Original Investigation
Özgün Araştırma

Turkiye Parazitol Derg
DOI: 10.4274/tpd.galenos.2025.32559

Efficacy of Medicinal Leech Therapy in Diverse Clinical Applications: A Comprehensive Study from Azerbaijan

Çeşitli Klinik Uygulamalarda Tıbbi Sülük Tedavisinin Etkinliği: Azerbaycan'dan Kapsamlı Bir Çalışma

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Cite this article as: Farzali S, Yaraliyeva S, Huseynov F, Manafov A, Sağlam N. Efficacy of medicinal leech therapy in diverse clinical applications: a comprehensive study from Azerbaijan. Turkiye Parazitol Derg. [Epub Ahead of Print]

ABSTRACT

Objective: Hirudotherapy (HT), the therapeutic use of medicinal leeches, has been practised for centuries, and the interest in modern medicine has recently been renewed. This study evaluates the clinical outcomes of HT at Herba Medical Center in Azerbaijan between 2020 and 2024, focusing on its efficacy across 11 medical conditions.

Methods: A total of 181 patients were treated using disposable medicinal leeches (*Hirudo orientalis*) sourced from hygienic farms approved by Azerbaijan's Ministry of Ecology and Natural Resources. Treatment protocols were tailored to disease severity, with sessions scheduled daily, every 3 days, or weekly, depending on the condition. Success rates were calculated based on post-treatment examinations, patient feedback, and physician evaluations. Statistical analyses, including Pearson correlation analysis and paired t-test, were used to compare treatment success rates between conditions.

Results: The overall success rate of HT was found to be 82.68±29.25%. 100% success was achieved in the treatment of osteoarthritis pain (n=50), lipoma (n=8), Raynaud disease (n=3) and scleroderma (n=2). High success rates were also observed in thyroiditis (94.44%, n=18), Baker's cyst (80%, n=25), ear diseases (80%, n=10) and diabetic foot ulcers (80%, n=5). Moderate success was achieved in eye diseases (75%, n=20), and the lowest efficacy was observed in the treatment of varicose veins (33.33%, n=30). HT effectively relieved pain and improved symptoms. However, it was limited in reversing structural deformities (e.g., hallux valgus) or tissue loss (e.g., diabetic foot ulcers).

Conclusion: These findings suggest that HT may have broader indications. We propose that HT can effectively relieve pain, regulate blood circulation, and treat some chronic diseases with fewer side effects. Further and more detailed research is needed to understand the mechanism of this treatment method better.

Keywords: Hirudotherapy, leech therapy, traditional medicine, complementary treatment, pain management, chronic diseases

ÖZ

Amaç: Tıbbi sülüklerin terapötik kullanımı olan hirudoterapi (HT), yüzyıllardır uygulanmaktadır ve modern tıbba olan ilgi son zamanlarda yenilenmiştir. Bu çalışma, 2020 ile 2024 yılları arasında Azerbaycan'daki Herba Tıp Merkezi'nde HT'nin klinik sonuçlarını değerlendirerek 11 tıbbi durumdaki etkinliğine odaklanmaktadır.

Yöntemler: Toplam 181 hasta, Azerbaycan Ekoloji ve Doğal Kaynaklar Bakanlığı tarafından onaylanan hijyenik çiftliklerden elde edilen tek kullanımlık tıbbi sülükler (*Hirudo orientalis*) kullanılarak tedavi edildi. Tedavi protokolleri, duruma bağlı olarak günlük, 3 günde bir veya haftalık olarak planlanan seanslarla hastalığın şiddetine göre uyarlandı. Başarı oranları, tedavi sonrası muayenelere, hasta geri bildirimlerine ve doktor değerlendirmelerine göre hesaplandı. Koşullar arasındaki tedavi başarı oranlarını karşılaştırmak için Pearson korelasyon analizi ve eşleştirilmiş t-testi de dahil olmak üzere istatistiksel analizler kullanıldı.

Bulgular: HT'nin genel başarı oranı %82,68±29,25 olarak bulundu. Osteoartrit ağrısı (n=50), lipom (n=8), Raynaud hastalığı (n=3) ve skleroderma (n=2) tedavisinde %100 başarı sağlandı. Tiroidit (%94,44, n=18), Baker kisti (%80, n=25), kulak hastalıkları (%80, n=10) ve diyabetik ayak ülserlerinde (%80, n=5) de yüksek başarı oranları gözlendi. Göz hastalıklarında orta düzeyde başarı (%75, n=20) elde edilirken, en düşük etkinlik varis tedavisinde (%33,33, n=30) görüldü. HT ağrıyı etkili bir şekilde hafifletti ve semptomları iyileştirdi. Ancak yapısal deformiteleri (örneğin, halluks valgus) veya doku kaybını (örneğin, diyabetik ayak ülserleri) geri döndürmede sınırlı kaldı.

