.

Hirudin forms a complex with thrombin, inhibiting its activity, resulting into bleeding for long time affecting the coagulation process. We have observed increased bleeding time and clotting time in all the volunteers who were applied with one and more than two leeches. However, prothrombin time remained unaffected.

It is a popular therapeutic practice throughout the ages for a wide range for diseases and it was applied as an unscientific home remedy by traditional therapists. Now a days, leech came back to the contemporary medicine with fewer applications, which were proven and supported by a huge 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. Hence, more efforts should be undertaken to optimize this utilization. More investigations are required also to assess leech efficacy and safety in the treatment of various diseases. The most common complication from leech treatment is prolonged bleeding, which can easily be treated, although allergic reaction and bacterial infection may also occur. hence it is suggested that utmost precaution should be taken during application leech with respect to size and number of leeches so that adequate amount of leech saliva is administered in venous blood.



## Conclusion:

Leeching is a popular therapeutic practice throughout the ages for a wide range of diseases and it was applied as an unscientific home remedy by traditional therapists. Now a day, leech came back to the contemporary medicine with fewer applications, which were proven and supported by a huge 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.

**Table 1.-**Alterations in Bleeding time (min/sec), clotting time (min/sec) and prothrombin time (sec) in male and female volunteers before and after applications of one leech.

| No. of volunteers | Bleeding time (min/sec) |          | Clotting time (min/sec) |         | Prothrombin time (min/sec) |       |
|-------------------|-------------------------|----------|-------------------------|---------|----------------------------|-------|
|                   | Before                  | After    | Before                  | After   | Before                     | After |
| 1                 | 3/15                    | 180/0**  | 7/10                    | 15/20*  | 11                         | 9     |
| 2                 | 2/20                    | 120/0**  | 5/10                    | 8/30*   | 10                         | 10    |
| 3                 | 3/00                    | 120/15** | 7/20                    | 12/00** | 9                          | 10    |
| 4                 | 2/00                    | 120/25** | 5/10                    | 13/00** | 10                         | 10    |
| 5                 | 3/20                    | 180/25** | 6/25                    | 10/12** | 12                         | 12    |
| 6                 | 2/20                    | 240/17** | 5/50                    | 15/00** | 11                         | 10    |
| 7                 | 2/25                    | 180/0**  | 6/30                    | 12/00** | 12                         | 12    |

\* $p < 0.005$ ; \*\* $p < 0.01$

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