

MICROSURGERY AND FLAP

Medicinal Leech Therapy as an Alternative Treatment for Vein Problems after Free Flap Surgery: A Case Report

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Background: Venous stasis due to vein thrombosis is a complication after microsurgical procedure which if left untreated, may ultimately lead to flap failure. Medicinal leech has been useful as a conservative treatment to overcome venous stasis in cases where it is not possible to perform salvaging procedure.

Patients and Methods: A 28-year-old female who suffered from a defect on the right heel following traffic accident. The patient was initially treated by performing sural flap to cover the heel defect, but was unsuccessful. Next reconstruction was done with free radial forearm flap, however in the early post-operative period vein compromise was seen which was caused by vein thrombosis. Even though heparinization therapy was immediately begun, the result was still unsatisfactory, so medicinal leech therapy was performed to prevent loss of entire flap tissue.

Results: Leeches turned out to be bulging due to sucking process on the congested venous. The sucking result on this patient was satisfactory.

Summary: This study shows that free tissue transfers with surgically unsalvageable venous obstruction can be helped by leech therapy protocol.

Keywords: free flap, vein thrombosis, vein stasis, leech therapy

Pendahuluan: Vena stasis akibat trombosis vena adalah komplikasi yang terjadi setelah operasi bedah mikro yang tidak teratasi, yang dapat berakibat kegagalan flap. Terapi lintah telah diketahui bermanfaat sebagai terapi konservatif untuk mengatasi vena stasis di mana tindakan penyelamatan jaringan sudah tidak memungkinkan untuk dilakukan.

Pasien dan Metode: Wanita usia 28 tahun mengalami defek pada tumit kanan akibat kecelakaan lalu lintas. Pasien segera ditangani dengan dilakukan *sural flap* untuk menutup defek pada tumit, tetapi mengalami kegagalan. Rekonstruksi berikutnya dilakukan dengan *free radial fore arm flap*, tetapi kondisi sesaat setelah post-operasi terjadi gangguan vena yang menyebabkan trombosis vena. Walaupun terapi heparinisasi secepatnya dimulai, hasil tetap tidak memuaskan sehingga terapi lintah digunakan untuk mencegah hilangnya seluruh jaringan flap.

Hasil: Lintah menjadi menggemuk setelah proses penghisapan pada kongesti vena. Proses menghisap pada pasien ini memuaskan.

Ringkasan: Laporan ini menunjukkan bahwa transfer jaringan bebas dengan obstruksi vena, penyelamatan dapat dibantu dengan protokol terapi lintah.

Kata kunci: free flap, vein thrombosis, vein stasis, leech therapy

Reconstruction of heel defects remains a challenging procedure in plastic surgery. The foot is an especially important part of the lower limb because of its integrated function as both sensor and effector. The skin that covers the foot is very peculiar, especially in the weight-bearing areas, where the non-shearing and padding properties make it quite resistant and strong. Although many reconstructive possibilities exist, their use is

limited and problems can occur. The initial design of fasciocutaneous flap along vertical axis have evolved to transverse pedicle and recently to distal pedicle. The treatment of choice depends on site, dimensions and cause of the defect. Limited soft tissue loss (type I) can be repaired by local flaps in weight-bearing areas and by skin grafts in non weight-bearing areas. For large soft tissue avulsion (type II) involving weight-bearing areas, the

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use of a free fasciocutaneous, musculocutaneous or muscle-plus-skin graft transfer is indicated. In cases of large avulsion with bone loss (type III), a free osteocutaneous transfer is recommended. Regarding classification above, our patient was considered type II.^{1,2}

Although many microvascular surgeries have independently reported excellent success rates for free tissue transfer to the head and neck region, occasional flap failures do occur. The most common causes of these failures are venous obstruction. Once venous obstruction is identified, these patients require emergency exploration to reestablish venous outflow. A recent survey of 95 microsurgical procedures with 41% salvage procedures rates in 192 threatened flaps were reported. Occasionally, despite the surgeon's best efforts, venous obstruction may not be surgically salvageable because of microcirculatory problems within the flap or lack of alternate recipient venous access.

