

The Difficulties of Reconstruction in The Achilles Area

Rani Septrina, Gentur Sudjatmiko

Jakarta, Indonesia.

Background: Scar management on the achilles region is also challenging due to its anatomical position, bony prominences, relatively limited skin, less subcutaneous fat, and less vascularization. Primary suture cannot be performed on the wide defect, whilst serial excisions are inapplicable to be done on a thick and tough scar. Wound healing in the lower limbs also typically get impaired due the gravitational effect on the venous system and the unlimited joint movement.

Patient and Methods: A 21-year-old woman presented with a hard and thick hypertrophic scar on the achilles area due to deep dermal burns caused by hot metal two years ago. The patient had pruritic chronic ulcer on her scar. Scar excision was performed. In order to reduce the tension, a V-Y advancement flap was used to close the defect primarily. Foreslab was applied to reduce mobilization, and then continued by pressure garment application. On her next visit to the clinic, wound dehiscent was found. 10 days after the first excision, debridement was performed, wound re-sutured and dressed using topical honey covered by gauze.

Result: Follow up results after 8 weeks showed a fully epithelialized wound. Compression bandage and limited mobility by foreslab application prevented the vertical growth of scar effectively. Patient no longer complaints about itchiness nor movement limitation.

Summary: Planning surgical procedures for achilles reconstruction must take consider the followings: (1) choice of skin graft or flap, (2) choice of donor sites, (3) type of excision (4) hemostasis (5) fixation of skin grafts and splinting, and (6) dressings. Adjuvant preventive measures must also be implemented postsurgery to prevent regrowth of hypertrophic scar.

Keywords: *Hypertrophic scar, honey, achilles*

Latar belakang: Manajemen parut pada daerah achilles sulit karena letak anatominya, tonjolan tulang-tulang yang ada, keterbatasan kulit sekitar, jaringan lemak subkutis yang tipis, dan vaskularisasi yang kurang. Penjahitan primer tidak dapat dilakukan pada defek yang luas, sementara eksisi serial tidak dapat dilakukan pada jaringan parut yang tebal dan kaku. Penyembuhan luka pada tungkai bawah juga sering terganggu karena efek gravitasi pada sistem vena tungkai dan banyaknya pergerakan sendi.

Pasien dan Metode: Seorang wanita 21 tahun datang dengan masalah parut hipertrofik yang tebal dan keras pada daerah achilles pasca luka bakar dalam akibat besi panas dua tahun yang lalu. Eksisi jaringan parut dilakukan, dipasang foreslap untuk mobilisasi, dilanjutkan dengan penggunaan pressure garment. Untuk mengurangi tegangan, defek ditutup primer dengan flap lokal V-Y advancement. Saat datang kembali, luka dehisens. 10 hari setelah operasi, dilakukan debridement, luka dijahit kembali kemudian dirawat dengan aplikasi madu dan kassa.

Hasil: Hasil follow up setelah 8 bulan menunjukkan luka yang sudah terepitelisasi. Perkembangan vertikal luka dihambat dengan pemakaian *compression bandage* dan pembatasan mobilitas. Pasien tidak lagi mengeluhkan gatal dan keterbatasan gerak.

Ringkasan: Dalam merencanakan intervensi bedah untuk rekonstruksi pada daerah achilles, pikirkanlah: (1) penggunaan graft atau flap kulit, (2) pilihan lokasi donor, (3) tipe eksisi, (4) hemostasis, (5) fiksasi graft kulit termasuk splinting, dan (6) dressing luka. Perawatan tambahan setelah pembedahan juga harus dilakukan untuk mencegah terbentuknya parut hipertrofik.

Every time the skin is cut or damaged through its full thickness it will heal and leave a scar. Some people naturally end up with better scars than others. We cannot accurately predict this. Abnormal scarring is classified as either hypertrophic scar or keloid.

Hypertrophic scar formation is a major clinical problem in the developing and industrialized worlds. Burn injuries, traumatic injuries, and surgical procedures can give rise to exuberant scarring which results in permanent functional loss and the stigma of disfigurement.^{1,2} In the

From Division of Plastic Surgery, Department Of Surgery, Cipto Mangunkusumo General National Hospital, Universitas Indonesia.

