



Historical Article: *Hirudo medicinalis*: ancient origins of, and trends in the use of medicinal leeches throughout history

I.S. Whitaker^{a,*}, J. Rao^b, D. Izadi^c, P.E. Butler^d

^a Department of Anatomy, University of Cambridge, Cambridge, UK

^b Department of Oral and Maxillofacial Surgery, South Manchester University Hospitals NHS Trust, Manchester, UK

^c Addenbrooke's Hospital School of Clinical Medicine, University of Cambridge, Cambridge, UK

^d Royal Free Hospital, London, UK

Accepted 30 October 2003

KEYWORDS

Hirudo medicinalis;
Medicinal leech;
History

Summary Blood letting and the therapeutic use of *Hirudo medicinalis* date back to ancient Egypt and the beginning of civilisation. Their popularity has varied over the years, reaching such a peak in Europe between 1825 and 1850 that supplies were exhausted. Towards the end of the century they fell out of favour and, during this period, the leech, once used by the physicians of emperors and influential academic surgeons, became associated with lay therapists and quackery. Leeches have enjoyed a renaissance in reconstructive microsurgery during the last 15 years, having been used by maxillofacial [Br. J. Oral Maxillofac. Surg. 41 (2003) 44] and other reconstructive surgeons to aid salvage of compromised microvascular free tissue transfers [Laryngoscope 108 (1998) 1129; Br. J. Plast. Surg. 34 (1984) 358], replanted digits [Int. J. Microsurg. 3 (1981) 265], ears [Ann. Plast. Surg. 43 (1999) 427], lips [Plast. Reconstr. Surg. 102 (1998) 358; J. Reconstr. Microsurg. 9 (1993) 327] and nasal tips [Br. J. Oral Maxillofac. Surg. 36 (1998) 462]. Peer-reviewed evidence suggests that the survival of compromised, venous-congested tissues is improved by early application of a leech [J. Reconstr. Microsurg. 12 (1996) 165; Arch. Otolaryngol. Head Neck Surg. 114 (1988) 1395; Br. J. Plast. Surg. 45 (1992) 235]. Leeches have also recently been used to treat a wide range of conditions, including periorbital haematomas [Br. J. Ophthalmol. 75 (1991) 755], severe macroglossia [Otolaryngol. Head Neck Surg. 125 (2001) 649; J. Laryngol. Otol. 109 (1995) 442] and purpura fulminans [Ann. Plast. Surg. 35 (1995) 300]. The first medicinal leech farm, Biopharm, was set up in Swansea in 1981 by Dr Roy Sawyer, and now supplies leeches to hospitals all over the world. In this paper, we summarise the history of treatment with *Hirudo medicinalis* from its origin to the present day, and take a brief look at the possible future of the annelid. © 2003 The British Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

*Corresponding author. Present address: 8 Avonlea Road, Sale, Cheshire M33 4HZ, UK. Tel.: +44-161-962-7563.

E-mail address: iain.whitaker@yahoo.com (I.S. Whitaker).

History of leech therapy

Hirudo medicinalis has stimulated human imagination for centuries. Its intimate contact with humans have provoked a somewhat symbiotic relationship in which the leech feeds off humans and humans use the leech for medicine, stories and imagery in popular culture^{12,13} (Fig. 1).

It is impossible to note accurately the time when man learned of the existence of leeches. However, we do know that both the annelid and the doctor have been closely linked since the dark ages. 'Leech' is derived from the Anglo-Saxon word 'laece' which, when literally translated, means physician. It is also important to note that 'leech' is etymologically distinct from the Latin word 'Hirudo'. The name *Hirudo medicinalis* was assigned by Linnaeus in 1758.¹⁴ Linnaeus (also Carl von Linné, 1707–1778) was a Swedish botanist, physician and zoologist whose work laid the foundations of modern biological systematics and nomenclature.

The first recorded use of medicinal leeches dates back to ancient Egypt and the beginning of civilisation. Leeches can be seen in wall paintings found in sepulchre of the 18th dynasty pharaohs (1567–1308 b.c.). The first written record of their medicinal use has been attributed to Nicader of Colophain (200–130 b.c.) in his medical poem *Alexipharmaca*.¹⁵ In the 1st century a.d. there was more extensive written reference to their usage. About this time, Chinese writings described medicinal leeching, as did references in Sanskrit, Persian

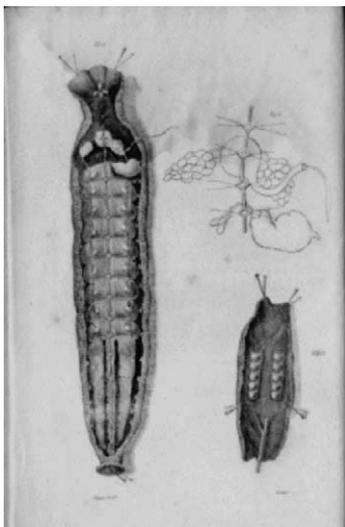


Figure 1 Johnson, James Rawlins. 'A treatise on the medicinal leech' (London, 1816) (History & Special Collections UCLA Louise M. Darling Biomedical Library).

and Arabic literature. The Romans were also familiar with leeches during this period, and it was they who named them 'Hirudo'.

