

# Medicinal leech therapy in pain syndromes: a narrative review

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**Summary** Medicinal leech therapy is used in a variety of conditions; most of which have pain as a major symptom. Its mode of action relies on the injection of leech saliva into patients' tissues during the process of blood withdrawal. Leech saliva contains active ingredients with anti-inflammatory, thrombolytic, anti-coagulant and blood- and lymph-circulation enhancing properties. A specific analgesic substance within the leech saliva is yet to be identified. Pain relief from leech therapy is rapid, effective and long-lasting in many conditions. This review compiles studies and case reports that provide clinical evidence for leech therapy's analgesic effects.

**Keywords** Leech therapy · Hirudotherapy · Pain treatment

## Introduction

Leech therapy has a long and widespread tradition, as pharaonic tomb paintings (1500 BC), Sanskrit writings

(1300 BC) and classical Greco-Roman reports testify [1–3]. In medieval England, the term 'leecher' was used synonymously with 'healer'. By the mid nineteenth century, leeching had become so popular, especially in France, that it nearly eradicated leeches' natural sources. In its heyday, leeching was a popular form of therapy, used by ordinary people as well as by prominent citizens, such as George Washington and Napoleon Bonaparte, alike. Although leech therapy's use declined to near oblivion in Western society, in the interim, it has enjoyed an impressive resurgence in popularity since the 1970s.

In Europe, three species of medicinal leeches exist in the wild: *Hirudo verbana*, *Hirudo medicinalis* and *Hirudo orientalis* [4], with *Hirudo verbana* being the most common. *Hirudo verbana* is found in river deltas and reservoirs in Turkey, Romania and Serbia or as small scattered populations in Northern Europe.

Leech therapy has only recently been approved as a legal therapeutic intervention in Europe, with Germany having the most extensive legal guidelines in this area to date. The German Health Authority, which began the leech therapy approval process in 2005, published its legal guidelines in 2007 [5]. These guidelines improve leech therapy's safety significantly, mandating that medicinal leeches be supplied only by companies with pharmaceutical manufacturing authorization. Germany's pioneering role in this area appears linked to its dominance of the European leech market, with approximately 100,000 leech sessions corresponding to about 350,000 leeches used in Germany annually.

## Materials and methods

The literature search for this review was conducted using the PubMed/Medline database, as well as Google Scholar and Current Contents Med. It included randomised controlled studies, uncontrolled studies and descriptive case

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**main topic**

53 reports; focusing on results from studies that used well-  
54 established quantitative pain measurement instruments.

55 **Suggested mode of action of leech therapy**

56 Blood withdrawal during leech therapy is of prime  
57 importance in only a minority of indications, such as the  
58 treatment of haematoma. In most cases, the essential  
59 principle of action is the injection of active ingredients  
60 in the leech saliva into patients' tissues during the blood  
61 withdrawal process. Research shows that leech saliva  
62 contains mainly peptides and proteins, as well as further  
63 small organic molecules [6]; a total of 100–200 suspected  
64 substances [7, 8]. The structure of only a few of these sub-  
65 stances has been identified to date [9, 10].

66 In a recent review article [6], a number of major com-  
67 ponents of leech saliva including histamine, serotonin,  
68 steroid hormones and modulators, enzymes, protease  
69 inhibitors and anti-microbial agents were noted. These  
70 substances have anti-coagulant and blood circula-  
71 tion enhancing effects (e.g., hirudin, Factor Xa inhibi-  
72 tor, calin); thrombolytic (e.g., destabilase); vasodilatory  
73 (e.g., hyaluronidase) or anti-inflammatory (e.g., bdel-  
74 lins, eglins, antistasin, leech-derived tryptase inhibitor  
75 [LDTI]) actions. Although a specific analgesic substance  
76 has yet to be found, clinical experience strongly supports  
77 its existence. In this context, the aphorism 'absence of  
78 evidence is not evidence of absence' seems apt.

79 The potential presence or absence of analgesic or  
80 anaesthetic substances in leech saliva has been debated  
81 for many years [11, 12]. Leech bites are not as painful as  
82 other types of comparable wounds, suggesting that an  
83 antagonistic painkilling agent is delivered during the bit-  
84 ting process.

