

EVIDENCE BASED CASE REPORT

**Leech Therapy for a Non-Surgical Method of Flap Salvaging
after a Free Flap Transfer****Parintosa Atmodiwirjo, Indri Aulia*****Department of Surgery, Faculty of Medicine Universitas Indonesia–
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Abstract

Leech therapy has been accepted in clinical settings to salvage a flap with vein congestion. We did leech therapy for 7 days with 10 days broad-spectrum prophylaxis antibiotics and applied 2 leeches with gradual decrement of frequency. The patient got vital fibular flap with partial necrotized distal part of skin paddle. The clinical question is how leech therapy can be applied in vein congestion or venous compromised after free flap transfer. Articles search was conducted on October 28th, 2014, in PubMed, using “leech therapy AND flap” as keywords. Initial search discovered 95 articles. A total of 4 articles that emphasized flap salvaging were included. Following outcomes: frequency and duration, number of leeches, sucked blood volume, antibiotics prophylaxis during therapy, and complications, were extracted and analyzed. Leech therapy is an alternate method for salvaging a flap without any secondary invasive and complex procedure. Leech therapy can be used 2-12 times in 24 hours for 3-10 days. A leech can suck 2.45-8 ml blood. Broad spectrum antibiotic has been used for prophylaxis, however infection of *Aeromonas hydrophilia* is recorded during the application. Further study is needed to give stronger evidences and explanations in using this method in clinical application.
Keywords: Leech therapy, flap salvaging, vein congestion.

**Terapi Lintah sebagai Tata Laksana Non-Operatif Penyelamatan Flap Pasca
Pemindahan Flap Bebas****Abstrak**

Terapi lintah sudah diterima sebagai tatalaksana penyelamatan flap dengan kongesti vena. Peneliti melakukan terapi lintah selama 7 hari dengan penggunaan antibiotik spektrum luas selama 10 hari dan menggunakan 2 ekor lintah dengan frekuensi yang diturunkan bertahap. Pasien yang terpilih memiliki fibular flap yang vital dengan bagian nekrosis di distal. Pertanyaan klinis riset ini adalah bagaimana terapi lintah dapat digunakan untuk kongesti vena setelah pemindahan flap bebas. Pencarian artikel dilakukan pada 28 Oktober 2014 di PubMed dengan kata kunci “leech therapy AND flap”. Terdapat 95 artikel pada awal pencarian. Total 4 artikel yang membahas tentang penyelamatan flap dimasukkan kedalam studi ini. Data seperti frekuensi, durasi, jumlah lintah, volume darah terhisap, antibiotik profilaksis dan komplikasi dikumpulkan dan dianalisis lebih lanjut. Terapi lintah menjadi pilihan tatalaksana untuk penyelamatan flap tanpa adanya tindakan sekunder yang invasif dan kompleks. Terapi lintah bisa dilakukan 2-12 kali dalam 24 jam untuk 3-10 hari perawatan. Seekor lintah bisa menghisap 2,45-8 ml darah. Profilaksis antibiotik spektrum luas dipergunakan selama penelitian, namun masih terdapat infeksi *Aeromonas hydrophilia*. Riset lebih lanjut diperlukan untuk memberikan bukti dan penjelasan lebih kuat mengenai penggunaan tatalaksana ini di praktik klinis.
Kata kunci: Terapi lintah, penyelamatan flap, kongesti vena.

Introduction

Flap is one of armamentarium for a plastic surgeon. Nowadays, for a better outcome functionally and aesthetically, plastic surgeons could use reconstruction elevator which give free flap transfer as an option. Since the technique for elevating and anastomosing a free flap requires complex procedure and equipment, it gives a lot of opportunity to induce failing flap. The failing flap is caused by vascular compromised; arterial and venous. The differences of both complications could be detected in intensive post-operative monitoring by inspection, palpation, and auscultation of blood flow using handheld doppler even it is not specifically detect the blood flow in anastomosed artery.