Plinius, described and noted that leeches sucked blood, and documented their useful effects when treating 'rheumatic pains, gout or fevers of any kind'. He compared them with *sanguisuga*—from *sanguis* (blood) and *sugo* (I suck).

The Syrian, Themisson of Laodicae, a pupil of Asclepiades¹⁶ advanced the use of leeches for blood letting at the beginning of the Christian era. He postulated that evil spirits caused illness and removal of these evil spirits required withdrawal of blood. Galen (130–201 a.d.), physician to Marcus Aurelius, further advanced the practice of blood letting through the development of his humoral concept of disease. This concept built on one first outlined by Hippocrates (460–370 b.c.), who believed in the rule of harmony and the theory that all body systems were in balance and that disease resulted from imbalance.

Galen taught the importance of maintaining balance between the four bodily fluids, or humours: blood, phlegm, yellow bile and black bile. Each fluid was associated with a specific personality characteristic. The belief was that removal of the patients blood would correct the humoral imbalance and restore good health. Alexander de Tralles (525–605 a.d.) even treated hearing loss with leeches, in addition to more novel treatments, such as the juices of roaches. Avicenna (980–1037 a.d.), believed that leeches drew blood from deeper sources than wet cupping. His '*Canon of Medicine*' included several pages of instruction about leeches.¹⁷

In the Middle Ages, barber surgeons, armed with a staff for the patient to grasp (so the veins on the arm would stand out sharply), a basin to hold leeches and catch blood, and a copious supply of linen bandages, continued the practice of blood letting.

The blood stained linen bandages wrapped around the barber's pole in the wind was responsible for the modern day red and white striped pole outside some hairdressers salons. The earliest barber's poles were surmounted by a leech basin, which in time has transformed into a ball on top of the poles.

Leeches were kept in special vessels that were filled with water and had perforated tops to let them breathe. Early leech jars were glass (Fig. 2), and later ceramic, and were often beautifully decorated and highly prized collectors' items. For house calls, physicians would often carry small glass or pewter containers containing a dozen or so leeches.¹⁸ Leeches were better tolerated than other methods of blood letting (e.g. the *fleam* and the *scarifier*¹⁹) (Fig. 3) as the pain of the bite was



Figure 2 Bossche, Willem van den. *Historia Medica* (Bruxellae, 1639).

far less painful than the wound inflicted by the other two methods. The fleam consisted of a blade cocked by a spring mechanism, and was also known as a spring lancet. The scarifier was used to make several cuts in the skin at one time, and a bleeding cup was placed over the abrasions. In general, leeches were considered to be of greater benefit when blood had to be removed from a part of the body where a lancet or cup could not be used, such as *'haemorrhoidal tumours, prolapsed rectum and inflamed vulva ... watching that they did not creep out of reach within any of the internal cavities, as serious results might ensue'*.²⁷

In France, under the influence of Broussais (1772–1832), head doctor of the Val de Grâce Hospital in Paris and surgeon in Napoleon's Grande Armée, the use of leeches spread rapidly.

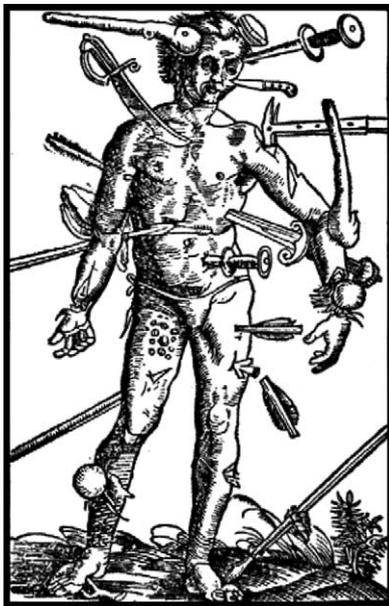


Figure 3 'Bloodletting man'. *The Calendar of Regiomontanus* (1475).



Figure 4 François-Joseph-Victor Broussais (1772–1838).