85 Most patients compare the initial leech sucking pro-  
86 cess to the experience of insect bites or stinging nettle  
87 pain, if any sensation is felt at all. Any unpleasant sensa-  
88 tions felt, during leech application, usually wear off soon  
89 after biting starts.

90 Leech saliva ingredients appear to block certain steps  
91 of the regular pain evolving cascade by counteracting  
92 cytokines with anti-inflammatory agents in the saliva,  
93 thus triggering the analgesic action [6]. Various saliva  
94 substances show protease-inhibiting effects; counter-  
95 acting the inflammatory effects of cytokines as potent  
96 sensitizers or activators of pain sensations. These sub-  
97 stances also cleave and inactivate pain-inducing tissue  
98 cytokines. In similar fashion, eglin C inhibits neutrophil  
99 activity, inhibiting inflammation, and leech-derived  
100 tryptase inhibitor appears to suppress mast cell-medi-  
101 ated inflammatory reactions.

102 As Hildebrandt and Lemke [6] note 'leeches' must  
103 'suppress the normal reactions of the host to such inju-  
104 ries (swelling, pain, inflammation) to remain undetected  
105 during the feeding process' (p. 995). This principle is also  
106 used by ticks, and other insects, when they bite.

107 In leech application, any pain protective action is  
108 short-lived, with most people experiencing unpleasant

itching sensations, slight swelling and signs of inflam- 109  
110 mation (skin reddening) at the bite site for some days. It  
111 is during this period, that the therapeutic effects of pain  
112 relief are expected to start.

**Clinical evidence of analgesic efficacy 113  
in medicinal leech therapy 114**

The analgesic action of leech therapy has been docu- 115  
116 mented in both controlled and uncontrolled trials, as  
117 well as in case reports, for patients with pain as a promi-  
118 nent part of widely varied clinical conditions.

**Osteoarthritis 119**

Michalsen et al. [13, 14] conducted a non-randomised 120  
121 controlled pilot study of leech therapy's impact as an  
122 adjunctive treatment in 16 patients hospitalised for 2  
123 weeks with osteoarthritic knee pain of at least 6 months'  
124 duration. Ten of these patients underwent a single leech  
125 therapy application in addition to their conventional  
126 treatment. The remaining six, control patients received  
127 solely the conventional treatment. Comparing the two  
128 groups showed that leech therapy induced more rapid  
129 pain relief (measured by a Visual Analogue Scale [VAS])  
130 within 3 days post-application, with clinically relevant  
131 and significantly superior improvements persisting after  
132 4 weeks. No serious adverse reactions were observed.

133 These results were reassessed later by the authors in  
134 a randomised controlled trial [15]. This study compared  
135 a single administration of leech therapy to the contin-  
136 uous use over 1 month of a standard analgesic medication  
137 (topical diclofenac) in 51 patients with osteoarthritis of  
138 the knee. Patients' pain scores on the Western Ontario  
139 and McMaster Universities (WOMAC) Arthritis Index [16]  
140 (s. Table 1) showed superior pain relief from leech ther-  
141 apy on all outcome measurements over 3 months, with  
142 highly significant differences in the first treatment week.

143 The analgesic rescue medication used in this study  
144 made no statistically significant difference to this out-  
145 come. Most of the leech therapy patients (17/24) reported  
146 itching at the bite sites and two patients experienced

**Table 1** Pain rating scale Western Ontario and McMaster 120  
121 Universities (WOMAC). Subscale for the measurement of  
122 osteoarthritis pain severity of pain at...

Walking	0	1	2	3	4
Stair climbing	0	1	2	3	4
Nocturnal	0	1	2	3	4
Rest	0	1	2	3	4
Weight bearing	0	1	2	3	4

Severity measures can be obtained by the Likert-type scale type (e.g., 0–4),  
or by visual analogue scales (0–100 mm) for each item  
0 none, 1 slight, 2 moderate, 3 very, 4 extreme

**AQ2**

147 localised burning sensations. One patient each reported  
148 one of the following symptoms; dizziness, a local cuta-  
149 neous reaction or prolonged bleeding from the bite site.  
150 Two control patients reported cutaneous tingling, with  
151 one patient each citing local burning sensations, skin  
152 reactions or abdominal complaints.

