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Hirudo Medicinalis and the plastic surgeon

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Summary Medicinal leech therapy is an ancient craft that dates back to ancient Egypt and the beginnings of civilisation. The popularity of *Hirudo Medicinalis* has varied throughout history, reaching such a peak in Europe in the early 19th century that supplies were exhausted. During the latter half of the 19th century, their use fell out of favour, as they did not fit in with the emerging concepts of modern medicine. Leeches have enjoyed a renaissance in the world of reconstructive microsurgery during recent years, and their first reported use in alleviating venous engorgement following flap surgery was reported in this journal [M Derganc, F Zdravic, Venous congestion of flaps treated by application of leeches, Br J Plast Surg 13 (1960) 187] [1].

Contemporary plastic and reconstructive surgeons in units throughout the United Kingdom and Ireland continue to use leeches to aid salvage of failing flaps. We carried out a survey of all 62 plastic surgery units in the United Kingdom and the Republic of Ireland to assess the current extent of use, and to investigate current practice.

We have shown that the majority of plastic surgery units in the UK and Ireland use leeches post-operatively and that the average number of patients requiring leech therapy was 10 cases per unit per year. Almost all units use antibiotic prophylaxis, but the type of antibiotic and combination used is variable.

We outline current practice and suggest a protocol for the use of leeches. Whilst the use of leeches is widespread, the plastic surgery community has progressed little in defining indications for their use or in achieving an accepted protocol for their application in units throughout the UK and Ireland.

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The first recorded use of the medicinal leech dates back to ancient Egypt, with images of the leech adorning the walls in a sepulchre of the 18th dynasty pharaohs (1567-1308 BC). Galen (130-201 AD), the physician to Marcus Aurelius, commonly

used leeches for blood letting, and through the development of his humoral concept of disease made leech therapy widespread. The belief was that removal of the patient's blood would correct the humoral imbalance and restore good health.

In France, under the influence of François-Joseph-Victor Broussais (1772-1832), surgeon in Napoleon's Grande Armée, the use of leeches reached its zenith. Leeches were so in demand

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that supplies throughout Europe and the United States of America were almost exhausted. Government initiatives to build leech farms had to be employed to meet demand, and the trafficking of leeches throughout the world reached an all time high. By the end of the 19th century, the leech had lost its popularity as their therapeutic use did not fit in with the concepts and development of modern physiology, pathology and microbiology.

Haycraft² discovered a pure anti-coagulating preparation contained in the saliva of the leech in 1884 which he named 'Hirudine' after the Latin word 'Hirudo', and brought the possible uses of leech therapy back into mainstream medical literature.

In 1955, Markwardt³ isolated and accurately characterised Hirudin from leech pharyngeal glands, and in 1986 this potent anticoagulant was first produced in quantity by genetic engineering.⁴ In addition to Hirudin, the leech also secretes hyaluronidase, which allows the anticoagulant to spread throughout the wound, and antihistamines, which vasodilate and contribute to prolongation of bleeding following a bite.

The medicinal leech has been used by reconstructive surgeons in recent years to aid salvage of compromised microvascular free-tissue transfers,^{5,6} replanted digits,⁷ ears,⁸ lips^{9,10} and nasal tips.¹¹ Peer-reviewed evidence suggests that the survival of compromised, venous-congested tissues was improved by early application of a leech.¹²⁻¹⁴

Although we know from our experiences in plastic surgery units throughout the United Kingdom and Ireland that leeches are used post-operatively in certain cases, no quantitative study on this subject has been previously published. In addition to assessing the current extent of use of *Hirudo Medicinalis*, we also assess current practice, and make recommendations for future improvements in protocols.

Method

A telephone survey of all 62 plastic surgery units in the United Kingdom and the Republic of Ireland was conducted in November 2002. The names, addresses and phone numbers were obtained from the British Association of Plastic Surgeons Website (www.baps.co.uk). Information was obtained from a senior member of nursing staff, who had first hand experience of the use of leeches on the unit.