For these cases, when flap failure is certain, leeches can be used as an alternative method for reestablishing venous outflow until inosculation occurs. Previous reports describe the successful use of leeches for treating flaps with venous congestion.

Leeches were used for bleeding by Syrian physicians as early as 100 BC. Historically, the leeches were placed or directed to small areas such as the mouth, ear or other areas using a "leech tube" (ear infections, sinusitis). Today, leech therapy is used in plastic surgery throughout the world as tools following reattachment of amputated digits, free flaps, pedicle flaps and replantation of amputated tissues (often includes an anastomosis between surgically ligated or traumatically severed blood vessels) that are compromised. The two main species used in medicine are the close relatives *Hirudomedicinalis* and *Hirudoverbena*. Both these species have distinct color patterns on their ventral body surfaces.^{3,4}

PATIENT AND METHODS

A 28-year-old female suffered from neglected open comminutive fracture of the calcaneus with dead bone and rupture of

Achilles tendon after motor vehicle collision 16 days before admission to Dr Muwardi General Hospital. Physical examination revealed a 10 x 7 cm defect in calcaneal region with soft tissue loss; and necrotic calcaneal bone in the base of the wound. We performed sural flap to close the defect but the flap was compromised and deemed non vital at 4th day postoperative period. (Figure 1) We then decided to reconstruct the defect with microsurgical procedure using free radial forearm tissue transfer. On the 1st day post operative, we found that the flap was compromised due to venous problem (figure 2), therefore the patient was given intravenous heparin 1000 unit three times daily. On 4th day post operative, the venous congestion became clinically more obvious. (figure 3) Leech therapy was chosen as one of the modalities to treat the venous congestion. (Figure 4) Leech attached on congested area for 8 days until it is automatically detached.

RESULT

Leeches turned out to be bulging due to sucking process on the congested venous. The sucking result on this patient was satisfactory. (Figure 5).

DISCUSSION

Microvascular surgery has developed into an integral part of reconstruction. The ability to transfer a wide range of tissues such as fasciocutaneous, myocutaneous, myofascial, osseous, and osseocutaneous flaps has given surgeons the ability to address considerable lesions and the resultant defects. Free tissue transfer has reached high levels of success in terms of flap survival. Most studies report an overall survival rate of 95%. Although numerous factors contribute to flap failure, thrombosis of the microvascular anastomosis is considered to be the major cause of failure. The consequences of vessel thrombosis are severe and cause significant morbidity and even mortality. Thrombosis of the pedicle, usually the vein, has been reported to occur in 3% to 15% of microvascular anastomosis. Thrombus



Figure 1. Preoperative picture, before radial forearm flap.



Figure 2. First day after radial forearm free flap.



Figure 3. Day 4 after free radial forearm flap surgery, flap was purple in colour and swollen; indicative of venous congestion



Figure 5. During leech therapy

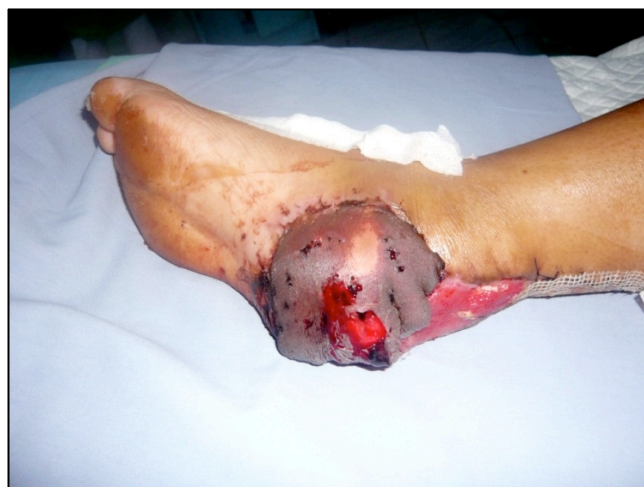


Figure 6. Eight day post leech detachment

formation in the high-flow arterial system is considered to be most dependent on platelet effects whereas thrombosis in the venous system is more dependent on tissue factors activating the coagulation cascade.³