Arterial compromised will show a pale, less tone, cold, slow capillary refilling time flap, and negative scratch test. This complication should be treated surgically to restore the arterial blood flow. Three hours after loss arterial blood flow still maintain the tissue without necrotizing muscle.¹ It is different from venous compromised which can cause irreversible damage and lately induced arterial compromised. This flap will show bluish or purplish color, high tone, and warm flap. In 8 hours, the flap with venous obstruction could cause total necrosis tissue. The flap with venous obstruction should be treated in the first 3 hours before the permanent compromise.¹

For those threats, there are 2 options of management in salvaging flap before it turns into non-vital flap; surgical and non-surgical method. Even the surgical method could show visually where is the main problem of the transferred flap, for few conditions less invasive treatment is preferable for less disadvantages and damages of the flap. Leech therapy as a non-surgical method has been accepted into clinical application to salvage a flap with vein congestion.^{1,2}

Leeches have 700 species with genus named *Hirudo*. Species that is used in medicine *Hirudo medicinalis*. Other names for this species comes from Anglo-Saxon, is *laece*, which means physician. Leech therapy is also called hirudotherapy. The earliest use of leeches is in Egypt (1576-1308 BCE) and became more popular in medieval periods until 19th century. Avicenna in 'Canon of Medicine' introduced Leech therapy in 1020. Abdel-Latifal-Baghdadi in 12th century stated that leeches therapy helped to promote cleaning tissues after surgery.³⁻⁶ The popularity of leeches in medicine decrease in late 19th and not well discussed in the first 75 years of 20th century.^{7,8}

Leeches are hermaphrodite, have 2.5 to 5 cm length. They have 2 suckers both in the end of their body. The sizes are different; the bigger one is in the caudal and they use it for crawling and attaching. No jaw is on the caudal sucker, so that no secretion of anticoagulant or anti platelet aggregation comes from the caudal side. The cephalic sucker is the smaller one; it has 3 jaws that contain of 60 to 100 teeth, which would make Y-shaped bite or Mercedes-Benz logo.^{7,8} The saliva consists of 12 biologically and pharmacologically active substances, which has effects such as anticoagulant and anti-platelet aggregation, vasodilator, increasing tissue permeability, local anesthetic, increasing intestinal viscosity and antibiotic action, and anti-inflammatory.¹⁻²² The amount of passive blood loss after leech detached is greater than 10 times ingested blood. The combination of sucked blood and passive blood loss will decrease venous congestion.¹

Few studies were reported in term of using leech therapy, such as after penile replantation, in lingual trauma that caused massive hematoma, after replantation of amputated facial tissues, replantation of the fingertip, in sublingual hematoma, macroglossia, and ischemic finger.²³⁻³⁰

Methods

Case Description and Clinical Question

A female patient, 24 years old, had enlarging mass on her jaw about three years ago. She underwent a surgery to remove the mass and reconstruct the jaw using plate and screw a year ago. Three months later, the plate extruded and the patient underwent another reconstruction to cover the plate using surrounding soft tissue.

This complains recurred 3 months after the surgery and the plate extruded on the central and left lateral segment based on Jewer Classification.³¹ The patient was referred to dr. Cipto Mangunkusumo National Hospital to get a proper option of management.

We chose a free fibular flap as an option to replace her mandible. Due to lack of soft tissue and skin in outer lining to cover the plate and bone of fibula and to avoid the recurrence, we decided to put skin paddle as outer lining, so that we chose the left fibular. The surgery finished in 12 hours that anastomosed 1 artery (peroneus artery to left lingual artery) and 2 veins (peroneus committantes veins to left lingual committantes vein and branch of external jugular vein). Flap condition was good in immediate post operative condition.

Twenty-four hours after the ischemic time, the color of distal part of skin paddle started to change into bluish. The scratch test was positive, although the blood color is nearly dark red. It meant that the arterial flow of this flap was good, but the venous flow was not adequate even it has 2 veins for blood drainage. We manage this complication using

leech therapy after 16 hours of the first assessment of vein congestion (Figure 1). The leech therapy was done for 8 days with gradual decrement of frequency. The detail of the treatment is described in Table 1. The weight was converted to volume by using formula $v=w/\rho$. Blood cell density is 1.125 gram/ ml.