Received/Geliş Tarihi: 18.03.2025 **Accepted/Kabul Tarihi:** 13.08.2025 **Epub:** 19.08.2025

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Türkiye PARAZİTOLOJİ Dergisi

Sonuç: Bu bulgular HT'nin daha geniş endikasyonlara sahip olabileceğini düşündürmektedir. HT'nin ağrıyı etkili bir şekilde hafifletebileceğini, kan dolaşımını düzenleyebileceğini ve bazı kronik hastalıkları daha az yan etkiyle tedavi edebileceğini ileri sürüyoruz. Bu tedavi yönteminin mekanizmasını daha iyi anlamak için daha fazla ve daha detaylı araştırmalara ihtiyaç vardır.
Anahtar Kelimeler: Hirudoterapi, sülük tedavisi, geleneksel tıp, tamamlayıcı tedavi, ağrı yönetimi, kronik hastalıklar

INTRODUCTION

The therapeutic properties of medical leeches have been recognised for centuries, and the treatment method involving these creatures is known as hirudotherapy (HT). Historical evidence of this treatment dates back to ancient Egyptian hieroglyphs from 3500 years ago, where leeches were utilised for bloodletting. The practice continued through the Roman Period, with Galen (AD 130-201) using leeches for medical purposes. In the Middle Ages, leech therapy was popularised by Avicenna, who detailed the method in his work "The Law of Medicine" in the 10th century (AD 980-1037). The peak of leech therapy's usage was in the early 19th century (1825-1850) (1-6). In France, more than five million leeches were used annually for treatment in hospitals in the 19th century. While the practice declined in the 20th century, it has experienced a resurgence in popularity over the last 40 years (7).

HT techniques have a rich historical background and have recently garnered increased attention due to their potential mechanisms of action. The importance of medicinal leech species, the main actors in this treatment method, has also increased. Among the Hirudinea family, the European medicinal leech, *H. medicinalis*, stands out as a well-known member, having been utilised for therapeutic benefits in various medical cultures such as Arab, Chinese, Greek, and Roman since ancient times (8). Six medicinal leech species under the *Hirudo* genus are employed in the Eurasian region for therapeutic purposes (9). These extraordinary creatures can even be found in European pharmacies, and more than 300 HT clinics offer medicinal leech treatment in Germany alone (10). In particular 2004, the US Food and Drug Administration authorised medicinal leeches in plastic and reconstructive surgery (11). As a result, their adoption of HT has gained global momentum and led many countries to establish legal frameworks to regulate their use (12-15).

HT is a commonly utilised treatment for various conditions, including pain, circulatory system disorders, diabetic complications, and arthritis. Leeches secrete vasodilators like hirudin, calin, hyaluronidase, and histamine while feeding, preventing blood clotting, offering pain relief, inducing muscle relaxation, and modulating the immune response. Plastic surgeons favour using medical leeches to enhance venous blood circulation, particularly in replantation surgeries. Furthermore, surgeons acknowledge leeches as an efficacious approach to managing venous disorders, hematomas, and persistent wounds (16). The discovery of hirudin, a potent anticoagulant from leech saliva, and the identification of leech saliva's components have increased scientific interest in leeches (17).

Recent studies have provided robust evidence supporting the efficacy of HT in various medical conditions. For example, a meta-analysis by Lauche et al. (18) demonstrated that HT significantly reduces pain in knee osteoarthritis compared to placebo (19). Similarly, Flecken and Michalsen (20) reported that HT alleviates symptoms of chronic venous insufficiency by reducing venous congestion. In the field of plastic surgery, HT has been shown to prevent venous congestion in flap and replantation procedures, highlighting its versatility (13). However, the long-term effects and mechanisms of HT warrant further investigation, particularly through well-designed randomized controlled trials (21).

There are still some concerns about the use of medicinal leeches in HT applications. One of the most important concerns is whether the leeches used in HT are taken from hygienic medical leech farms. There are 11 medical leech farms in Azerbaijan for this purpose. In these farms, *Hirudo orientalis*, known as a Caucasian medicinal leech, is grown, and this leech species is widely used in leech treatment (22). Historically, medicinal leeches were employed in Azerbaijani traditional medicine within palaces and among the populace through HT, either solely with leeches or with cupping. This practice persists in specific clinics today (23). This study represents one of the first studies on leech therapy in Azerbaijan, providing baseline data for prospective studies. It aims to contribute to a deeper understanding of the mechanisms and applications of HT by analysing patient outcomes and success rates in 11 different medical conditions.

