

## Medicinal leech therapy on head and neck patients: a review of literature and proposed protocol

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**Objectives.** To this day, a standardized protocol for medicinal leech therapy does not exist. The purpose of this article was to review literature in the hope of proposing a unified, coherent, feasible, and safe protocol for using medicinal leeches when warranted.

**Study Design.** A literature search was conducted in the following databases: PubMed, MDConsult, The Cochrane Library, OMIM, and Google. This was supplemented by a search for selected authors. Keywords used were medicinal leech therapy, leech therapy, leeching, replantation, thromboembolism, venous congestion, *Hirudo medicinalis*, Hirudotherapy, leech protocol, and *Hirudo* protocol.

**Results.** Based on titles and abstracts, 26 articles and 1 Web site were identified.

**Conclusions.** Leech therapy can be an excellent alternative for the treatment of venous congestion in free flaps, pedicled flaps, and replanted tissues. Psychological precounseling, antibiotic therapy, number of leeches to be used, length of therapy, and laboratory checks should be taken into consideration before initiating therapy. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;116:e167-e172)

Medicinal leeches (*Hirudo medicinalis*) have been used for thousands of years, but are resurging in health care today, primarily as a treatment for venous congestion. Free flaps, pedicled flaps, and replanted tissues can survive arterial insufficiency for up to 13 hours, but venous congestion can cause necrosis in 3 hours.<sup>1</sup> Medicinal leeches may be helpful in treating tissues with venous insufficiency by establishing temporary venous outflow, until graft neovascularization takes place. Implementing leech therapy requires that the surgeon be familiar with the protocol, however, especially given a time constraint.<sup>2,3</sup> To this day, a standardized protocol for medicinal leech therapy does not exist. The purpose of this article was to review literature in the hope of proposing a unified, coherent, feasible, and safe protocol for using medicinal leeches when warranted.

### MATERIAL AND METHODS

A literature search was conducted in the following databases: PubMed, MDConsult, The Cochrane Li-

brary, OMIM, and Google. This was supplemented by a search for selected authors. Keywords used were medicinal leech therapy, leech therapy, leeching, replantation, thromboembolism, venous congestion, *Hirudo medicinalis*, Hirudotherapy, leech protocol, and *Hirudo* protocol. Based on titles and abstracts, 26 articles and 1 Web site were identified.

Pertinent data were then extrapolated from these articles to meet the objectives of this literature review, that is, proposing a protocol for medicinal leech therapy. Pertinent data included number of patients, indication for use, number of leeches used, frequency, duration, antibiotic prophylaxis, laboratory checks, blood transfusions, and complications.

### Review of literature

Utley et al.<sup>3</sup> reviewed 4 cases of failing, venous-congested flaps and suggested early recognition of flap failure and initiation of leech therapy. Their technique was to place the leech at the affected site for 5 to 6 hours until it falls off on its own or is removed. Their article also recommended antibiotic prophylaxis.

Chepeha et al.<sup>4</sup> described 8 of 450 free tissue transfers to the head and neck that developed venous congestion and survived using medicinal leech therapy. Five of their patients received extraoral and 3 patients received intraoral leech therapy. *Hirudo medicinalis* was the leech species used. An average of 215 leeches were required for each patient (range 80-350). Each leech remained attached to the flap for approximately 20 minutes, this equated to approximately 3 leeches per hour. This continuous leeching schedule lasted for 24 hours. Subsequently, the leech schedule was modified

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this *Journal*.

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**Table I.** Summary of literature review displaying different leech therapy protocols

Literature	No. patients	No. leeches	Length of time	Total days	Antibiotics	Laboratory checks
Utley et al. <sup>3</sup>	4	1	Every 5-6 h	>3 d	Yes	As indicated
Chepeha et al. <sup>4</sup>	8	3	Every 1 h	6.6	Yes	Every 4 h: PTT, CBC, and chemistry checks
Whitaker et al. <sup>5</sup>	>500	1-2	Every 15-40 min	3-7 d	Yes	As indicated
Iowa Head and Neck <sup>7</sup>	>10	1-2	Every 2 h	As needed	Yes	Serial every 8 h hematocrit checks
Hullett et al. <sup>8</sup>	1	1-4	Twice daily	>3 d	Yes	As indicated
Elyassi et al. (current study)	1	1	Every 2-4 h	5 d	Yes	Pre- and post-therapy hematocrit check

CBC, complete blood count; PTT, partial thromboplastin time.

based on the degree of congestion. The average length of time for leeching was 6.6 days. Clinical and hematologic evaluation, including a complete blood cell count, partial thromboplastin time, and serum chemistry studies, was performed every 4 hours, and in many cases, the patients received blood transfusions for hemoglobin lower than 8 g/dL. Chepeha et al.<sup>4</sup> recommended sulfamethoxazole-trimethoprim and a quinolone double coverage during leech therapy and single coverage for 2 weeks after leech therapy is discontinued.