153 Another randomised controlled trial [17] compared  
154 single and repeated (after 1 month patients not respond-  
155 ing to a first leech application) leech administrations in  
156 113 patients with osteoarthritis of the knee to a sham  
157 (artificial leech) control. The study observation period  
158 was 6 months. The pain measures used (WOMAC, Knee  
159 Injury and Osteoarthritis Outcome Score (KOOS) [18] and  
160 the VAS with 0, representing no pain to 10, the worst pos-  
161 sible pain) showed that all study groups improved, but  
162 statistically significant differences occurred only in the  
163 leech therapy groups. Patients' use of pain medication  
164 was also statistically significantly lower in the two leech  
165 treatment groups than in the control group. The greatest  
166 improvements and long-term effects were seen after 1  
167 month in patients who had repeated leech applications.  
168 The only side effects of the leech therapy were transient  
169 local skin reactions with itching ( $N=39/73$  patients) and  
170 post-application bleeding that required bandaging, in  
171 two patients.

172 In a third randomized controlled trial 40 patients with  
173 osteoarthritis of the knee underwent a single application  
174 of leech therapy; or a therapeutically irrelevant single  
175 application of transcutaneous electrical nerve stimula-  
176 tion (TENS) as sham control [19]. Patients' treatments  
177 were changed every 6 weeks, with a consecutive follow-  
178 up period of 3 weeks, using a cross-over design. Partic-  
179 ipants' pain scores on the Lequesne Index [20] showed  
180 highly significant pain reductions over time in the leech  
181 treatment group, in contrast to the TENS controls. The  
182 leech therapy patients reported mild local skin itching as  
183 the sole adverse reaction.

184 A meta-analysis that included the above studies of  
185 osteoarthritic knee pain [13–15, 17, 19] found strong evi-  
186 dence of leech therapy's immediate and short-term anal-  
187 gesic effects, as well as moderate evidence of longer-term  
188 benefits [21].

189 In addition to the above, other studies of leech therapy  
190 have been conducted in the context of Indian traditional  
191 medicine.

192 For example, Abbas Zaidi et al. [22] combined leech  
193 therapy with a traditional Ayurvedic herbal formulation  
194 (a powder consisting of *Cholchicum luteum*/Tanacetum  
195 umbelliferum/*Withania somnifera* and a *Cholchicum*  
196 *luteum* oil for twice daily local application), compar-  
197 ing this to the use of the herbal medication alone, in a  
198 total of 40 patients with osteoarthritic knee pain. The  
199 herbal medication was given continuously for 6 weeks to  
200 all patients, with additional leeching performed in one  
201 group at baseline and again after weeks 2 and 4. In week  
202 6, use of the WOMAC pain score showed a 29% decrease  
203 in pain in the leech therapy/herbal medication group  
204 ( $N=20$ ), as compared to 14% in the mono-therapy herbal  
205 medication group ( $N=20$ ). However, the pain reduction

206 in both groups did not differ significantly. The only side  
207 effect was mild itching at the bite site, reported by 55% of  
208 the patients who received the leech applications.

209 A descriptive study by Rai et al. [23] explored the  
210 effects of a single leech therapy session in patients with  
211 knee osteoarthritis. The results showed a significant  
212 decrease in patients' pain values, measured on a VAS, 6  
213 weeks post-treatment. Local skin itching and prolonged  
214 bleeding, as well as scars at the bite site for 2–3 weeks,  
215 were cited as adverse reactions to the leech therapy.

216 Two further studies included an undisclosed number  
217 of patients with osteoarthritis of the knee [24, 25]. These  
218 patients underwent six, weekly, leech sessions. The pain  
219 outcome measure used in both studies (VAS) showed a  
220 statistically significant level of pain relief during the  
221 course of the leech treatments. No adverse reactions  
222 were cited.

223 Shiffa et al. [26] also compared leech therapy com-  
224 bined with applications of the same twice daily local tra-  
225 ditional Ayurvedic herbal formulation, to use of the latter  
226 alone, in 60 patients with osteoarthritic knee pain. In this  
227 study, the leech therapy sessions were delivered weekly  
228 for 1 month. Patients' pain measurements (KOOS Scale,  
229 VAS) showed statistically significant stronger effects from  
230 the combined approach than the Ayurveda mono-ther-  
231 apy alone, for at least 2 months. Mild local itching at the  
232 leech bite site was reported as the sole adverse reaction  
233 by 17% ( $N=30$ ) of the Ayurveda/leech therapy patients.