METHODS

This study was conducted at Herba Medical Center, which practices traditional and complementary medicine (TCM) in Baku, Azerbaijan. The study aims to analyse the health status data of patients who applied to the health centre and received medical leech therapy before and after treatment. The research covers data recorded between 2020-2024 and includes data on 181 patients treated.

No regulation is prepared within the framework of TCM practices in Azerbaijan. Hospitals and clinics that want to apply leech therapy can use it with the hospital's approval or if the physician decides on leech therapy. In this context, the results of this study include the clinical results of patients who agreed on HT by Herba Medical Center and the physicians of this clinic. Although Azerbaijan lacks a formal ethics committee system for TCM applications, efforts are being made to align with international ethical standards to enhance such studies' global acceptance and credibility.

Patient Selection and Data Collection

The patients evaluated in the study represent 11 different cases and diseases admitted to Herba Medical Center and treated with medical leech therapy. Each patient's treatment process was determined after a detailed anamnesis and physical examination. In this process, treatment parameters such as the area where the leeches will be applied, the number of sessions and the number of leeches to be used are planned according to the patient's specific needs. A treatment protocol specific to each disease and patient was created and recorded. In addition to standard treatment protocols, patient feedback regarding pain relief, symptom improvement, and overall satisfaction was recorded to provide a holistic understanding of HT outcomes. The success rate of the applied leech therapy on the disease was calculated proportionally by rating it according to the feedback of the patients, their healthy participation in daily life and the evaluations of our physicians.

Supply and Use of Medicinal Leeches

The leeches used in the treatment were obtained from medical leech farms approved by Azerbaijan's Ministry of Ecology and Natural Resources for cultivation under hygienic conditions. The leeches used were disposable for each patient and were not used in other patients. The used leeches were first anaesthetised in 10% alcohol for 30 minutes and then euthanised in 70% alcohol and disposed of as medical waste.

Treatment Protocols

Treatment sessions were planned according to the severity and progression of each condition. Sessions were organized at intervals of daily, every 3 days, every 7 days, or every 10 days, depending on the disease. For chronic conditions, treatment was repeated every 3, 4, or 6 months. The number of leeches applied per session ranged from 1 to 12, depending on the condition's type, size, and severity. Detailed protocols for each condition are outlined below:

Osteoarthritis: In this study, 50 patients with osteoarthritis of the neck, waist, and shoulders were treated using leech therapy. Each patient received 14 sessions, divided into two periods of 7 sessions each, with a 4-month interval between periods. For neck and lumbar osteoarthritis, 12 leeches were applied per session, distributed evenly across the neck, waist, and back (Figure 1A). Similarly, 12 leeches were administered around the shoulder area in each session for osteoarthritis. Thus, each session involved 12 leeches, resulting in 84 leeches per treatment period (Table 1).

Varicose veins: Thirty patients with varicose veins sought treatment at the health centre. After confirming the absence of anaemia and low blood pressure in all patients, 16 sessions of leech therapy were administered, divided into two periods of 8 sessions each, with a 6-month interval between periods (Figure 1B). In both periods, sessions were conducted weekly. During each session, 9 to 12 leeches were applied, with the total number of leeches used in each treatment period ranging from 72 to 96, depending on disease severity (Table 1).

Baker's cyst: A total of 25 patients with Baker's cyst were treated with leech therapy for 6-8 sessions, depending on the severity of the disease. For treatment, an average of 5 leeches (4-8 leeches) were applied around the cyst formed behind the kneecap at 7-day intervals (Figure 1C). Thirty-fourty leeches were used for Baker's cyst treatment (Table 1).

Eye diseases: Leech treatment was applied to patients who applied to the health centre with complaints of glaucoma, macular disease, eye allergy, diabetic retinopathy and eye trauma. A total of 20 patients were admitted to the clinic with complaints of the above-mentioned diseases, at least two patients each. All patients were treated with leech therapy for nine sessions at 7-day intervals. In each session, 2-6 leeches were applied to the patients (Figure 1D, E). A total of 18-54 leeches were used to treat eye diseases (Table 1).