According to some, leech therapy is required for 3 to 7 days. One or 2 leeches are used for partially degloved or replanted appendages, whereas more than 4 leeches may be required for larger flaps. Regardless, it is recommended that patients undergoing leech therapy be on prophylactic antibiotic coverage for *Aeromonas hydrophila*.<sup>5,6</sup>

The Iowa Head and Neck Protocol recommended that patients start on levaquin before initiation of leech therapy. One or 2 leeches are used per session and the leech is expected to stay in place for 30 minutes. Leeches are applied every 2 hours and serial hematocrits are taken every 8 hours. Their protocol recommends levaquin started before the first leech is applied and continued until 24 hours after leech therapy is discontinued.<sup>7</sup>

In a similar case, Hullett et al.<sup>8</sup> showed how leech therapy helped save a complex avulsive laceration of the right ear. Their protocol consisted of applying leeches twice a day and adjusting number and frequency of treatments after the third postoperative day. They also recommended antibiotic prophylaxis for *Aeromonas hydrophila*.

Trovato and Agarwal<sup>9</sup> used leech therapy to successfully replant an avulsed ear. Frodel et al.<sup>10</sup> used medicinal leeches to salvage soft tissue avulsion in key facial structures of 4 patients involving avulsions of the ear, nose, lip, and scalp.

In addition to using leech therapy in head and neck reconstruction,<sup>1-13</sup> there are numerous other studies showing leech therapy used for sural flaps,<sup>14,15</sup> penile

replantation,<sup>16,17</sup> and even to help reduce pain in osteoarthritis of the knee.<sup>18</sup>

A summary of the literature reviewed, pertaining to the head and neck regions, is listed in Table I.

### Report of a case

The authors of this article treated a 12-year-old girl who presented 2 hours after sustaining a 7-cm complex avulsive laceration of the right ear. Almost the entire upper third of the ear was detached from its vascular bed, causing damage to the underlying cartilage (Figure 1). The patient was brought to the operating room to explore, irrigate, and debride the wound in a controlled setting before attempting primary repair. The cartilaginous framework was tacked with 4-0 gut sutures and the ear was replanted and repaired as close to natural position as possible using 5-0 Prolene sutures. The patient was admitted for intravenous antibiotic therapy and wound care.

On the first postoperative day, venous congestion was noted along the superior third of the right ear (Figure 2). Medicinal leech therapy was initiated at 1 leech every 2 hours (Figure 3). After the third postoperative day, because there was marked improvement in the tissue (i.e., showing signs of revascularization), leech therapy was modified to 1 leech every 4 hours. On the fifth postoperative day, leech therapy was terminated and the patient was discharged home. The patient returned 13 days after her initial injury to remove the sutures. At this point, the ear exhibited signs of complete revascularization (Figure 4).

### DISCUSSION

The process of imbibition and inosculation for graft neovascularization takes 96 hours to complete, according to Jordan.<sup>19</sup> Leech therapy can therefore be used to temporarily reestablish venous outflow until permanent outflow is established.<sup>17,19</sup> Hence, leech therapy is especially indicated in a situation in which tissue exhibits dark-purple discoloration that can be suggestive of venous congestion.<sup>20</sup>



Fig. 1. Twelve-year-old-child with 7-cm complex avulsive type of laceration of right ear.



Fig. 2. Venous congestion was noted along the upper helix of the right ear, where the tissue appears dusky, edematous, and purple-blue in color.

Leeches effectively reduce venous congestion by removing blood directly and by injecting hirudin into the local tissue.<sup>21</sup> Leech saliva contains hirudin, a selective thrombin inhibitor and potent histaminelike vasodilator, which allows the leech to ingest several milliliters of blood before detaching.<sup>3,21-23</sup>

Each leech can be used only once and then euthanized in 70% alcohol for 5 minutes. Possible complications of leech therapy include anemia, bleeding, infection, anemia, tissue or graft loss, psychological responses, allergic reaction, and migration of leeches to other sites.<sup>3,4,24-26</sup>

Infection associated with leech therapy is a documented complication with reported incidences of 2.4%



Fig. 3. Leech therapy was initiated at 1 leech every 2 hours to the obstructed region of the ear.