234 Table 2 summarizes the clinical studies in knee osteo-  
235 arthritis using pain scales for the measurement of leech  
236 therapy's efficacy.

237 Teut and Warning [27] described the case of an elderly  
238 woman with osteoarthritis in her knees. This patient had  
239 not responded well to varied analgesics, including opi-  
240 ates, citing side effects such as dizziness and nausea. She  
241 was unable to walk on admission to hospital, because  
242 of pain. Following admission, she underwent one leech  
243 therapy session. Three days later, her pain had declined  
244 to the extent that she was able to begin physiotherapy  
245 exercises. Additional analgesic medication (Metamizol)  
246 further improved her condition. In their discussion, the  
247 authors emphasised the timing of the crucial improve-  
248 ments that occurred in this patient's condition, noting  
249 that they had followed the introduction of the leech ther-  
250 apy. No adverse reactions were reported.

251 A large observational study of 400 patients with osteo-  
252 arthritis of the knee also showed the effectiveness of  
253 leech therapy's pain-reducing effects, with such relief  
254 lasting for 6–12 months, or more, in half of these patients  
255 [28]. Accordingly, it is recommended to perform bian-  
256 nual leech sessions for the long-term treatment of many  
257 patients with pain from joint disease. The authors cited  
258 local itching as a major adverse reaction in this study,  
259 also expressing concern about leech therapy as a poten-  
260 tial allergen.

261 Another clinical study compared the effects of a single  
262 leech therapy session with topical diclofenac application  
263 twice daily for a month in 32 women with osteoarthri-  
264 tis of the thumb [29]. The researchers, using a 100 mm

**Table 2** Pain measurements in knee osteoarthritis patients undergoing leech therapy

Reference	Pain measurement instrument	Outcome
Michalsen et al. [13, 14]	Visual analogue scale	Leech therapy showed superior ( $p < 0.05$ ) pain relief as compared to control from day 3 onwards
Michalsen et al. [15]	Womac pain score	Leech therapy showed superior ( $p < 0.001$ ) pain relief as compared to topical diclofenac, most pronounced at day 3 and slightly diminishing over time
Andereya et al. [17]	WOMAC pain score, KOOS pain score, visual analogue scale	Leech therapy groups (single and repeated treatment) showed statistically significant pain reductions over time in contrast to the control group
Stange et al. [19]	Lequesne index	Leech therapy showed superior pain reductions as compared to TENS therapy at all rating sessions ( $p < 0.001-0.007$ )
Abbas Zaidi et al. [22]	WOMAC pain score	Leech therapy in combination with an Ayurveda herbal formulation showed a more pronounced decrease in pain, but no significant differences to the herbal formulation alone
Rai et al. [23]	Visual analogue scale	Leech therapy showed significant ( $p < 0.001$ ) decreases of pain scores during the 6 weeks following the single application session
Kumar and Prakash [24, 25]	Visual analogue scale	Leech therapy showed significant ( $p < 0.001$ ) decreases of pain scores in the course of 6 weekly sessions
Shiffa et al. [26]	KOOS pain score, visual analogue scale	Leech therapy in combination with an Ayurveda herbal formulation showed significantly superior pain reductions after 4 weeks ( $p < 0.0002$ ) and 8 weeks ( $p < 0.0001$ ) in the KOOS pain score and in the visual analogue scale pain ratings (week 4 and 8: $p < 0.0001$ )

265 VAS, measured patients' pain at rest, on motion and  
 266 on gripping. Patients' pain scores showed a significant  
 267 group difference under all three conditions, in favour of  
 268 the leech therapy treatments, from Day 7 onwards. This  
 269 difference lasted until the end of the rating period on  
 270 Day 30. No serious adverse events were cited. In all 13 of  
 271 the 16 leech therapy patients reported mild local itching  
 272 and skin reddening, emerging 2-3 days post-leech appli-  
 273 cation; effects that lasted some four days. In the diclofe-  
 274 nac group, five patients also reported mild local skin  
 275 reactions.