Inflammation of the thyroid gland: A total of 18 patients with thyroid gland inflammation underwent six sessions of leech therapy. Each session involved the application of 10 leeches, five placed around the salivary gland and five around the thyroid gland (Figure 1F). Over the course of the treatment, 60 leeches were used (Table 1).

Figure 1. Application points of medicinal leeches according to some diseases. **A)** Osteoarthritis, **B)** Varicose veins, **C)** Baker's cyst, **D)** Eye diseases (right), **E)** Eye diseases (left), **F)** Inflammation of the thyroid gland, **G)** Ear diseases, **H)** Hallux valgus, **I)** Lipoma, **J)** Diabetic foot ulcer, **K)** Raynaud's disease, **L)** Scleroderma

Table 1. Diseases for which hirudotherapy is applied in Azerbaijan include the number of patients, treatment protocols, and treatment success rates

Cases	Number of patients	Number of treatment sessions	Session frequency	Number of treatment repetitions	The time between the two treatments	The mean number of leeches in each session (± SD)	Treatment site	Positive result	Treatment success rate (%)
Osteoarthritis	50	7	7 days apart	2	4 months	12	Neck, Waist, Shoulder	50	100
Varicose veins	30	8	7 days apart	2	6 months	10±2 (9-12)	Varicose veins area	10	33.33
Baker's cyst	25	6-8	7 days apart	1	-	6±2 (4-8)	Behind the knee, the Baker cyst area	20	80
Eye diseases	20	9	7 days apart	1	-	6	Around the eyes	15	75
Thyroid gland inflammation	18	6	10 days apart	1	-	10	Salivary gland and thyroid gland surroundings	17	94.44
Ear diseases	10	7-8	7 days apart	1	-	7	Around the ear and neck	8	80
Hallux valgus	10	8	7 days apart	1	-	7	Toes and top of foot	-	0
Lipoma	8	6-8	7 days apart	1	-	5±2 (3-7)	Lipoma circumference	8	100
Diabetic foot ulcer	5	8-10	Every day	2	3 months	4.75±2.36 (3-8)	Junction area of necrotic area and healthy tissue	4	80
Raynaud's disease	3	6-8	3 days apart	1	-	3±2 (1-4)	Toes where the disease develops	3	100
Scleroderma	2	7	7 days apart	2	3 months	5	Damaged sub-district	2	100
General results	**181**	**6-10**	**1-10 days apart**	**1-2**	**3-6 months**	**6.11±3.44**		**159**	**82.68±29.25**

SD: Standard deviation

Ear diseases: Ten patients sought treatment at the health centre for various ear conditions, including external otitis, middle ear inflammation, and tinnitus. These patients underwent 7-8 sessions of leech therapy at weekly intervals. Seven leeches were utilised during each session, totalling 49-56 for treating ear diseases. Specifically, four leeches were applied around the ear, while three leeches were placed in the neck area, 2 cm below the ear-head junction (Table 1, Figure 1G).

Hallux valgus: In the research, ten patients diagnosed with hallux valgus underwent leech therapy, which consisted of eight sessions. The treatment involved the application of seven leeches on the toes at seven-day intervals (Figure 1H). A total of 56 leeches were utilised to treat hallux valgus (Table 1).

Lipoma: The eight patients diagnosed with lipoma underwent 6-8 sessions of leech therapy. The treatment involved applying 3-7 leeches around the affected area, depending on the severity of the condition, at weekly intervals (Table 1, Figure 1I).

Diabetic foot ulcer: A total of five patients presented at the health centre with complaints of diabetic foot ulcers. Each patient underwent 8-10 sessions of leech therapy, divided into two periods spaced three months apart. During each treatment period, 3-10 leeches were applied to the patients daily (Figure 1J). The total number of leeches used per treatment period ranged from 30 to 80, depending on the severity of the disease. Leech application targeted the junction points between necrotic and intact tissues. The number of treatment sessions was escalated until the colour transition between necrotic and intact tissues lightened (Table 1).

Raynaud's disease: In the study, three patients diagnosed with Raynaud's disease underwent 6 to 8 sessions of leech therapy. The treatment involved the application of 1-4 leeches to the affected areas, based on the disease's severity, with a 3-day interval between sessions (Figure 1K). This treatment regimen was repeated every three months until an improvement in blood flow

and the normalisation of skin colour in the affected area were observed (Table 1).

Scleroderma: Two patients with a diagnosis of scleroderma received seven sessions of leech therapy. The treatment involved applying five leeches around the hardened scar tissue at 7-day intervals (Figure 1L). Thirty-five leeches, given in sets of five per session, were used for treating scleroderma (Table 1).