1. Are leeches used post-operatively by the plastic surgeons in your unit?
2. How many times per year on average are leeches used?

3. Do you use antibiotics routinely post-operatively when leeches are applied?
4. Do you disinfect sites prior to leech application?
5. How frequently are the leeches monitored?
6. Do you routinely counsel patients?
7. Had any patients refuse treatment with leeches?
8. Were there written protocols for the use of leeches?
9. Do you keep leeches in the hospital overnight?

Results

Accurate information was gained from 50 (81%) of the 62 units. Of these, 40 (80%) had used leeches post-operatively in the salvage of compromised free flaps or digital replants within the last 5 years. Fifteen units used leeches 1-5 times per year, 10 units used leeches 6-10 times per year, 12 units used leeches 11-15 times per year and three units used leeches more than 16 times per year (see Fig. 1). The average number of patients requiring leech treatment was 10 cases per unit using leeches per year. Thirty seven units used prophylactic antibiotics routinely during leech application, with augmentin, metronidazole, benzyl penicillin, ciprofloxacin and flucloxacillin all being used (see Fig. 2).

The site of application was disinfected by 31 units (77.5%). Of these, 13 (42%) used sterile water, 12 units (39%) used saline, three units (10%) used alcohol, one unit (3%) used heparinised saline, one unit (3%) used warm saline and one unit (3%) used warm water. Eleven of the 40 units (27.5%) routinely had a nurse stay with the patient for the entire duration of 'leech therapy'. In the remainder of units, nurses observed at 5-10 min intervals, and plastic surgeons observed patients when on the ward. Most units counted leeches on the wound to avoid losing leeches in the dressings.

Patients were routinely counselled in 21 (52.5%) of the plastic surgery units, patient information leaflets were available in four units (10%), and the services of a clinical psychologist were available in five units (12.5%). Four units (10%) reported patient refusals in the last 5 years. Written protocols concerning the use of leeches were available in 35 units (85%) and 28 units (68%) routinely kept leeches in the hospital pharmacy overnight.

Discussion

Our study shows that the majority of plastic surgery units in the United Kingdom and Ireland use *Hirudo*

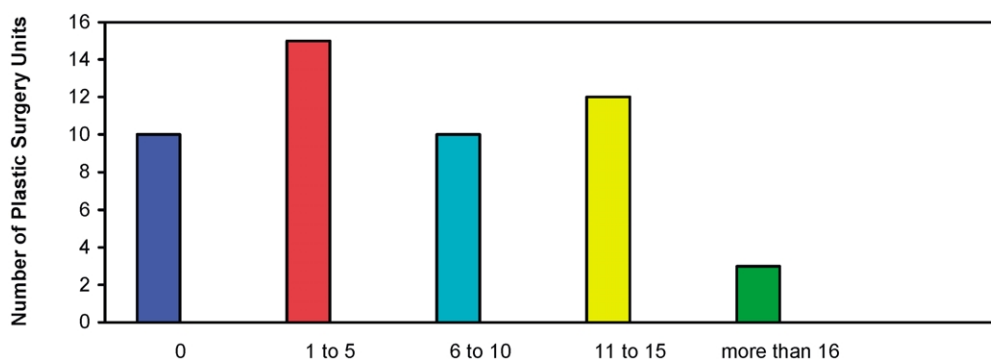


Figure 1 Number of cases requiring *Hirudo Therapy* per year.

Medicinalis to improve drainage from venously congested tissue post-operatively. Although prophylactic antibiotics were used by almost all units questioned, there was no agreement upon the appropriate antibiotic regimen. Six different antibiotics were used, either individually or in combination.