276 A questionnaire survey, based on 171 reports, also  
 277 linked the use of leech therapy in German patients to  
 278 pain relief and/or reductions in patients' use of analgesic  
 279 medications in various forms of arthritis [30].

280 The handbook by Michalsen and Roth [10] cited leech  
 281 therapy's value in reducing arthritic shoulder and ankle  
 282 pain; echoing Müller's [31] recommendations that it can  
 283 be used for various forms of arthritis and related inflam-  
 284 matory joint conditions. The authors went on to outline  
 285 leech saliva's potential action on joint support struc-  
 286 tures, such as tendons, muscles and ligaments. Leech  
 287 saliva may also initiate beneficial secondary changes in  
 288 peri-articular connective tissues, in line with the targets  
 289 of physiotherapy techniques like thermotherapy or mas-  
 290 sage. By enhancing blood and lymphatic drainage, leech  
 291 saliva may also induce local tissue decongestion, leading  
 292 to further potentially therapeutic effects.

293 Clinical evidence suggests that leech therapy can  
 294 greatly reduce the pain of patients with osteoarthritis.  
 295 This reduction may, in turn, set the stage for physiothera-  
 296 peutic interventions that would otherwise be prevented  
 297 by pain and/or reduced motor function. For many  
 298 patients, a single leech therapy session is often enough  
 299 to give long-lasting pain relief. During the resulting pain-  
 300 free intervals, many patients can cope without using  
 301 analgesic medication.

*Epicondylitis* 302

303 Chronic epicondylitis is characterised by prevalent pain  
 304 with impaired motor function. The condition is known  
 305 for its limited response to treatment.

306 A randomised controlled trial compared a single  
 307 session of leech therapy to topical diclofenac use in 40  
 308 patients with painful epicondylitis of at least 1 month's  
 309 duration [32]. The diclofenac cream was applied twice  
 310 daily throughout the 30 day study. Patients' pain was  
 311 measured at intervals, at rest, on motion and during grip-  
 312 ping, using a VAS. Follow-up measures were also taken at  
 313 Day 45. Various movement disability and quality of life  
 314 parameters were also documented using relevant ques-  
 315 tionnaires. The results showed that the leech therapy  
 316 patients reported significantly greater pain relief at Day 7  
 317 than the diclofenac group. Evidence of superior, although  
 318 non-significant, efficacy persisted in the leech therapy  
 319 group at Day 45. Patients' functional disability scores  
 320 (disabilities of the arm, shoulder and hand (DASH) [33])  
 321 also showed greater improvement in the leech therapy  
 322 group, being most prominent ( $p = 0.0075$ ) after 45 days.  
 323 Leech therapy patients also reported that their quality of  
 324 life was improved post-treatment, although non-signif-  
 325 icantly. The authors mentioned that no serious adverse  
 326 events were observed in this study. The adverse events of  
 327 leech therapy included mild to moderate itching and red-  
 328 dening of the skin, which emerged 1-7 days post-leech  
 329 application in 10 of 20 patients. The itching, which lasted  
 330 for a mean of 5 days, did not require further treatment.  
 331 Two leech therapy patients experienced a moderate  
 332 decrease in systolic blood pressure, with mild sensations  
 333 of dizziness for several minutes after leech application.  
 334 Again, this did not require further therapeutic interven-  
 335 tion. In the diclofenac control group, only 1 of 20 patients  
 336 noted mild local skin reactions.

337 Case reports noting leech therapy's value in various  
 338 forms of painful tendinitis and tenosynovitis are cited by



339 Müller [31]. Michalsen and Roth [10] also recommended  
 340 leech therapy, in these conditions amongst others, in  
 341 their more recent handbook.

342 *Vertebrogenic pain syndromes/lower back pain*  
 343 *(Lumbago)*

344 Leech therapy can be a useful adjunct to physiotherapy  
 345 and to pain management in various back pain syn-  
 346 dromes, in particular in cases of increased muscular  
 347 tension and in inflammatory conditions. Myalgia and  
 348 myogelosis are common major symptoms of back pain.  
 349 These symptoms can be improved by the analgesic, anti-  
 350 inflammatory and blood circulation enhancing effects of  
 351 leech saliva's ingredients.