Presented in 14th IAPS Scientific Meetings In Balikpapan, East Kalimantan, Indonesia

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

majority of cases, hypertrophic scar develops in wounds at anatomic locations with high tension, such as shoulders, neck, presternum, knees and ankles. The epithelium is thin and they may become focal areas of ulceration. The color is pink to purple and may be accompanied by hyperpigmentation. The borders of the tumor is usually linear following a surgical scar, papular or nodular following an inflammatory and ulcerating lesions, which are commonly pruritic.³ Treatments for hypertrophic scar are divided in two modalities, surgery and conservative. Reconstruction is usually done by graft or flap. Scar excision in the Achilles area is a challenge considering its anatomical position, bony prominences, relatively limited skin, less subcutaneous fat, and less vascularization. Wound healing in the lower limb may be impaired due its gravity effect on venous system and unlimited on joint movement. We present a case of hypertrophic scar in the Achilles area where scar excision was performed, twice –with lesson learnt– and the result is satisfactory.

PATIENT AND METHODS

A 21-year-old female presented to our outpatient department. Two years ago, she experienced a motorcycle traffic accident. Her skin at the right achilles came into contact with a hot metal. She went to a general practitioner after the accident to treat her complaints of bullae and was given a topical placental gel. She then continued the treatment at home with Rivanol solution. The wound gradually healed but some part of it still has raw surface, with other healed part feeling thick and stiff (Fig. 1). It became very itchy especially if she moved or perspired. Patient also complained of a limited foot movement when running and jumping. Scar excision was performed, followed by reconstruction using a local flap.

Before surgery was performed, the skin laxity and the ankle's range of motion were measured. The scar was indeed solid and sturdy with chronic ulceration on it (Fig. 2). Considering the challenging reconstructive options, the goal of operation was determined to first remove the ulcer and flatten the scar so



Figure 1. Stiff and thick hypertrophic scar of the achilles with pruritic chronic ulcer, discomfort, and limited motion. *Upper:* Posterior view, *Lower:* Posterolateral



Figure 2. Examination of the scar by pinching revealed hard and thickened scar with anticipated difficulty in postexcision defect closure.

the patient will fit into her shoes comfortably. Intraoperative under local anesthesia, some part of the wound was found to be lax enough to be sutured primarily without tension. The remaining wound near the heel tip required a local V-Y advancement flap closure. Interrupted unabsorbable sutures were used, then wound



Figure 3. Five days post-surgery wound dehiscent presented despite the no-tension closure utilizing V-Y advancement flap

covered using tulle dressing and dry gauze. Compression bandage was applied to prevent wound vertical overgrowth, and dorsal foreslab was worn to limit mobilization. After a short period of recovery patient went home. Patient came back on the 5th day post operation with dehiscent wound (Fig. 3).

Ten days after the initial excision and reconstruction, the wound dehiscence was debrided and refreshed. Only 3 stitches were made to approximate the wound, with some raw surface left in between sutures. Honey was applied topically and wound covered by gauze. Foreslab and compression bandage were continued to be worn.

RESULTS

Follow up results after 8 weeks showed a fully epithelialized wound (Fig. 4). Compression bandage and limited mobility by foreslab application prevented the vertical growth of scar effectively. Patient no longer complains about itchiness nor movement limitation.



Figure 4. The result after 8 weeks: full epithelialization occurred with flattened and softer scar. Pruritic and discomfort upon movement were resolved. *Left:* Posterior view, *Right:* Lateral view.

DISCUSSION

Hypertrophic scars are defined as elevated scar tissues which do not grow beyond the original wound border. They are usually formed secondary to excessive tensile forces across the wound.⁴ The predilection sites are on the shoulders, neck, presternum, knees and ankles.² Burn injuries, traumatic injuries, and surgical procedures can give rise to exuberant scarring that result in permanent functional loss and the stigma of disfigurement. It still becomes major clinical problem in the world¹ with an incidence between 40% to 70% following surgery up to 91% following burn injury, depending on the depth of the wound.² Common complaints from patients other than aesthetic concerns are the pruritus. Several

conservative therapeutic options are currently available. The application of rose hip oil and vitamin E are well-known to be used as topical treatment but they are largely anecdotal. Other treatment including corticosteroid, compression garment, silicone sheeting, hydrogel sheeting, smooth beam laser, Erbium laser, and chemical peels are among other options than surgery with some studies proving their effectivity.¹