Statistical Analysis

Statistical analyses were conducted to evaluate the efficacy of HT across different diseases. Descriptive statistics, including mean, standard deviation, and percentages, were used to summarize treatment sessions, success rates, and the number of leeches per session. The Pearson correlation analysis was used to explore the relationship between the number of treatment sessions and treatment success rates, identifying potential trends in treatment outcomes. A paired t-test was applied to evaluate the effectiveness of HT on pain management in different diseases. Pre-treatment and post-treatment pain scores were compared for each patient. Statistical significance was set at $p<0.05$-0.001.

RESULTS

In the study, 181 patients were treated using medicinal leeches for 11 cases and diseases. While a positive response was obtained in 159 patients, no result was obtained in 22. The average success rate of HT applied in 11 different diseases in the clinic was 82.68±29.25 (Table 1). Treatment results have revealed the need for personalised treatment protocols according to different diseases and the complexity of each case.

It is observed that the most common patients applying to the treatment centre have pain caused by osteoarthritis. As a result of the treatment used on 50 patients to relieve neck, waist and shoulder osteoarthritis pain, it was observed that the patients' pain started to decrease significantly from the first session. It was determined that all patients' pain disappeared entirely with the completion of the treatment sessions. It was determined that leech therapy was 100% successfully relieved osteoarthritis pain (Figure 2A).

Leech therapy applied to 20 patients with large varicose veins did not improve the dilation of the veins. It was determined that the vascular structure returned to normal in 10 patients with dark-coloured vascular structures in the capillaries. It was defined that HT was effective, especially in varicose capillaries and non-chronic cases (Figure 2A).

Baker's cyst, characterised by the accumulation of excess joint fluid in the bursa at the back of the knee, often leads to severe pain and circulatory issues over time. As a result of leech application within the protocol framework for this disease, it was determined that 20 out of 25 patients recovered completely, and the treatment success rate was 80% (Figure 2A).

Fifteen out of 20 patients with glaucoma, macular disease, eye allergy, diabetic retinopathy, blood leakage into the fundus of the eye and eye trauma recovered, and the success rate of leech therapy was 75% (Figure 2A). Three patients with macular disease and two patients with diabetic retinopathy did not get positive results from leech therapy in the clinic. Although the overall success rate was high, it showed potential difficulties in treating advanced or chronic vascular conditions in the eye with leeches therapy.

Successful results were obtained in 17 out of 18 patients who received leech therapy due to thyroid gland inflammation (thyroiditis), making the success rate 94.44% (Figure 2A). It was determined that the patient, without successful results, had chronic thyroiditis. The application of HT in different protocol combinations in chronic cases may give more positive results.

Eight out of 10 patients were cured with leech treatment for complaints of otitis media, otitis externa, and tinnitus. Positive results were obtained in three out of five patients treated for otitis media. While the success rate in the treatment of otitis media is 60%, 100% success has been achieved in tinnitus and otitis externa (Figure 2A). The general success rate of leech treatment in ear diseases was 80%.

Hallux valgus was determined that pain decreased in 8 out of 10 patients who received leech therapy for the disease, but no deformity improvement occurred (Figure 2A). Although an improvement in pain reduction was observed in these patients, leech therapy had no positive effect on deformation.

Improvement was observed in all eight patients who were treated for lipoma complaints. The success rate of leech treatment in lipoma is 100% (Figure 2A).