352 An early article by Oberheid [34] noted remarkable  
 353 analgesic effects from leech therapy on various forms  
 354 of back pain, based on clinical experience. Müller [31]  
 355 supported this view, citing several authors who con-  
 356 firmed the pain-relieving effects of leech therapy in back  
 357 conditions. A more recent review article by Michalsen  
 358 [35] stated that back pain syndromes are often seen to  
 359 improve immediately, after leech therapy; aiding the  
 360 baseline conditions for further physiotherapy measures  
 361 considerably. The following adverse events were cited,  
 362 post-leech application, local itching, delayed healing of  
 363 leech bite wounds and pseudo-allergic erythema.

364 *Hematoma/swelling/oedema/contusion/distortion*

365 Leech therapy's analgesic effects on pain due to hae-  
 366 matoma and swelling result from the removal of excess  
 367 blood and the thrombolytic effect of the salivary ingredi-  
 368 ents [36, 37].

369 Pain relief and reduced swelling are cited in numerous  
 370 case reports. Leech therapy has been used successfully  
 371 in various forms of head and neck surgery. For example,  
 372 Menage and Wright [38] report its DE tumescent and  
 373 pain-relieving action in severe peri-orbital haematoma.  
 374 Other reports describe successful leech treatment in  
 375 cases of sublingual haematoma [39, 40] and massive, at  
 376 times life-threatening, macroglossia (tongue swelling)  
 377 secondary to blunt trauma [41], tooth implant surgery  
 378 [42] and intra-oral surgery [43].

379 In a more recent review article, Porshinsky et al. [44]  
 380 cite published reports of leech therapy for massive post-  
 381 traumatic lingual swellings. They conclude that clinical  
 382 results were satisfactory in these cases, with resolution of  
 383 the original swelling and only minor post-leeching glos-  
 384 sal puncture marks as adverse reactions. They also note  
 385 that the continued drainage of dark, non-clotted, blood  
 386 from the leech attachment sites seen, suggests that hae-  
 387 matoma resolution may continue for some time post-  
 388 leech detachment.

389 Leech therapy has also proven successful in reducing  
 390 haematoma and swelling pain at other body sites [45],  
 391 including cases of massive scrotal haematoma caused by

blunt trauma [46], following vessel wall rupture after per-  
 cutaneous transluminal angioplasty [47], in transfemoral  
 puncture for cardiac cauterisation [48, 49] and in radical  
 radiotherapy [50].

Leech therapy has also been used successfully for  
 reducing swelling and pain after reconstructive surgery  
 [51, 52]. A long-standing review article by Deuser [53]  
 described the value of leeches in treating various sports  
 medicine injuries involving swelling. Such views have  
 been echoed in more recent anecdotal accounts in soc-  
 cer and ice hockey players [54]. These accounts include  
 an article in the English 'The Sun' newspaper, citing  
 leech application's value in treating a professional soccer  
 player with a chronically swollen knee [55].

*Varicose veins/leg ulcer/phlebitis/thrombophlebitis*

Pain, pressure sensations and feelings of swelling and  
 heaviness are common in cases of restricted blood flow,  
 vessel or tissue inflammation, and are due to venous sta-  
 sis. The analgesic effects of leech therapy in treating vari-  
 cose veins, has long been recognised in the literature of  
 internal medicine [31, 34, 56]. A clinical study by Bapat  
 et al. [57] supports such views, finding leech therapy (1-4  
 leeches for 2-20 sessions) an effective adjunct in manag-  
 ing complicated, painful varicose veins and leg ulcers in  
 19 patients. None of the potential complications of leech  
 therapy in these conditions, such as wound infection or  
 excessive bleeding, were seen in this study.

In similar fashion, Zarnigar [58] found a marked  
 reduction in pain, and complete healing of severe vari-  
 cose vein ulcers, in three out of four patients follow-  
 ing leech therapy for a period of 60 days. Leeching was  
 described as safe and well-tolerated in these patients.

Further articles describing the successful use of  
 leech therapy for varicose veins confirm these findings  
 [34, 59-61].

Many individual case presentations also describe the  
 pain-reducing effects of leech therapy in phlebitis and  
 thrombophlebitis [34, 62-69].

