

# [Effectiveness of leech therapy](https://assignbuster.com/effectiveness-of-leech-therapy/)

It has been estimated that there are about 60, 000 miles or more blood vessels within a human body where blood, gases and nutrients are being circulated. Any blockage of these vessels will cause blood congestion at the site and thus give rise to various vascular diseases. For instance, a congested coronary artery will cause heart attacks, and a congested carotid artery will cause strokes. Other common examples are inflammatory reactions, haematomas, deep vein thrombosis, and so on. Hidurotherapy, also known as the leech therapy, is an ancient remedy now being revived and evaluated scientifically, hoping that it could be a one cure for all these diseases and provide a much more effective yet safer treatment.

So, how a leech can cure and is it really more effective over currently used drugs in treating vascular congestion and related diseases?

The mechanism behind hidurotherapy can be simplified as such: when a leech bites a target, the patient will not feel much pain because its saliva contains special anaesthetics. It then starts its active feeding by sucking the blood. At the same time, the saliva which also contains various components that prevent the formation of blood clot at the wound and allow it to flow continuously for hours even after the leech has been removed. This situation is known as passive bleeding.

I have classified the leech treatment into 3 common types based on these effects of saliva contents and their applications.

## Type 1: Hirudin as an anticoagulant

It has been recognised that the acute coronary syndromes involving the atherosclerotic plaques or thrombus has direct connection to the thrombin in the blood. Thrombin triggers platelet aggregation and gives rise to fibrin clot formation. Intravenous heparin, aspirin, and anti-ischemic medications are the standard treatments provided by hospitals. Hirudin appears to have more advantages when compared to heparin. It can act independently while heparin works indirectly with anti-thrombin III as its cofactor. As a result of this, heparin is not effective when it comes to the fibrin clot that already has thrombin bounded to it.

In addition, platelet factor 4 or plasma proteins might neutralise the effect of heparin. Some patients might even develop thrombocytopenia, which affects 5 to 15 percent of the patient population. In such cases, hirudin is highly selective for thrombin and is not affected by peptides and enzymes in the blood. It binds with thrombin to form an inactive hirudin-thrombin complex and halts the conversion of fibrinogen into insoluble fibrin. Another highlight of hirudin would be its stability as its form can remain unchanged when it is removed from the body through urination.

Overdosage of hirudin is very rare, if such cases really happen, there is no antidote because no antagonists for it have been found. This would be the disadvantage of hirudin but its usage remains safe as long as the doctors prescribe living leeches according to standard recommendations.

In a research, patients with acute coronary syndromes were randomly given either intravenous heparin and hirudin placebo or hidurin and heparin placebo on a double blind basis. This led to the possibility of comparing the effect of hirudin and heparin in treating coronary syndromes and preventing deaths.

The outcome results showed that hirudin had significantly decreased the risk of death or myocardial infarction or reinfarction over hours of study compared to heparin.

In long term, hirudin still displays significant advantage over heparin in reducing the risk of death or myocardial infarction or reinfarction.

## Type 2: Removal of blood via active feeding and passive bleeding

Detached body tissues or limbs can be reattached, transferred or transplanted through modern reconstructive surgeries. Microsurgical techniques are being used to restore the blood vessels supplying blood and oxygen to the connecting tissues or limbs to enable their survival. However, often we see that after a complicated reconstructive surgery, venous congestion occurs at the connecting tissues due to the formation of blood clot after a venous outflow. Thus, the blood cannot be circulated and the tissue flap will eventually die off and is lost if the congestion prolonged.

It is then vital to remove excess blood accumulated at the site so that risk of cell death can be minimised. Moreover, it provides time for the ingrowth of new venous outflow from the surrounding normal tissues. Surgical revision is rarely possible or successful to fix the problem.

When venous congestion threatens a tissue flap, live medicinal leeches (Hirudo medicinalis) are placed on the congested tissue to remove excess blood. The application of medicinal leeches to a congested tissue flap reportedly increases blood flow within congested tissue directly via active feeding and indirectly by passive bleeding from the bite after the leech detaches. The continued passive emission of blood following leech detachment assists in the decongestion process. It is facilitated by the actions and interactions among different salivary secretions of the leech, and platelet aggregation inhibitors.

## Type 3: Effects of other substances in the leech saliva

As the leech saliva also contains anti-inflammatory and anaesthetics substances, the patient will feel no pain being bitten. This special effect attributes towards the treatment of diseases such as arthritis of the joint.