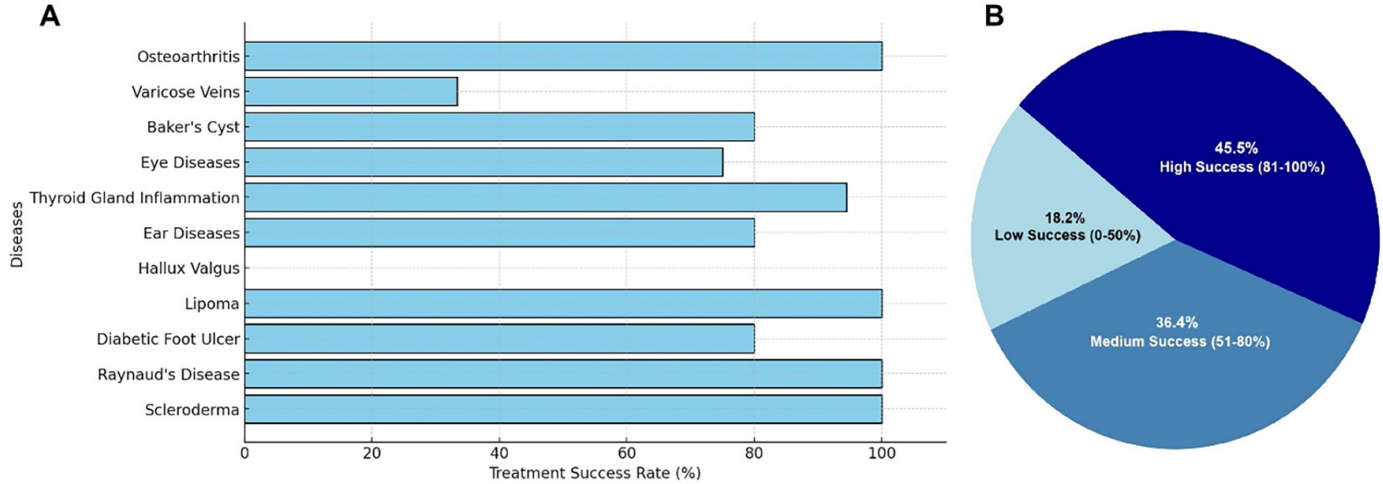

Figure 2. Success rates of hirudotherapy on a disease-by-disease and grouped basis. **A)** Hirudotherapy success rates by disease in Azerbaijan, **B)** Proportion of diseases by treatment success rate

Four out of five patients who applied with diabetic foot ulcer complaints had positive results from treatment with leeches. The success rate of leech treatment in diabetic foot ulcers was 80% (Figure 2A). While leech treatment was successful, especially in the initial stages of wounds, it was observed that leeches were insufficient in the treatment of chronic and enlarged ulcers. It was observed that although the abscess and necrotic structure healed, the tissue loss did not reverse.

Raynaud's disease is characterised by the formation of colour changes or bruising due to insufficient blood flow in the veins, especially at the tips of the pointed organs such as the toes, fingers and ear tips. In three patients treated with Raynaud's disease, 100% success (Figure 2A) was achieved by getting positive results from treatment with medicinal leeches.

In two patients, 100% success (Figure 2A) was obtained from leech therapy against scleroderma manifested by skin thickening. In both patients, it was determined that the skin thickening returned to normal after HT.

Leech therapy showed low success rate (18.2%) in two diseases (varicose veins and hallux valgus), moderate success rate (36.4%) in four diseases (Baker's cyst, eye diseases, ear diseases, diabetic foot ulcer) and high success rate (45.5%) in five diseases (osteoarthritis, thyroid gland inflammation, lipoma, Raynaud's disease, scleroderma) (Figure 2B).

Pearson correlation analysis revealed a weak and negative correlation between the number of leeches (Figure 3) used per session and treatment success ($r=-0.179$, $p=0.599$). This value shows that the increase in leeches does not significantly increase the treatment success and may even show a slight inverse relationship. Still, this relationship is not statistically significant ($p>0.05$). This result shows that the treatment success is not directly related only to the number of leeches; other factors, such as the type of disease, the patient's health status, and the applied treatment protocol, are also effective.

When the relationship between the total number of sessions applied for leech treatment and the success rate is taken into consideration, the success rate was observed at levels of 75% and above in diseases with an average of 7-8 sessions of HT. However, increasing the number of sessions did not always increase the success rate, for example, in the treatment of varicose veins, the success rate remained low despite 8 sessions (33.33%). This suggests that treatment success may be related not only to the number of sessions, but also to the protocol applied and the nature of the disease (Figure 4).

According to the paired t-test analysis results, a statistically significant decrease in pain levels was observed after HT treatment in osteoarthritis ($t=26.85$, $p<0.001$), varicose disease ($t=23.71$, $p<0.001$), Baker's cyst ($t=21.26$, $p<0.001$), thyroid gland inflammation ($t=18.39$, $p<0.001$) and ear diseases ($t=11.77$, $p<0.001$). These findings reveal that HT has a significant effect in reducing pain and can be considered as a potential complementary treatment method.

However, since sufficient patient numbers were not reached for other diseases, the change was not statistically significant. Therefore, supporting studies with larger sample groups are required. It reveals that HT is effective in pain management in some diseases, but it may not be equally effective for every disease.

DISCUSSION

Both clinical studies and case reports confirm the effectiveness of medicinal leech therapy in relieving pain (6,19,21,24-26). Leech therapy has been recommended in patients with knee osteoarthritis because of the decrease in pain after HT and few side effects after the procedure (6,18,20,27-29). In this study, the 100% success of HT applied against joint pain due to osteoarthritis reveals that leech therapy can be an effective method in managing and reducing or completely eliminating pain. Although no side effects were determined in HT for relieving osteoarthritis, pain shows similar results with Lauche et al. (18).