Because in up to 91% of burn injuries result in the formation of hypertrophic scar, when planning reconstructive surgery for post-burn patients, a surgeon must first consider what is the patient's primary complaint. Treatment are indicated either for function, comfort, or appearance. Definitive correction of burn scarring should generally be delayed for a year or more after scar is mature.^{8,9} Nowadays, the first approach of burn reconstructive surgery should be considered is the use of local or regional flaps. Such flaps can be raised either with normal skin or with burn scar.⁹

Pertaining to this case, the reconstruction techniques in the achilles area requires specific consideration and is worth discussing for. Soft-tissue reconstruction on distal tibia is viewed by many as the most challenging of all lower-extremity areas. Reconstruction of the foot and ankle is made more complex because the reconstructed part often must bear weight and yet still conform to the overall shape of the foot to allow shoe fit.¹⁵ Flaps are usually required for covering recipient beds that have poor vascularity, covering vital structures, padding body prominences,³ and more advantageous in preventing secondary deformities.⁷

The availability of adequate soft tissue around the ankle is limited. Consequently, there is typically a good deal of tension along the incision line and dehiscence can easily occur. Attinger stated, the highest complication and failure rates come from local flaps because of dehiscence or incision line necrosis. The angiosomes and vein drainage should also be considered.¹⁰⁻¹²

VY advancement allows a linear scar to be lengthened without any flap transposition and without the fear of compromise to the blood supply. No undermining of the flap tips

is carried out, but these are simply pushed into the defect.⁴ When a V-Y flap is used, it should be in the oblique axis, keeping the tail of the V-Y towards the calf, as there is usually extra skin for direct closure.^{15,16}

Dressing must be comfortable, well-padded, and not too tight, with an opening that allows monitoring of the flap.^{3,4,6} Despite a surgeon's best operative efforts, strategies may still fail due to postoperative shear forces created by premature joint motion or pressure. The key is to immobilize the ankle, and limb elevation to help venous return against gravity. Because patient compliance can be a real issue, the use of an external fixator should be used whenever there is a question about the feasibility of keeping the ankle immobilized. Alternatives include casting or splinting.^{10,15,16}

In the properly selected patient population, external fixators serve as an indispensable adjunct to wound healing by providing temporary offloading or immobilization of joints, particularly if the flap or pedicle is in the weight-bearing area while the patient is supine.^{15,19} When reconstruction involves the achilles tendon, a non-weight bearing cast is applied at surgery and remains in place for 3 weeks, and then a weight bearing cast is worn for another 3 weeks. At the end of 6 weeks, a prefabricated walking boot is applied. The patient may begin active and passive exercises and calf strengthening. At 3 months, a heel lift is used, and the patient is allowed to return gradually to previous activities.¹⁴

A four-layer dressing wraps of the lower extremity consisting of impregnated-tulle, gauze, cast padding, and elastic wraps are commonly used. After a venous stasis wound has healed, 30 to 40 mm Hg pressure stockings must be worn continuously to prevent hypertrophic scar recurrence, which can be as low as 17% during the next 3 years.⁴ Other references stated that there are no study which states the definite optimum pressure, but suggested that 25 mmHg may be the ideal loading pressure. It also suggested an application time of 23 hours a day with two half-hour removal periods for hygiene and massage. Pressure therapy is less effective after six months of treatment.⁵ Munro suggested that

consistent sustained pressure is needed throughout treatment, starting at the beginning of epithelialization and continues for as long as possible into the maturation phase. In hypertrophic scar, it slows down synthesis and increases lysis, inducing extracellular matrix reorganization.¹⁵

Honey has been scientifically proven in several studies to hasten wound healing process. The rapid rates of healing seen when wounds are dressed with honey are due to more than just it creating a moist non-adherent environment. Dressing with honey gives greater epithelialization rate, greater thickness of granulation tissue, better angiogenesis stimulation, helps oxygenation, and provides energy source for destruction of bacterias.¹⁸