Although arthritis belongs to immunological disorder, the inflammation around the joints causes pain to the patients. Therefore, leech therapy might be useful in soothing the pain suffered with the anti-inflammatory and anaesthetics substances. A study designed by researchers from Germany’s Academic Teaching Hospital showed that one application of leeches to the area can reduce pain 60% for more than 60 days. Besides that, the results also showed that it is even more effective than Diclofenac. Diclofenac is a group of drugs that is commonly used to treat pain or inflammation caused by arthritis or ankylosing spondylitis by reducing the hormones causing such symptoms.[2]

There was also a previous leech therapy for knee osteoarthritis that gave significant pain relief for over a week “ differences for function, stiffness, and total symptoms remained significant in favour of leech therapy until the end of study and for quality of life until day 28”.

Ann Intern Med. 2003 Nov 4; 139(9): 724-30. Effectiveness of leech therapy in osteoarthritis of the knee: a randomized, controlled trial. Michalsen A, Klotz S, Lüdtke R, Moebus S, Spahn G, Dobos GJ.

## Alternatives

## Recombinant Hirudin

A leech’s saliva contains limited amount of natural hirudin, so the idea of mass hirudin extraction for treatments is almost impractical as this will multiply the cost. One possible solution to this is to synthesise a similar substance. Scientists have previously cloned the cDNA for hirudin and it is expressed in yeast. However, the resulting recombinant protein was found to be produced in the unsulfated form, which is known to have an at least 10 times lower affinity for thrombin than the naturally occurring tyrosine-sulfated hirudin.

Recombinant hirudin has been approved by United States’ FDA to be produced and applied commercially. It can be an alternative when living leeches are not available and the patient seems to develop intolerance against heparin. The dosage must be calculated properly in order to reduce the risk of side effects.

* Hirudin
* Heparin
* Recombinant Hirudin

Advantages

* Led to a very consistent anticoagulant effect over time, independently of the use of thrombolytic therapy, a feature that represents a practical advantage
* Inexpensive, performed well as an antithrombin agent in the current trial and should still be regarded as the standard therapy
* Demonstrable and consistant effect, especially on the rate of reinfarction, in the group of patients with acute coronary syndromes as a whole

Disadvantages

* Excessive usage will increase bleeding risk
* Not infrequently engenders an immune thrombocytopenia, which can result in serious thrombotic complications
* Small clinical effect

Table 1: Comparison between hirudin, heparin, and recombinant hirudin by means of advantages and disadvantages

## Hementin

Hementin is a unique secretion in the saliva of Amazon Giant Leech (Haementeria ghilianii). As shown in Figure 2, it inhibits the coagulation of blood differently with hirudin by breaking down the fibrinogen. Because Haementeria ghilianii does not belong to the order of Arhynchobdellida but Rhynchobdellida, therefore it was not recognised as medicinal leech. However, Maurice Moloney, professor of plant biotechnology at the University of Calgary in Alberta, Canada discovered that “ while hirudin prevents clot formation, hementin dissolves a particular kind of platelet-rich clot that can cause stroke and heart attack and against which clot busters like streptokinase and urokinase are ineffective”.[3]

## Mechanical Leech

A leech-induced skin wound on a congested fasciocutaneous tissue flap will bleed passively for a number of hours with 90 percent of blood emission within 5 hours after leech detachment. However, after 3 hours, passive blood loss averages only 2. 9 ml. Furthermore, increases of maximum surface perfusion only extend 8 mm from the leech bite during passive bleeding. As suggested by these prior results, passive blood loss from a single leech bite should not be relied on to sufficiently decongest an impaired tissue flap, even after a relatively large active blood meal. There is the potential, however, of augmenting passive blood loss volumes with the use of a mechanical device that facilitates the antithrombogenic environment of a congested tissue flap. Such a mechanical device may encourage increased tissue viability. Increases in blood loss volumes may translate into improved postoperative blood perfusion in congested tissue flaps, resulting in improved tissue flap viability and survival.

## Implications

Environmental, Economic: disposal, release to the wild, pollution, disrupts food chain, expensive for medical purposes, but lucrative for pharmaceutical industries

Ethical, Social: reject the chance giving better treatment for patients, risk of side effects (bleeding), fear, can be overcome by mechanical leeches

## Evaluation

## Conclusion

It can be seen that leech therapy is somehow more effective than modern drugs. However, it raises a few more questions like why we do not just extract the leech contents to treat the patients directly with it? I think it is because even though numerous studies and researches have been carried out, there are still some uncertain areas need to be recognised and solved. Besides that, the current situation allows us to avoid overdose of leech content…etc.