Table 1. Details of Amount of Sucked Blood Measurement

Day	Frequency	Number of leeches	Weight before attached (mg)	Weight after detach (mg)	Weight addition (mg)	Sucked blood volume (ml)	Total sucked blood (ml)	Additional Information
1 (29.10.14)	4 times	2						
		2						
		2						
		2						Not measured
2 (30.10.14)	3 times	2						
		3						
		2						
3 (31.10.14)	3 times	3	2	4,5	2,5	2,22	4,89 (@2,45)	8,01/day
			1	4	3	2,67		
			1	1	0	0		
		2	2	8	6	5,33	9,77 (@4,89)	
			1	6	5	4,44		
		2	1	1,5	0,5	0,44	1,33 (@0,67)	
4 (01.11.14)	2 times	2	2	4	2	1,78	7,11	4,89/day
			2	8	6	5,33	(@3,56)	
		2	2	2	0	0	2,67	
			2	5	3	2,67	(@1,33)	
5 (02.11.14)	2 times	2	3	9	6	5,33	10,66	8,44/day
			1	7	6	5,33	(@5,33)	
		2	0,5	3	2,5	2,22	6,22	
			0,5	5	4,5	4,0	(@3,11)	
6 (03.11.14)	2 times	2	1	3	2	1,78	1,78	4,0/day
			1	1	0	0	(@1,78)	
		2	0,5	3	2,5	2,22	4,44	
			0,5	3	2,5	2,22	(@2,22)	
7 (04.11.14)	2 times	2	1	5	4	3,56	6,67 (@3,33)	4,66/day
			0,5	4	3,5	3,11		
		2	3	4	1	0,89	2,67	
		4	6	2	1,78	(@1,33)		
Total or Average		38	@1.5	@4.35	@2.85	58.21	30.00 @2.72	6.0/day

We put 38 leeches during this therapy, the application was 4 times and decreased gradually until 2 times before we decided to stop the therapy on the 8th day. Before attached onto the skin paddle, we measure the weight of leech (Figure 2 and

Figure 3) and measure it again after it detached spontaneously. The weight was converted to volume by using formula $v=w/\rho$. (Blood cell density is 1.125 gram/ ml). We gave the patient prophylaxis antibiotic during the therapy using ceftriaxone 2x1 gram.



Figure 1. Skin Paddle Condition in The First Day of Leech Therapy on October 29th 2014

The leeches sucked 58.21 ml of total blood during this therapy or 2.85 ml for each leech. On the last day of therapy, we checked if there was



Figure 2. Skin Paddle Condition before Leeches were Attached on November 2nd 2014



Figure 3. Leeches Detached Spontaneously after 2 Hours on November 2nd 2014

any infection or bacteremia. The final result is vital fibular flap with partial necrotized distal part of skin paddle, which had been corrected using local skin flap 2 weeks after the leech therapy (Figure 4-6). There is no infection after the therapy that is proven in the cultured blood laboratory finding which showed sterile blood.

We do this study to answer the clinical questions of what we do based in strong evidences and explanations in using leech therapy in clinical application for salvaging a free flap on venous congestion status; how many times we do leech therapy in a day; how long the therapy should be; how much the sucked blood for each leech; what is the advantage and disadvantage of this therapy; is there any precaution that should be noted in leech therapy.



Figure 4. Skin Paddle Appearance 2 Weeks after Leech Therapy. The Skin Paddle Showed Necrotic skin on The Distal part.



Figure 5. Design of Rhomboid Flap that was Used to Close the Skin Defect

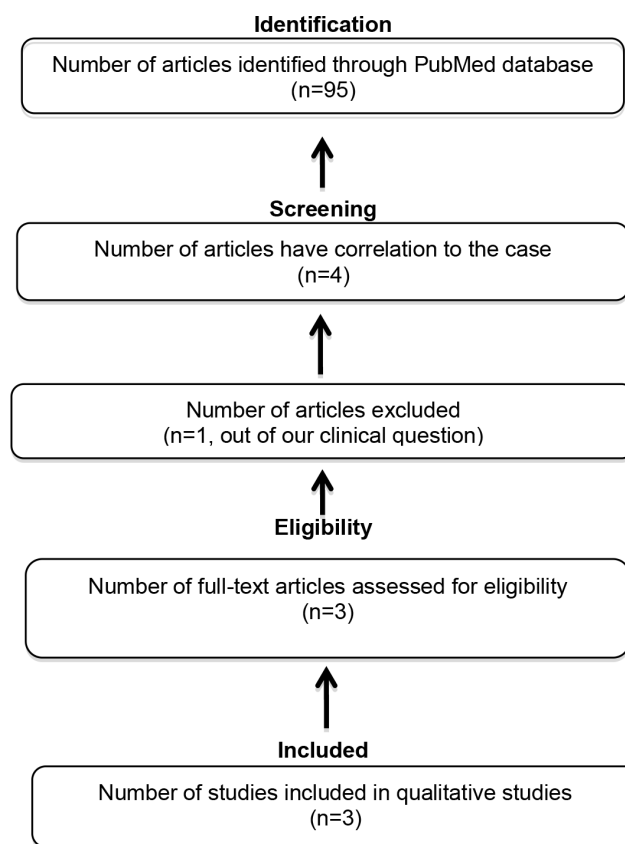


Figure 6. Immediate Post Operative Result after Secondary Reconstruction

We search the tantamount studies using “leech therapy AND flap” as keywords in medical database in PubMed, then cited and summarized the appropriate relevance and take quintessence of the study to reinforce what we do in our center. We describe the methods using the flowchart.