Many researchers have reported positive results from HT on varicose veins. In particular, it has been stated that it is effective in normalising the colour change in the vein structure, relieving pain, relieving inflammation and oedema (30-35). In a study conducted for the treatment of varicose veins in the lower legs, 8-10 leeches were applied to 20 patients every 10 days for 60 days, and the patients were followed up for one year to evaluate the effectiveness of HT. It was observed that leech therapy significantly reduced venous fullness by removing oedema, inflammation and venous congestion (32). In our study within the framework of our protocol, similar results were obtained with the research of Iqbal et al. (32). One study reported that ulcers entirely healed in 3 out of

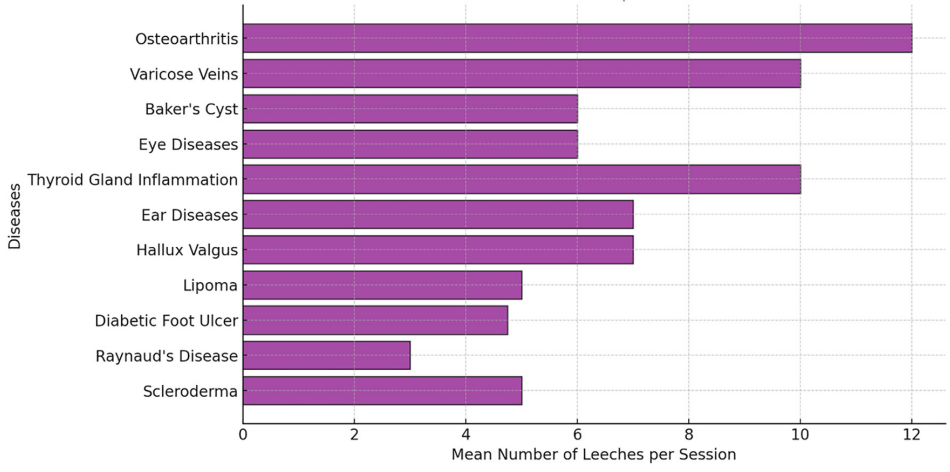

Figure 3. Average number of leeches used per session acros disease

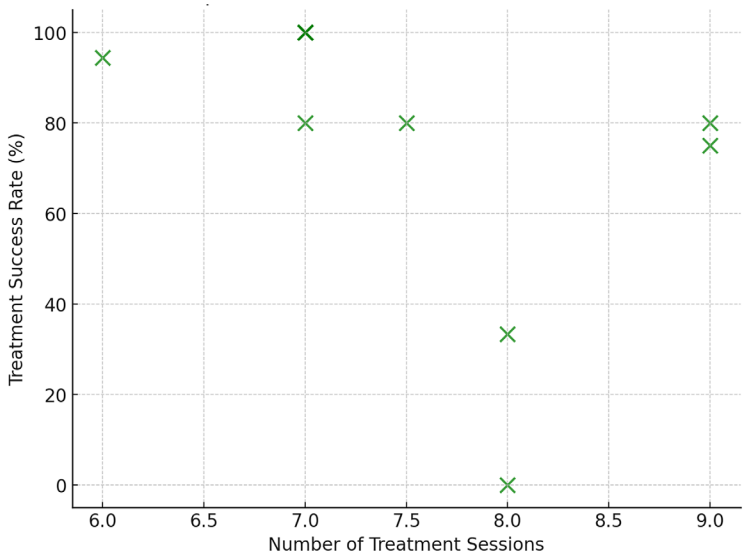

Figure 4. Relationship between number of sessions and success rate

4 cases against varicose vein ulcers, and significant improvements in other variables were also observed (36). Within the scope of this study conducted on varicose veins in Herba Medical Center in Azerbaijan, it was found that the symptoms of all 30 patients were visibly improved, primarily when the pain was eliminated. However, it was determined that the appearance of the veins did not return to its standard structure. HT studies on varicose veins have shown that similar results are generally obtained (20,36,37). Compared to similar studies conducted in regions like Eastern Europe and South Asia, the success rates observed in this study are consistent with findings on conditions such as osteoarthritis and varicose veins.