Fig. 4. Appearance of the ear when patient returned for suture removal 10 days after initial injury.

to 20.0%.<sup>25,26</sup> Infections are usually caused by *Aeromonas hydrophila*, a gram-negative rod that symbiotically lives in the intestines of the leech.<sup>3</sup> This is a reason why one should not mishandle or squeeze the leech, causing it to regurgitate the bacteria into the wound. Some would advocate intravenous antibiotic therapy with piperacillin/tazobactam or a third- or fourth-generation cephalosporin before results for sen-



Fig. 5. Proposed leech therapy protocol.

sitivity testing are received.<sup>25</sup> Others advocate therapy with aminoglycosides, sulfa drugs, tetracyclines, cotrimoxazol, levaquin, or ciprofloxacin during leech therapy.<sup>3,7,21,25</sup> Regardless, most literature agrees on some form of antibiotic prophylaxis for *Aeromonas hydrophila*, while undergoing leech therapy.

From the literature we have examined, an average of about 2 leeches were used during each session and each leech remained attached to the flap for at least 20 minutes. Once the leech was done feeding, it would let go of the host tissue bed. At this time, it would be appropriate to clean and reexamine the wound. Blood clots can be expressed and removed with heparinized saline and/or hydrogen peroxide. Another session of leech therapy can then be commenced. The frequency of sessions seemed to be most variable across all literature examined. Although some claimed that 1 session would suffice,<sup>17,18</sup> most of the literature claimed that about 5 days of therapy was necessary.<sup>3,4,20</sup>

Novakovic et al.,<sup>27</sup> while examining free flap success rates, concluded that venous thrombosis is the most common cause of flap failure. In select cases, venous

congestion was managed by medicinal leech therapy. This study,<sup>27</sup> along with the study by Dabb et al.,<sup>2</sup> suggested that relief of venous congestion for 4 to 10 days via leech therapy may allow enough time for neovascularization of the flap.

### PROPOSED PROTOCOL

After review of literature, case studies, and different protocols that have successfully worked for different institutions, the authors of the article suggest the following. First of all, choose the appropriate candidate. The patient should not have a previous allergic reaction to or psychological fear of leeches. Once venous congestion has been identified and the patient has agreed to undergo leech therapy, it is important to explain to the patient the process in detail and what to expect. Focus should be made on the scientific merits of the therapy. This will unduly influence the patient's attitude toward the use of leeches.

Next, antibiotic prophylaxis for *Aeromonas hydrophila* should be commenced before initiation of leech therapy. Consensus seems to be directed toward the use

of a fluoroquinolone or third/fourth-generation cephalosporin. The authors of this article recommend continuing antibiotics for at least 24 hours after leech therapy has been completed.

Moreover, the number of leeches and frequency of sessions was most variable among all literature reviewed. Most surgeons who have used leech therapy would agree that these 2 variables depend on the area and degree of venous congestion. Although somewhat subjective, most do agree that an average of 1 or 2 leeches is sufficient to treat a replanted ear,<sup>20,21</sup> whereas a large flap may require 6 or more leeches.<sup>4-6,27</sup>

In addition, patients may lose up to 15 mL of blood per leech, per session. The wound may continue to ooze up to 24 hours after the leech is removed. Therefore, many advocate at least a pretherapy hematocrit check and a post-therapy hematocrit check. Those who used 3 or more leeches in their protocol typically would check the hematocrit more often. This was entirely dependent on the number of leeches used, frequency of sessions, and total duration of therapy (i.e., anticipated blood loss).<sup>3,4</sup>

Furthermore, duration of therapy has been the most random variable among all the literature reviewed. Although 1 article suggests 1 session of leech therapy is sufficient,<sup>17</sup> others may suggest at least 3 leeches every hour,<sup>4,18</sup> a far more aggressive protocol. In the study by Chepeha et al.,<sup>4</sup> even though 8 flaps were saved by an aggressive leech therapy protocol, an average of 13 U of packed red blood cells per patient was necessary. Nevertheless, despite the number of leeches, number of sessions, or duration of therapy, most of the literature examined shows successful outcomes of leech therapy.

Based on our experience, we have shown the successful outcome of leech therapy, using 1 leech every 2 hours for every 3-cm<sup>2</sup> area of venous congestion. The frequency of therapy was decreased to 1 leech every 4 hours once approximately half of the tissue coloration returned to normal. The degree of venous congestion can be estimated by describing the percentage of ruborous and vilaceous color of the flap skin paddle, testing capillary refill, and observing color of the blood oozing from leech bite sites.<sup>4</sup> Serial photographs can most definitely help assess the intensity of venous congestion on a daily basis.

During leech therapy, thus, it is not only important to take serial photographs, but also properly document the progress of treatment in the patient's medical records. Documentation should include, but is not limited to, (1) assessment of tissue before, during, and after procedure session; (2) color, temperature, and turgor of flap; (3) amount of bleeding; and (4) the patient's response to leech therapy.

In summary, leech therapy can be an excellent alternative for the treatment of venous congestion in free flaps, pedicled flaps, and replanted tissues. Having a general protocol for leech therapy, as summarized by the flow chart in Figure 5, can help direct the surgeon to its safe and successful use.

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