Results

There were 95 articles shown on PubMed with those keywords, accessed on October 28th, 2014. Those articles are sorted and analyzed then only 4 articles are specifically discussed about flap salvaging. The selection result is described below.



We evaluate the following outcomes: type of patient cases, frequency, duration of therapy, sucked blood volume, number of leeches, prophylaxis antibiotic during therapy, risk and complications, and other additional information (Table 2).

Table 2. Summary of Evidence Articles

Authors	Patients' Cases	Frequency	Duration	Number of leeches	Amount of Blood	Risk	Precaution	Additional Information
Utley DS, Koch J, Goode RL	Pectoralis major myo-cutaneous flap, supraorbital forehead flap, paramedian forehead flap.	6-12 times in 24 hours	15-2 hours each application	2 leeches every period	7-8 ml and 50 ml additional blood loss	Infection of <i>Aeromonas hydrophilia</i> , overbleeding	Third generation of cephalosporin, ciprofloxacin, aminoglycosides, sulfa drugs, and tetracycline.	<ul style="list-style-type: none"> - Change the solution of leeches storage every 3 days using distilled water - Do not detach forcefully.
Green PA, Shafritz AB	Pedicle flap, free flap, and replantation.	2-3 times over unspecified time period. Leeches should be applied once passive bleeding has stopped.	7-10 days or until the flap has re-vascularized.	3-6 leeches at a time	2.45 ml, and 2.5 ml passive blood loss	Infection of <i>Aeromonas hydrophilia</i> , excessive blood loss, scarring from leeches bites, local hypersensitivity reaction, and anaphylaxis.	Oral ciprofloxacin 2x 250-500 mg	<ul style="list-style-type: none"> - 1 leech/ 2cm² of congestion - Wipe the wound with a moist or heparin-soaked gauze every 15-30 minutes to encourage passive bleeding
Frodel JL Jr, Barth P, Wagner J	Subtotal avulsion of upper third ear, subtotal avulsion of nasal tip and nasal ala, small pedicle flap of central lip, multiple avulsed forehead and scalp segments.	3-4 times	3-4 days	1-2 leeches	N/A	Infection of <i>Aeromonas hydrophilia</i>	Broad spectrum antibiotics and prophylaxis: second generation or greater cephalosporin, aminoglycosides, trimethoprim-sulfamethoxazol, ciprofloxacin.	N/A
CASE	Fibula Free Flap transfers.	2-4 times	7 days	2-3 leeches at a time	2,85 ml with passive blood loss	No evidence of infection	Ceftriaxone 2x1 gr	Gradual decrement of frequency

Discussion

Leech therapy is an alternate conservative method for salvaging a flap without any secondary invasive and complex procedure. It gives advantages and disadvantages that should be considered both with the clinical circumstances and postoperative monitoring result. It can be used in reconstructive planning in plastic surgery both in neoplasm cases and trauma cases. The longest day of application of leech therapy is 10 days; despite it could be stopped after 3 days. In this term, clinical judgment is needed in recognizing re-vascularized flap that is no need of further leech therapy.

Based on this study, we recommend the use of leech therapy 2-4 times in a day until the venous congestion could be treated. Broad-spectrum prophylaxis antibiotics should be used during the therapy that is third generation of cephalosporin, aminoglycoside or quinolone. The leeches should be put on the part that is most threatening of congestion and watchful waiting during the therapy is needed considering the patient's psychological aspect and avoid the misplaced leeches.

Conclusion

The experts try to develop artificial substances that could be used in salvaging flap just like what is in leech saliva. So that surgeons or physicians do not have to use leeches as a therapy due to its disadvantages such as threatening for psychological aspect, cannot be specifically controlled to salvage any part of flap, need uncommon preparation in medicine, inefficient in term of application. Further study is needed to give strong evidences and explanations in using this method in clinical application.

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