It has previously been shown that the use of prophylactic antibiotics with *Hirudo* therapy is not ubiquitous,¹⁵ and when employed, a range of antibiotics is used. Infection is possibly the most worrisome complication of leech application and generally presents as cellulitis or a local abscess. The exact incidence of leech-associated infection is difficult to assess, with incidences ranging from 2.4 to 20% being reported in the literature^{16,17} ranging from cellulitis to extensive tissue loss and septicaemia.^{18,19} Extensive studies have been carried out on the surface and mouth flora of leeches²⁰ which show *Aeromonas* to be prominent in the resident flora. Since 1976 three *Aeromonas* genospecies (*Aeromonas hydrophila*, *Aeromonas sobria* and *Aeromonas caviae*) have been subdivided into 14 monospecies.²¹ Infections due to *Aeromonas hydrophila* are a recognised complication of leech application, first described in this journal in 1983.²² Apart from *Aeromonas hydrophila*, pathogens causing wound infection following *Hirudo* therapy that have been reported in the literature include;

Serratia marcescens,²³ *Aeromonas sobria*²⁴ and *Vibrio fluvialis*.²⁵

The single report of *Vibrio fluvialis* associated infection may well have been misnamed, as the API20E method was used for identification purposes. The microbe was almost certainly an *Aeromonad*.²⁶ In view of the frequency of human infections following leech treatments, it would seem logical to give antibiotics prophylactically. The occurrence of β -lactamases rules out the use of first generation cephalosporins and penicillins^{27,28} and the occasional finding of extended β -lactamases mitigates against the use of synthetic or semi-synthetic cephalosporins or even penems. Resistance to septrin and tetracyclines has also been reported. Our recommendation would be to use a quinolone (for example ciprofloxacin) with perhaps an aminoglycoside, as resistance to these groups has not been cited.

Persistent and prolonged bleeding after the removal of the leech has long been considered a complication. In 1819 Anthony White reported that a 2-year-old girl had died with the loss of blood induced by a single leech.²⁹ Similar deaths were described throughout the century. The bleeding, however, in the vast majority of cases can be well controlled with direct pressure and topical thrombin. It is sensible to keep a daily check on the haemoglobin during leech therapy, particularly in young children.

Anaphylaxis and local allergic reactions to salivary secretory products have been described,³⁰ and excessive scarring has been associated with leeching.¹⁵ The leech's propensity to migrate after attachment has caused various problems. Upper airway obstruction has been described following leech migration to the hypopharynx and subsequent engorgement with blood, and haemoptysis has been reported following leech migration to the bronchus.³¹

Early in the 19th century, certain physicians caused leeches to disgorge themselves by applying

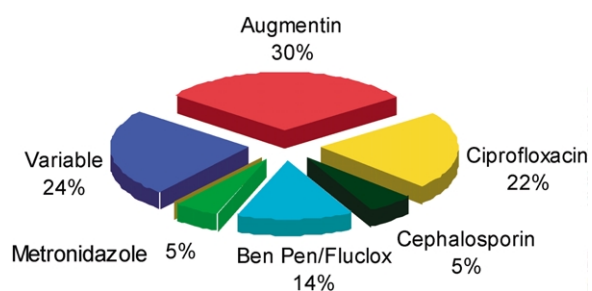


Figure 2 Antibiotic prophylaxis used by plastic surgery units during *Hirudo Therapy*.

salt to their mouths, and in this manner leeches were used as many as 50 times.²⁴ It is important to remember that leeches should never be reused as they have been known to vomit ingested blood if mishandled, and in theory may have the potential to transmit infections such as hepatitis and HIV.³² The majority of units disinfected the sites, but there was no agreement on the appropriate agent to use. The majority used saline or sterile water, with three units using alcohol.

Disinfection with alcohol is not to be recommended as either alcohol or hypertonic saline may cause the leech to regurgitate blood and possibly infect the site with its own bacterial flora. As early as 1804, Wilkinson postulated that 'the area to which leeches were to be applied should be washed with soap and water, rinsed thoroughly, and, when appropriate, shaved very close to the skin: 'I have found the sharp points of the incised hairs so greatly to annoy them as to prevent their fixing'.³³ In the past, if attachment proved difficult, leeches could be encouraged to bite by rubbing the target area with sugary water, milk, or most effectively of all a small quantity of fresh blood.³⁴ Some physicians found that submerging leeches in diluted wine or very briefly in warm full strength porter, caused leeches to bite more vigorously.³⁵ Anecdotal reports indicate that placing leeches in a smoke filled room impeded leech attachment.²⁹ It has been recently suggested³⁶ that submersion of the tissue in water improves leech attachment. This technique could prove valuable in situations involving extremities, but is otherwise somewhat limited.