*Cancer pain*

Finally, Kalender et al. [70] reported the use of leech ther-  
 apy in a patient with renal cell carcinoma and leiomyo-  
 sarcoma whose severe lumbar pain remained unresolved  
 by radiotherapy, systemic or epidural analgesic infusions.  
 This patient became pain-free following leech therapy.  
 The authors noted that this first report of leech therapy's  
 use in cancer pain suggests possible analgesic benefits in  
 this indication, demanding for further investigation.

*Discussion*

Leech therapy has been used in a wide variety of clinical  
 pain conditions to date. Whilst pharmacological studies

A03

main topic

442 have shown that leech saliva has anti-inflammatory, 498  
 443 anticoagulant, thrombolytic, blood and lymph circula- 499  
 444 tion enhancing effects [6], they have yet to identify the 500  
 445 biochemical or pharmacological substances or mecha- 501  
 446 nisms responsible for the analgesic action of leech ther-  
 447 apy. Additional biochemical analyses, linked to clinical  
 448 experience, are needed to further illuminate this area.

449 Clinical results consistently indicate a strong and long- 502  
 450 lasting pain-reducing effect from leech therapy, particu- 503  
 451 larly in patients with osteoarthritis of the knee, but the 504  
 452 methodological pitfalls of investigating such therapy are 505  
 453 challenging. Leech therapy's nature does not allow for 506  
 454 the use of credible 'blinding' techniques. Attempts in this 507  
 455 direction (use of an optical shield, leech bite simulation 508  
 456 by needle prick and use of wet gauze to simulate a leech 509  
 457 body), tried by Andereya et al. [17], proved unsuccessful. 510  
 458 A placebo effect must therefore be taken into account  
 459 when interpreting any leech therapy study results.

460 The literature search located no controlled, long-term 511  
 461 studies comparing conventional and leech therapy in 512  
 462 clinical pain syndromes. The duration of patients' pain 513  
 463 reduction from leech therapy therefore remains unclear, 514  
 464 although clinical experience in patients with osteoar- 515  
 465 thritic knee pain suggests that benefits may appear rap- 516  
 466 idly and persist for several months. 517

467 The available data also contain insufficient informa- 518  
 468 tion on dose efficacy ratios in leech therapy, with research 519  
 469 generally reporting only the number of leeches applied, 520  
 470 commonly 2-8 per session. Further studies are needed to 521  
 471 investigate potential relationships between the number 522  
 472 of leeches applied and the onset of their action, or the 523  
 473 effect size over time. 524

474 To compare the benefit/risk ratio of conventional and 525  
 475 leech therapy for clinical pain syndromes, the relative 526  
 476 adverse effects of these two approaches must be weighed 527  
 477 and leech therapy's safety record taken into account. Def- 528  
 478 inite and common adverse reactions from leech therapy 529  
 479 are related to leeches' mode of action: slight bleeding for 530  
 480 some hours and mild skin reactions (e.g., reddening and 531  
 481 itching) at the bite site. Rare cases of local allergic reac- 532  
 482 tions to leech therapy, which have been reported, also 533  
 483 require attention. Whilst the long-term use of conven- 534  
 484 tional analgesics (e.g., non-steroidal anti-inflammatory 535  
 485 drugs [NSAIDs]) has well-known systemic effects; leech 536  
 486 therapy's analgesic effects are localised. For patients who 537  
 487 experience persistent reactions to conventional analge- 538  
 488 sics, leech therapy may prove a valid alternative. 539

489 Finally, a German study compared the cost of con- 540  
 490 ventional and leech therapies in reconstructive surgery, 541  
 491 including the treatment of painful haematomas [52]. 542  
 492 They found that leech therapy was much less expensive 543  
 493 than its conventional comparators. 544

494 **Conclusions**

495 Leech therapy works by bloodletting and mainly by 545  
 496 injecting active ingredients in leech saliva into patients' 546  
 497 tissues. Although pain reduction of leech therapy has 547

been noted clinically for a long time, a specific analgesic 498  
 substance in leech saliva is yet to be found. Further work 499  
 is needed to determine the precise mechanisms behind 500  
 leech therapy's analgesic effects. 501

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