Broussais has been referred to as 'the most sanguinary physician in history'²⁰ (Fig. 4). He proposed that all diseases resulted from an excess build up of blood and alleviation of this condition required heavy leeching and starvation. French physicians would commonly prescribe leeches to be applied to newly hospitalised patients even before seeing them.²¹ Leeches became the therapeutic agent *par excellence*, and even inspired fashion. Females wore imitation leech decorations; *'fastidious ladies ... used to deck their dresses with embroidered leeches'*²² and their cosmetic uses included enhancement of their pale complexions.

During this period in Russia, Mudrov and Didkovsky were equally enthusiastic about using leeches. They reported that phlebotomy with leeches achieved excellent results in various conditions, including inflammation of the cerebrum, liver and kidney disease, rheumatism, tuberculosis, epilepsy, hysterics and sexually transmitted diseases. Contraindications to the treatment were not mentioned, and it seemed that they treated patients irrespective of age and state of health.

The use of leeches became so popular during this period that the species became endangered in Europe. Patients were prescribed up to 80 leeches a session. Russia consumed about 30 million leeches annually. In 1833 alone, French doctors imported almost 42 million leeches, and the annual consumption approached 100 million. The ever increasing demand made prices soar, and the French government granted awards to companies who could improve production by developing new stocks from marshes, streams and ponds. Leech harvesting became a popular way of earning money, and people

waded into ponds and then removed and sold the leeches that had become attached to their feet and legs.

In Germany, they shipped an estimated 30 million leeches annually to the United States, and German authorities too became concerned about the ability of the country to meet domestic needs. European leeches were preferred to their American counterpart, *Hirudo decora*, as the American leech did not make as deep or as large an incision and drew less blood. Americans were having difficulty in obtaining European medicinal leeches, and in 1835, a \$500 award was offered to anyone who could breed European leeches in the United States.²³

By the end of the 19th century, the leech had lost its popularity. This is well illustrated by the records of a certain English hospital, which stated that in 1832 almost 100,000 leeches were used, whereas 50 years later the number had fallen to less than 2000 leeches.²⁴ Their therapeutic use did not fit into the emerging modern concepts of medicine. There was now an increased emphasis on experimental methods and stringent restraints on empirical methods. With the development of modern physiology, pathology and microbiology, leeches fell out of favour, not only with physicians, but also with patients. During this period only occasional references can be found with regard to removal of blood.

Haycraft²⁵ brought leeches back into mainstream thinking with his discovery in 1884 that a pure anti-coagulating preparation was contained in the saliva of leeches which he named 'Hirudine' from the Latin 'Hirudo'. In hindsight it seems that Haycraft simply confirmed an earlier observation made by a Russian, Professor Diakonov. In his article *Changes of human blood in the leech* in 1809, he wrote that 'lack of blood coagulation and dissolution of red blood corpuscles in the leech's intestinal duct testifies that some dissolving agent exists there'. In 1955, Markwardt²⁶ isolated and accurately characterised Hirudin from leeches' pharyngeal glands. It was not until 1986 that this potent anticoagulant was first produced in quantity by genetic engineering.²⁷

Medicinal leeches have recently been re-discovered and are used by maxillofacial and other microsurgeons to aid salvage of compromised venous engorged tissue, including free and pedicled flaps, and amputated digits, ears and nasal tips.²⁻⁸ Peer-reviewed evidence has suggested that the survival of a compromised, venous-congested flap is improved by early application of a leech.⁹⁻¹¹

In 1981, an American biologist, Roy Sawyer, abandoned his academic career to found Biopharm Ltd,

a company in Swansea, Wales, devoted to breeding and farming leeches and developing new drugs for clinical use. Biopharm estimates that it supplies about 25,000 leeches to the United Kingdom and Ireland each year and 60,000 to the United States.

Researchers led by head and neck surgeon Gregory Hartig at the University of Wisconsin at Madison in the United States, are developing a *mechanical leech*,²⁸ which they think has distinct advantages over its flesh-and-blood counterpart.

They postulate that the device can deliver and disperse the anticoagulant heparin better to compromised tissue, and the device's porous tip, implanted just beneath the skin, rotates to inhibit coagulation further. The development team think that the biggest advantage of the mechanical leech is a psychological one, as patients seem to prefer being attached to a machine than a live creature.

The ancient art of applying leeches still has a role to play in contemporary reconstructive surgery, but will the mechanical leech force its living counterpart into retirement? Only time will tell.