Staff in approximately half the units routinely counselled patients on the benefits and psychological aspects of leech therapy, and the services of a clinical psychologist were available in some units. Patient information leaflets were not often available. All units got informed consent from the patient before leech therapy was instituted, and it was well received by virtually all, with only a small number of units reporting patient noncompliance within the last 5 years. This may be due to the fact that patients saw the leeches as a 'last resort' in salvaging the compromised tissue. Written protocols were available in the majority of units, and over half routinely kept leeches in the hospital pharmacy overnight.

For a unit to use leeches, the hospital pharmacy must buy a storage tank and medium in addition to the leeches. 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 application.

Biopharm Ltd estimated that they supply approximately 25 000 leeches to the United Kingdom and Ireland each year and 60 000 to the United States of America.

Suggested protocol for the use of leeches

We suggest a protocol based on our review of relevant literature, the information pack from Biopharm UK and research into various hospital guidelines.

General considerations

Leeches should be kept in a cool environment to enhance performance and in warm weather, a cold jacket should be placed around the jar approximately half an hour before application.

Preparation of the site

Clean the patient's skin thoroughly with warmed heparinised saline to enhance vasodilation, promote ongoing bleeding and remove any ointment, alcohol or iodine from the skin that could in theory impede attachment. Dampen a square of gauze with sterile water and cut a 1 cm hole in the middle. Place the gauze in close contact with the cleansed area, with the hole over the required attachment site. This will form a barrier to help prevent the leech from migrating. The area can be then pricked with a hypodermic needle to encourage the animal to attach to the specified area as the process of encouraging the leech to feed can be taxing.

Handling and application

Pick up the leech with care, using either polythene gloves or plain unserrated forceps and steer the leech's head to the hole in the gauze. Once attached, the leech will remain safely in place until fully distended (30-60 min). It is important to be vigilant and check the wound site often to ensure that the leech has not migrated or detached prematurely which may result in aforementioned complications. Once fully engorged the leech will detach. The leech should not be forcibly removed.

NB To detach an errant leech rapidly, sprinkle its head with common salt. They should never be forcibly removed from a surface.

Prophylactic antibiotics³⁷

A prophylactic regimen of a quinolone (for example ciprofloxacin) with an aminoglycoside should be used for the entire duration of leech application. Patients treated with leeches and discharged with eschars or open wounds should continue oral antibiotic therapy until wound closure.

Daily investigations

Haemoglobin should be checked at least daily for

the duration of leech therapy to help monitor blood loss particularly in young children.

After-care of wounds

The therapeutic effect of leech application is gained almost entirely in this period, and depends greatly on the care given to the bite wounds. Each bite must be encouraged to bleed by gently removing any locally forming clot at regular intervals.

Re-use of leeches

Leeches should not be re-used-fresh and used leeches must be kept completely separate and labelled clearly.

Disposal of leeches

Used leeches are treated as clinical waste; on no account should used leeches be returned to pharmacy. They must not be flushed down a toilet or sluice. Leeches should be placed in a small screw capped jar with about 20 ml of 8% ethanol and clearly labelled with the patients name. After 3 min 50 ml of 70% methylated spirit should be added and lid replaced securely. The jar should be put in a sharps container and send for incineration.

We have shown that whilst the use of leeches is widespread we have progressed little in defining indications for their use or in achieving an accepted protocol for their application in plastic surgery units in the UK.

Whilst traditionally leeches have been used for attempted salvage of relatively small volumes of tissue, for example finger or ear amputations or sub-total amputations, most surgeons seem to develop their own indications with experience.

The ancient craft of leech application still has a place in contemporary reconstructive surgery and remain a useful part of the armamentarium for the plastic surgeon.

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