During microsurgical procedure, traction or other pressure related changes in tissue tension, changes in blood flow patterns can therefore lead to impaired perfusion. The microsurgical anastomosis of the hair thin blood vessels is extremely challenging; venous insufficiency sometimes occur and could lead to necrosis of flap. In this case, during surgery there was a discrepancy in the diameter of veins between recipient and donor and the location of anastomosis was only 5 mm below lateral malleolus so that reanastomosis as a salvaging procedure, if needed, was not considered a wise option.⁴

Indications for leech therapy is vein compromise on microvascular surgery, signed by: skin color – dusky or bluish; capillary return – brisker than normal, pinprick response – bleeding should be dark and rapid; history – with consideration of vein problem which appear due to surgery. In this case, we found venous problem after surgery with the signs as mentioned before.⁴

The salivary glands of medical leech contains more than 100 bioactive substances (very few are known in terms of chemical structure and mechanism) including bacteriostatic, analgesic, resolving actions, has anti-edematous effect, improves immune system activity, eliminates microcirculation disorders, restores permeability of tissues and organs, eliminates hypoxia, reduces blood pressure, detoxifies the organism. The agents contained within leech saliva are as follow: 1)*hirudin* (a potent anticoagulant) enables the blood to flow for some time without clotting, It is thought that the prolongation of bleeding after leech bite is mainly due to *hirudin* 2)*calin* is another constituent of leech saliva and the main function of this protein is to induce secondary bleeding which can last up to 12 hours, 3)*hyaluronidase* –known as the “spreading factor” further facilitates the penetration and diffusion of these pharmacologically active substances into the

tissues- especially in joint pain (no empirical studies to confirm this) and has antibiotic properties, 4)*destabilase* - dissolves fibrin and has thrombolytic effects, 5)*bdellins* – Anti-inflammatory effect and inhibits trypsin, plasmin and acrocin, 6)*acetylcholine, histamine*-like substances – vasodilator, increases the inflow of blood at the bite site.⁴

Hirudomedicinalis has two suckers, one in its anterior and one in its posterior region. They usually feed via the anterior suckers in a process that lasts about 20 to 40 minutes. They can suck 10-15 ml of blood and may increase their body size eight to 11 times. Leeches have different chemical agents within their bodies that are released when salivating.

The protocol of leech therapy is as follows: Leech placement is continuous (3 leeches per hour) and tapered slowly according to clinical assessment of inosculation. Patient is admitted to intensive care unit for hemodynamic monitoring, flap monitoring, and undivided nursing care. An arterial line and a central venous line are helpful for treating these patients. Flap monitoring consists of nurse listening to the Doppler signal and examining flap every hour, and physician doing this every 1 to 2 hour until the flap is stabilized and thereafter every 2 to 4 hours. Degree of venous congestion is estimated by describing percentage of ruborous and violaceous color of flap skin paddle, testing capillary refill, and observing color of the blood oozing from leech bite sites. Flap monitoring can become difficult as leech therapy continues because of multiple leech bite sites on skin paddle. Antithrombotic therapy is administered with aspirin (81 mg perdose), heparin sodium (goal partial thromboplastin time, 50-60 s), and/or dextran 40 (continuous intravenous infusion at 25 mL/h). Hematologic evaluations are performed every 4 hour and consist of complete blood cell count, partial thromboplastin time, and serum chemistry studies. Blood transfusions are given when needed, based on hemoglobin level of 8 g/dL. Antibiotic prophylaxis for *Aeromonashydrophila* is administered, with double coverage during leech application and single coverage for 2 weeks after leech therapy