References

1. Rao J, Whitaker IS. Use of *Hirudo medicinalis* by maxillofacial surgery units in the UK: current views and practice. *Br J Oral Maxillofac Surg* 2003;41:44-5.
2. Utley DS, Koch RJ, Goode RL. The failing flap in facial plastic and reconstructive surgery: role of the medicinal leech. *Laryngoscope* 1998;108:1129-35.
3. Batchelor AGG, Davison P, Sully L. The salvage of congested skin flaps by the application of leeches. *Br J Plast Surg* 1984;34:358-60.
4. Foucher G, Henderson HR, Maneau M, Merie M, Braun FM. Distal digital replantation: one of the best indicators for microsurgery. *Int J Microsurg* 1981;3:265-70.
5. Cho BH, Ahn HB. Microsurgical replantation of a partial ear, with leech therapy. *Ann Plast Surg* 1999;43:427-9.
6. Walton RL, Beahm EK, Brown RE, Upton J, Reinke K, Fudem G, et al. Microsurgical replantation of the lip: a multi-institutional experience. *Plast Reconstr Surg* 1998;102:358-68.
7. Hirase Y, Kojima T, Hayashi J, Nakano M. Successful upper labial replantation after 17 hours of ischemia: case report. *J Reconstr Microsurg* 1993;9:327-9.
8. Mortenson BW, Dawson KH, Murakami C. Medicinal leeches used to salvage a traumatic nasal flap. *Br J Oral Maxillofac Surg* 1998;36:462-4.
9. De Chlain TM. Exploring the use of the medicinal leech: a clinical risk-benefit analysis. *J Reconstr Microsurg* 1996;12:165-72.
10. Hayden RE, Phillips JG, McLear PW, Leeches. Objective monitoring of altered perfusion in congested flaps. *Arch Otolaryngol Head Neck Surg* 1988;114:1395-9.
11. Lee C, Mehran RJ, Lessard ML, Kerrigan CL. Leeches: controlled trial in venous compromised rat epigastric flaps. *Br J Plast Surg* 1992;45:235-8.

12. Grzimek HCB. *Grzimek's animal life encyclopaedia*, vol. 1. New York: Van Nostrand Reinhold; 1974.
13. Sawyer RT. *Leech biology and behaviour*, vols. 1–2. Oxford: Clarendon Press; 1986.
14. Mory RN, Mindell D, Bloom DA. The leech and the physician: biology, etymology, and medical practice with *Hirudinea medicinalis*. *World J Surg* 2000;**24**:878–83.
15. Wells MD, Manktelow RT, Boyd JB, Bowen V. The medical leech: an old treatment revisited. *Microsurgery* 1993;**14**:183–6.
16. Price RA. *Treatise on the utility of sangui-suction or leech bleeding*. London: Simpkin and Marshall; 1822. p. 3–4.
17. Grunner OCA. *Treatise on the Canon of Medicine of Avicenna incorporating a translation of the first book*. London: Luzac and Co; 1930. p. 513–4.
18. Kravetz RE. Leech jar. *Am J Gastroenterol* 2001;**96**:894.
19. Adams SL. The medicinal leech: historical perspectives. *Semin Thromb Hemost* 1989;**15**:261–4.
20. Rolleston JD. François-Joseph-Victor Broussais 1772 to 1832: his life and doctrines. *Proc R Soc Med* 1959;**22**:405.
21. Upshaw J, O'Leary JP. The medicinal leech: past and present. *Am Surg* 2000;**66**:313–4.
22. Thearle MJ. Leeches in medicine. *Aust NZ J Surg* 1998;**68**:292–5.
23. Shurtleff B, Channing W, Walker W. Premium for breeding leeches. *Boston Med Surg* 1835;**12**:322.
24. Hare CJ. *Good remedies—out of fashion*. London: Churchill; 1883. p. 30–47.
25. Haycraft JB. On the action of secretion obtained from the medicinal leech on coagulation of the blood. *Proc R Soc Lond* 1884;**36**:478.
26. Markwardt F. Untersuchungen über Hirudin. *Naturwissenschaften* 1955;**52**:537.
27. Fields WS. The history of leeching and hirudin. *Haemostasis* 1991;**21**(Suppl 1):3–10.
28. Conforti ML, Connor NP, Heisey DM, Vanderby R, Kunz D, Hartig GK. Development of a mechanical device to replace medicinal leech (*Hirudo medicinalis*) for treatment of venous congestion. *Rehabil Res Dev* 2002;**39**:497–504.
29. Menage MJ, Wright G. Use of leeches in a case of severe periorbital haematoma. *Br J Ophthalmol* 1991;**75**:755–6.
30. Byrne PJ, Bernstein PE. The use of medicinal leeches to treat macroglossia secondary to blunt trauma. *Otolaryngol Head Neck Surg* 2001;**125**:649–50.
31. Smeets IM, Engelberts I. The use of leeches in a case of post-operative life-threatening macroglossia. *J Laryngol Otol* 1995;**109**:442–4.
32. de Chalain T, Cohen SR, Burstein FD. Successful use of leeches in the treatment of purpura fulminans. *Ann Plast Surg* 1995;**35**:300–6.

Further reading

Available online at www.sciencedirect.com