In this patient, the best treatment would be to give the patient a non-ambulatory setting for at least 1 month. However her socioeconomic burden makes it difficult to apply. Every time she came to visit, she had to use the public transportation and walked in some distance. That, in some measure impaired her recovery. As a kindergarten teacher, the patient was quite compliant to doctor's orders. In the first month, she walked with splint and obeyed the postoperative instructions. However, in the first visit after the scar excision, she came back for a follow-up visit on the 5th day, two days later than she should have come. She presented with a wound dehiscence which required further operative intervention. Fortunately, with minimal revisional procedure in the second operation, combined with topical honey application, immobilization, as well as pressure application by garment; full healing was attained, joint movement improve, with no residual complaints form the patient.

SUMMARY

Planning surgical procedures for achilles reconstruction must take consider the followings: (1) choice of skin graft or flap, (2) choice of donor sites, (3) type of excision (4) hemostasis (5) fixation of skin grafts and splinting, and (6) dressings.^{3,4,7,9,13,15} Adjuvant preventive measures must also be implemented

postsurgery to prevent regrowth of hypertrophic scar.

Gentur Sudjatmiko

*Cleft Craniofacial Center. Plastic Surgery Division
Cipto Mangunkusumo General National Hospital
Jalan Diponegoro.No.71, Gedung A, Lantai 4.
dr_gentur@yahoo.co.id*

REFERENCES

1. Aarabi S, Longaker MT, Gurtner GC. Hypertrophic scar formation following burns and trauma: New approaches to treatment. *Plos Medicine* 2007;4(9):234.
2. Gauglitz GG, Korting HC, et al. Hypertrophic scarring and keloids: Pathomechanisms and current and emerging treatment strategies. *J Mol Med* 2011;17(1-2):113-25.
3. Thorne CH. *Grabb and Smith's plastic surgery*, 6th ed. Lippincott Williams &Wilkins: 2007.
4. Foster RD. *Plastic surgery*, 2nd ed. Elsevier: 2006.
5. Smith FR. Causes of and treatment option for abnormal scar tissue. *J of Wound Care* 2005;4(2).
6. Mustoe TA, et al. International clinical recommendation on scar management. *Plast Reconstr Surg* 2001;110(2).
7. Lin Ch, et al. Free flap reconstruction of foot and ankle defects in pediatric patients: Long term outcome in 91 cases. *Plast Reconstr Surg* 2006;117(7).
8. Barret-Nerrin JP. ABC of burn, burn reconstruction. *BMJ* 2004;329.
9. J Barret-Nerrin JP. *Principles and practice of burn surgery*. Marcell Dekker: New York, 2005.
10. Attinger C.E., Evans K.K., Bulan E., Blume P., Cooper P. Angiosomes of the foot and ankle and clinical implications for limb salvage: Reconstruction, incisions, and revascularization. *Plast Reconstr Surg* 2006;117: 261S-293S.
11. *Greys Anatomy*, e-edition, Elsevier, 2006. Available online: www.elsevier.com
12. Bergman RA. *Anatomy atlases: Atlas of human anatomy in cross section: Section 7 lower limb*, plate 7.27. Available onlie: www.anatomyatlases.org
13. Orgill DP. Excision and skin grafting of thermal burns. *N Engl J Med* 2009;360(9).
14. Canale ST, Beaty JH. *Campbell's Operative Orthopaedics*, 11th ed. Philadelphia: Mosby; 2008.
15. Fu-Chan W. *Flaps and Reconstructive Surgery*. China: Saunders; 2009. p 363.
16. Georgidae NG, Riefkohl R, and Levin LS. *Georgiade plastic, maxillofacial and reconstructive surgery*, 3rd ed. New Castle: Williams & Wilkins; 1996.
17. Reddy V, Stevenson TR. Lower extremity reconstruction. *Plast Reconstr Surg* 2008;121(4).
18. Molan PC. Using honey in wound care. *Int J of Clin Aromatherapy* 2006;3(2).
19. Clemens MW, et al. External fixators as an adjunct to wound healing, *J Foot Ankle Clin* 2008;13(1): 145-56.2nd ed. New York, NY: Springer; 2004:342.