is discontinued. (The approach varied depending on the preference of the attending physician on the infectious disease consultation service. Sulfamethoxazole-trimethoprim and a quinolone were most commonly recommended.). Flap is cleaned hourly with gauze soaked in isotonic sodium chloride solution to stimulate hemorrhage from leech bite sites. Skin surface is maintained to be free of ointment and Doppler gel, to facilitate attachment of leeches. Clear plastic adhesive membrane dressing (Tegaderm; 3M Health Care, St Paul, Minn) is placed on skin surrounding the flap to avoid errant leech attachment or skin excoriation. In cases of intraoral leeching, path to the oropharynx is blocked with gauze to prevent leech migration into the more distal aerodigestive tract, and the perioperative tracheotomy is left in position to protect the airway. Use of narcotics and benzodiazepines is minimized to avoid sluggish leech activity. Once leech has completed the blood meal, it detaches and is immersed in 70% ethanol.⁷

We have not yet established our own leeching protocols therapy, including what type of leech, how many leeches were needed during therapy, and retained until reaching a volume indicative of venous congestion.

The contraindications are as follow: arterial insufficiency, previous exposure to leeches (because of risk for anaphylaxis or allergic reaction), immunosuppression (because of risk of infection from *Aeromonashydrophila*), patient refusal to accept blood transfusions, patient refusal to undergo leech therapy, unstable medical status, the skin is cold, extreme age (older humans or children), smokers, perfumed skin. There was no contraindication found in this patient.⁷

Leeches are not beneficial in a blue flap. The only indication to use them is a less perfused marginal angiosome in an otherwise well-perfused flap. Leeches only digest congested blood from the flap surface without any effect on the causal agent located distant

from the skin. In addition, the temporary effect of stasis reduction on the flap surface will lead to false interpretation of a "well" perfused flap and thus a disastrous delay in definite recognition of the real problem.⁸

SUMMARY

We reported a case of medicinal leech therapy to treat venous congestion in Free Radial Forearm Flap. From this study, we learn that salvaging venous obstruction is possible by using leech protocols.

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REFERENCES

1. Santanelli F, Tenna S, Pace A, Scuderi N. Free flap reconstruction of the sole of the foot with or without sensory nerve coaptation. *Plast. Reconstr. Surg.* 2002; 109 : 2314.
2. Ayyappan T, Chadha. Super sural neurofasciocutaneous flaps in acute traumatic heel reconstructions. *Plast.Reconstr. Surg.* 2002; 109 : 2312.
3. Emerick KS, Deschler DG. The effect of low-molecular-weight heparin on microvenous thrombosis in a rat model. *Arch. Facial. Plast. Surg.* 2007; 9:19.
4. Panicker N. Leech therapy-*Hirudomedicinalis*. Australian Wound Management Association (South Australia). 2011. http://www.sawma.org.au/documents/2011_02_leech_therapy.pdf
5. Kaya B, Bat O, Bulut EN, Altun H, Memisoglu K. Prolonged venous bleeding due to traditional treatment with leech bite: a case report. *Journal of Medical Case Report.* 2011; 5:17.
6. Siddall ME, Trontel P, Utevsky SY, Nkamany M, Macdonald KS. Diverse molecular data demonstrate that commercially available medicinal leeches are not *Hirudomedicinalis*. *Proc. R. Soc. B.* 2007; 274:1481.
7. Chepeha DB, Nussenbaum B, Bradford CR, Teknos NT. Leech therapy for patients with surgically unsalvageable venous obstruction after revascularized free tissue transfer. *Arch. Otolaryngol. Head. Neck. Surg.* 2002; 128:960.
8. Wilson JL, Morrit AN, Morrison WA. Avoiding Complication. In: Wei, F.C., Mardini, S (eds). *Flap and Reconstructive Surgery*. New York: Saunders Elsevier, 2009. pp:134.