Clinical practice in patients with Baker's cysts has shown that leeches often significantly reduce cyst size and improve symptoms when application sites are used proximal to or directly above the cyst (20). In one study (38), five leeches were applied locally to the swelling in the popliteal fossa five times every ten days. It was observed that the cysts in all patients entirely resolved and did not recur even after two years of follow-up. In our study, the observation that the applications made directly on the cyst significantly reduced the pain and the size of the cyst in Baker's cyst patients and provided complete healing in some patients was similar to the findings of the researchers.

Excellent results have been obtained in treating severe periorbital haematoma with medicinal leeches (39). HT has been reported to be successfully used in many branches of ophthalmology, ophthalmosurgery, ophthalmo-oncology and emergency ophthalmology, including inflammatory diseases of the eye (keratitis, iridocyclitis, uveitis, etc.), traumatic injuries and vascular pathology of the organ of vision, cataract, glaucoma, etc. Moreover, in Eastern Europe, Russia and some South Asian countries (Indian subcontinent, Sri Lanka) HT is officially recognised as a classical alternative treatment for glaucoma (2,40,41). It has been reported that in cases where surgical treatment methods are insufficient to cure an acute glaucoma attack, HT may be the only way to save the eye (42). Just as researchers have successfully treated a wide range of eye diseases, successful results were obtained in this study for five different ophthalmological problems (glaucoma, eye allergy, blood leakage into the fundus of the eye and eye trauma), excluding diabetic retinopathy and macular disease.

It has been reported that Hashimoto's thyroiditis, an autoimmune disease, can be treated by using multiple TCM methods together, including HT (43). There are almost no scientific references for the treatment of thyroiditis disease with medicinal leeches. However, within the scope of this study, a high rate (94.44%) of positive results were obtained from the leech treatment applied to patients with thyroid gland inflammation (thyroiditis).

It has been reported that leech therapy has been used successfully in the treatment of tinnitus, acute and chronic otitis, outer ear and chronic ear diseases (42,44-46). This study obtained similarly successful results with leech therapy in acute and chronic otitis and otitis external. It has also been determined that leeches have significant effects after ear flap surgery (47) and in cases of tinnitus (1,46). This study also achieved significant success in patients treated with tinnitus complaints.

It has been reported that HT has successfully treated patients diagnosed with lipoma (48). This study, parallel to previous studies, achieved 100% successful leech treatment in 8 patients suffering from Lipoma.

This study obtained successful results in four out of five patients treated with leeches for diabetic foot ulcer disease. In one patient, it was observed that although the ulcer did not close completely, the wound became significantly stable, and the progression of the disease stopped. These findings were similar to many studies using HT against diabetic foot ulcer disease (3,49-52).

Raynaud's disease (53) is a disease characterised by colour changes or bruises due to insufficiency in blood flow in the vessels, especially in the tips of the toes, fingers, and the tip of the ear. Although no article was found on the effect of leech therapy against scleroderma, this study determined that skin thickening improved in two patients who received leech therapy.

Study Limitations

This study demonstrates the significant potential of medicinal leech therapy (HT) in treating various medical conditions, achieving high success rates, particularly in osteoarthritis pain, lipoma, Raynaud's disease, and scleroderma. However, the study also highlighted the limitations of HT, particularly in treating chronic and advanced conditions such as varicose veins and certain eye diseases, where the success rates were lower.

CONCLUSION

These results suggest that while HT can be highly effective, its efficacy may vary depending on the specific condition and the chronicity of the disease. The need for personalized treatment protocols tailored to individual patient conditions was evident, emphasizing the complexity and variability of responses to HT. Further research is necessary to explore the mechanisms underlying HT's effects and to optimize treatment protocols for broader clinical applications. This study contributes to the growing body of evidence supporting the use of HT as a complementary treatment modality, offering a promising alternative for managing pain and various chronic conditions with minimal side effects.

*Ethics

Ethics Committee Approval: According to Azerbaijani laws, an ethics committee approval certificate is not required since the study data are published with the patient's consent and are the results of clinical cases treated after the approval of Herba Medical Center management and physicians.

Informed Consent: All patients were informed about the purpose, procedures, potential risks, and benefits of medicinal leech therapy.

Footnotes

*Authorship Contributions

Surgical and Medical Practices: S.Y., F.H., Concept: S.Y., F.H., N.S., Design: S.F., S.Y., F.H., N.S., Data Collection or Processing: S.F., S.Y., F.H., A.M., N.S., Analysis or Interpretation: A.M., N.S., Literature Search: A.M., N.S., Writing: S.F., S.Y., N.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: No financial support was received to conduct this study, which used the infrastructure of Herba Medical Center in Baku, Azerbaijan.

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